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Interdisciplinary

Work Output Level using ICT

Diverse Physiographical Areas

Highlights

Machine Learning Algorithms

Services Atguaranty Trustbank

Discovering Thoughts, Inventing Future

VOLUME 22 ISSUE 1 VERSION 1.0

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Fabric Defect Detection using Image Processing

By Md. Rakibul Alam Khan & Halima Akhter
University of Information Technology and Sciences

Abstract- Fabric defect is one of the most important and serious matters of quality control in textile industry in Bangladesh. This task takes a lot of time and money. For this reason we have introduced a simple process to find defects on fabric based on edge detection. This process is mainly focused on image processing which can be integrated with fabric defect detection automation system. In this paper we have tried a new approach using the filter method with edge detection and found good results. Our algorithm can detect defected fabric area successfully. It can be also used in real-time defect detection considering light intensity, zoom, fabric width, camera resolution etc. As our algorithm mainly works on the principle of edge detection, it cannot detect defect on multicoloured or patterned fabric. It works well on single coloured fabric without any fold or edge.

Keywords: *fabric, threshold, wiener filter, rgb.*

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Md. Rakibul Alam Khan [α] & Halima Akhter [σ]

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Keywords: *fabric, threshold, wiener filter, rgb.*

I. Introduction

As we entered in digital age, our information has improved better than ever. In the textile industry, fabric defect is one of the most important and the first task of quality control and economy business. So many approaches have made in the field of fabric defect detection. In Bangladesh, textile industries are trying to improve their production with minimum cost. After the waving of a huge roll of fabric, it's then sent for inspection to find if there is any defect on the fabric. An automated fabric defect detection system would be better than human detection which will alert users when any error found [1].

So many researchers have been made to identify fabric defect methods. Some methods are well established. Structural, statistical, spectral, model-based, learning, hybrid, comparison studies, optical analysis methods and image analysis methods are more common. Some researchers have tried Fourier Transform and Gabor Filters; others use Gabor and HOG in the image analysis method, which is more complex and time-consuming. But we have tried a simple method using edge detection and heuristics. This paper has focused on single colour-based fabric defect detection using image processing. We have experimented with different edge detection algorithms, e.g. Sobel, canny etc. along with noise filter and different threshold. Above those, canny edge detection shows more promising results in fabric defect detection. A simple algorithm is proposed here to detect different kinds of fabric defects. Our goal is to find a more cost-effective and fast process to identify fabric defects accurately. Some parameter like zooming, image resolution, colour etc should be considered. Main fabric defects as namely[3,4]Floats, Weft Curling, Slubs, Holes, Oil Stains, Stitching, Knots, Irregular Pick Density, Snag, Tear, Gouts, Snarls, Miss-end, Stripes, Tight/Slack Warp Thread, Double Ends, Smash, Open Reed, Miss-pick, Double Picks, Coarse-pick, Tight/Slack Weft Thread etc. All of these defects are examined with our algorithm and the result comes out very good and promising with some considerations.

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II. Objective

Different work has been done in previous year for fabric defect detection. And so many methods are being proposed. A direct benchmark among different algorithms for fabric flaw detection was first and last conducted by Bodnarova et al. [5], who compared algorithms based on the ideas of co-occurrence matrices, normalized cross-correlation, blob detection and spectral analysis. All algorithms were manually implemented by the authors. Almost all papers somehow combine a basic method with several other advanced techniques. Some tried to classify the defect and others tried real-time defect detection with accurate position of defect.

The objective of this paper is to find different approaches to find a better method to detect fabric defects using image processing. Many tried to classify these defects; others tried to compare existing methods. But my method does not classify the error type. It can only determine if there is any defect that exists in the given fabric image.

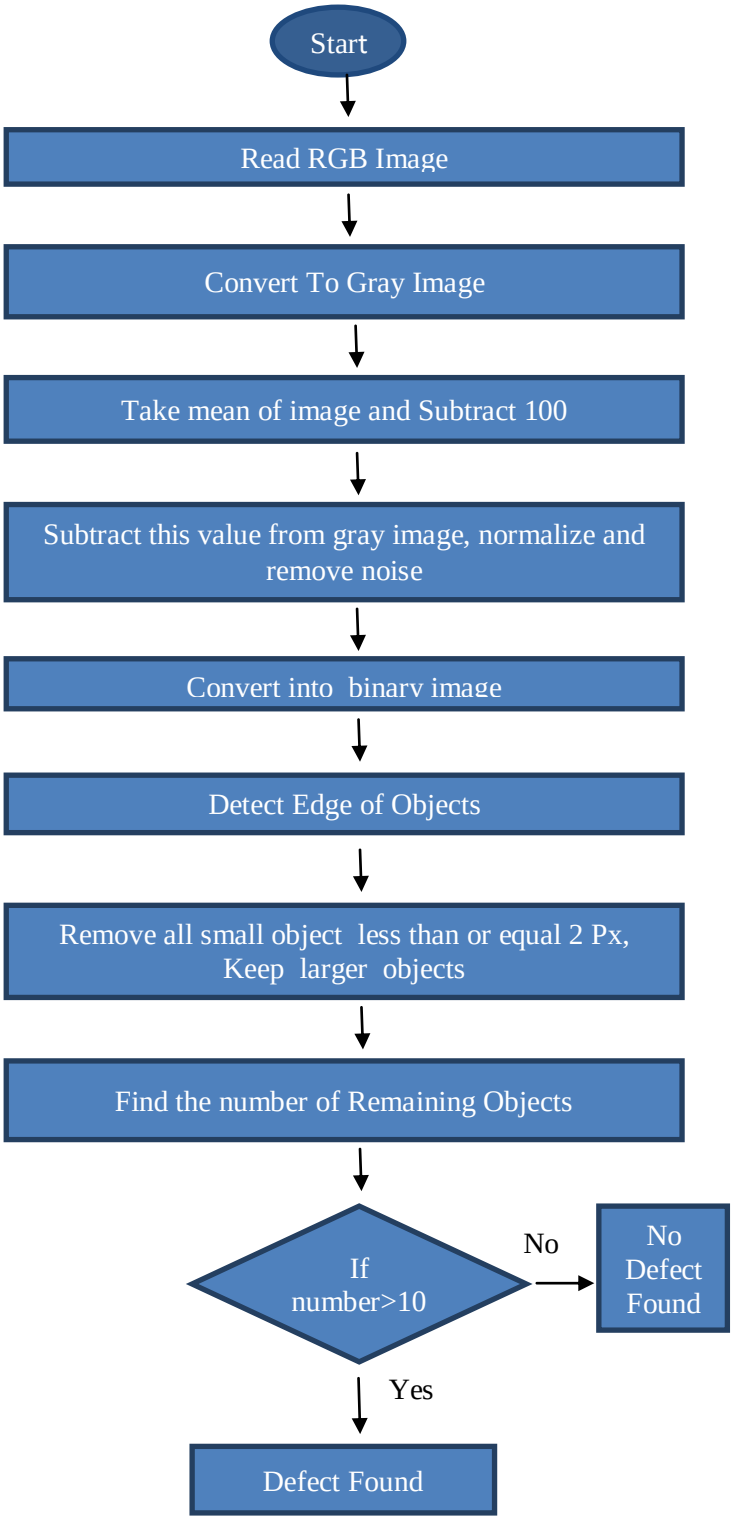
III. Proposed Method

The objective of the proposed method in this paper is to design an efficient method for fabric defect detection with image. In this section we will discuss fully our method. Matlab software is used for this purpose. We have used a filter-based edge detection method and heuristic to predict if the fabric image contains any errors. If an error is found, then the software shows error found and if not then it shows no error found. This algorithm is designed to perform better in single-color fabrics. Texture and printed fabrics are not suitable. Due to the increasing demand for quality fabrics, high quality requirements are today greater since customers have

become more aware of poor quality problems. To avoid rejection of fabric, it is necessary to avoid defects.

At first RGB image is taken as an input. This is the test image. It may not contain any errors. Different types of fabric are used for testing. Then the image is converted into a grayscale image. Image is now converted to a n×m matrix. Now take the mean of the image matrix. This value is essential for image pixel equalization. We subtract 100 from this mean value and subtract from every pixel in the gray image. This is done because subtracting from every pixel it will be more efficient for applying thresholds. Now we convert this grayscale image into a binary image. The pixel values are now in 0s and 1s. If the value falls below the threshold value, the pixel value will become 0 and if the value falls above the threshold value, the pixel value will become 1. Then we apply edge detection to the image. A Canny Edge detection algorithm is used here. After that objects are formed in the image. We now remove noise from the image. If any small object contains 2px by 2px or less, we will remove it from the image. As all image pixels do not contain the same rgb or gray value. Noise removal is very important to our method. Without this we cannot find accurate results. If an image does not contain any error, though we can find some small object as noise, that's some value will still remain above threshold. We keep all larger objects and count them. Error can be any size and any length. Finally, we compare the number of remaining objects. If the number is greater than 10 then we can say the image has error otherwise no error. This is the heuristic value. This value can be less than 10 if we want to get a more accurate result , it will then detect some false result.

a) *Flowchart of method*



b) Some Considerations

This algorithm is not for patterned fabric or wool. This will work better in single-colored fabrics like cotton or silk. The light intensity should be the same for all over the image and there should not be any stretch. When the picture is taken it should not be so close to the fabric or the image should not be zoomed.

c) RGB image Input

Image pixels contain values in RGB. In matlab it forms a three-dimension matrix. The main purpose of the RGB color model is for the sensing, representation and display of images in electronic systems, such as televisions and computers, though it has also been used in conventional photography.

Fig-1: RGB image with error (source google.com)

If we zoom in on this image, we can understand the pixels inside it.

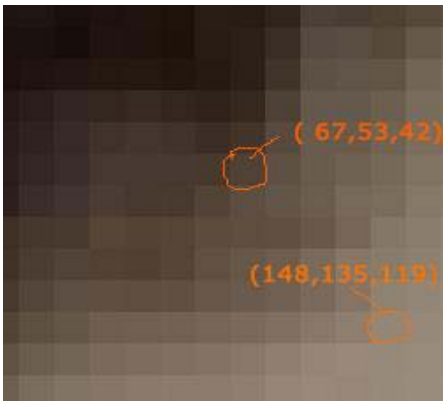


Fig-2: Zoomed image with RGB value

d) RGB to Gray Conversion

Convert each pixel value to a gray level by the following equation.

$$(0.299 * R + 0.587 * G + 0.114 * B)$$

To convert RGB image into a binary image, this gray level conversion is needed. Grayscale image contains values from 0 to 255. And the image is formed into two dimensional arrays of pixel values.

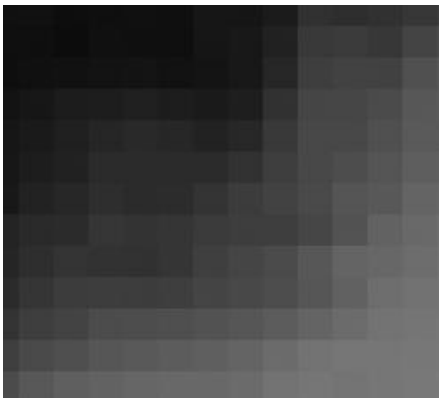


Fig-3: Gray Scale Image

e) Mean and subtracting

Calculate the mean of the grayscale image. Take each pixel value and sum them. And divide the sum with total number of pixel. The equation is-

$$\text{Mean} = (n1+n2+n3+\ldots..+nN)/N$$

Here n1,n2… are the pixel values and N is the total number of pixel. We subtract 100 from this value and finally subtract each pixel value from the gray image. We normalize the image so that the intensity level is distributed all over the pixel value. Now we remove noise from this image by applying a wiener filter.

f) Convert to binary image

Computes a threshold for each pixel using the local mean intensity around the neighborhood of the pixel. This is done by the following equation 2*floor (size(I)/16) + 1

Fig-4: Binary image

Binary image is needed for edge detection and separate different size objects. This image contains only 0 and 1 value.

g) Removing and filtering object

Remove all objects less than 2px. This is noise removal. Any pixel not associated with object will be removed. We have used a Wiener noise removal filter in this paper. The purpose of the Wiener filter is to filter out noise that has corrupted image. This filter is based on a statistical approach. The goal of the wiener filter is to

reduce the mean square error as much as possible. Replacing each pixel value in an image with the mean value of its neighbors, including itself [6].

h) Decision making

We will keep all the larger objects in the image. If the number is below 10, we will assume that the fabric is defect free. And if the number is greater than 10, we will assume there is a defect in the fabric image.

IV. Analysis and Discusion

a) Experiment on different sample image

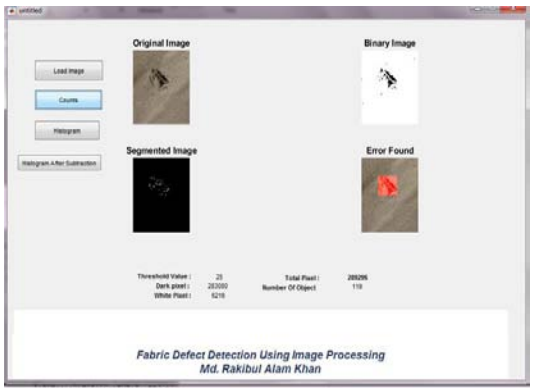


Fig-5: Test image 1

The first test image contains a hole error. The error area is marked red.

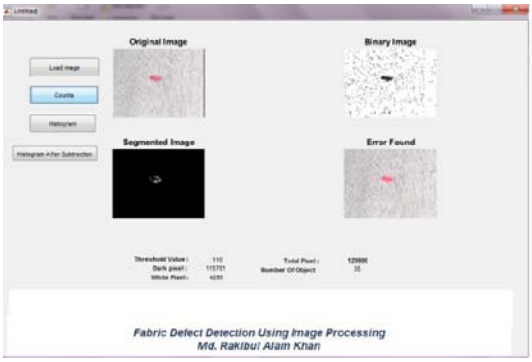


Fig-6: Test image 2

Second image contains a error color marking/tag.

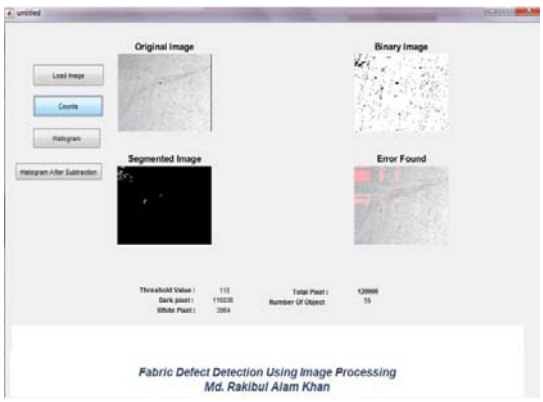


Fig-7: Test image 3

Third image contains pilling the dot/ball in the image.

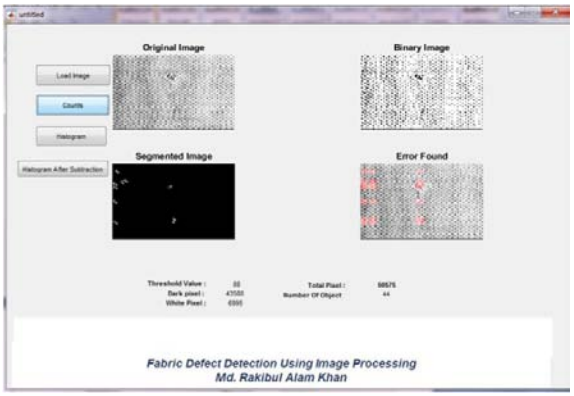


Fig-8: Test image 4

Forth image also contains hole defect.

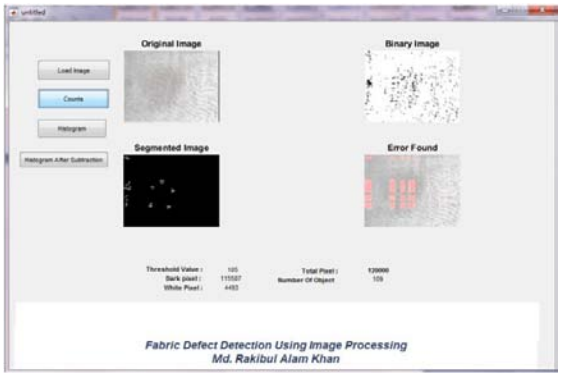


Fig-9: Test image 5

This image contains oil strain. The red marked area is error.

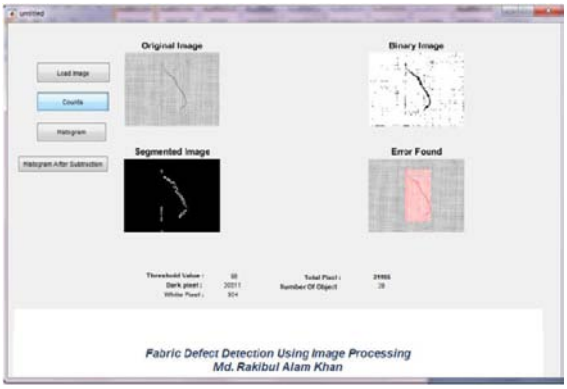


Fig-10: Test image 6

This image contains a error tight weft thread. The area is marked red.

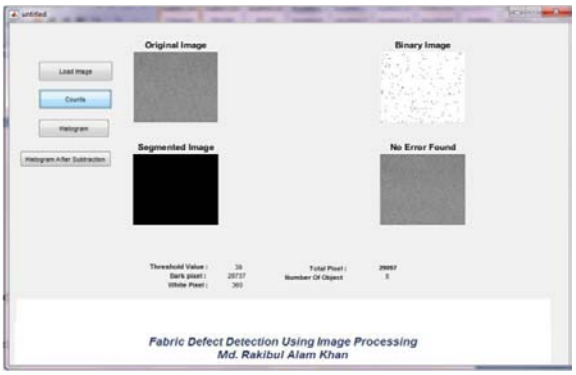


Fig-11: Test image 7

The above image does not contain any error. The algorithm found it correctly.

50 different images are given as input. These sample images contain different errors and different colors. Only one image was not identified correctly. Among the 50 images, 49 were identified correctly. So we can tell that the accuracy level is (49/50)*100=98% which is very good.

b) Comparative Analysis of Fabric Defects Detection Methodologies

Compared to other fabric defect detection methods [7] we found our algorithm to be better in certain conditions.

Technique	Accuracy	Total Fabric Samples and Defect Types
Gabor Wavelet Filter Methodology	96% with 3.2 % of False Rate	71 fabric images (39 of them are defect-free), more than 30 types of defects are tested.
Methodology of Wavelet-Texture Analysis and LVQ Neural Network	The accuracy of Identification is on average of 7 type of defects is 95%	Total 350 images with 7 types of defects (including wrap missing, weft missing, double weft, materialize bar, oil pigment, hole, non defected)
Usage of Computer-Vision and Artificial Neural Network	Overall average is 77%. Average identification for hole is 72%, for Scratch is 65%, For	Total 200 images. Trained to 4 types of defects (Hole, Scratch, Other, and no-fault)
	other faults 86% and for no faults is 83%.	
Methodology of Digital Image Analysis	83% Accuracy	Total 2000 Rotations
Our proposed method	98% with 2% false detection	Total 50 image with different defect image

V. Conclusion

The objective of our project was to find defects in fabric using image processing. The method we used is fast and very accurate. With low false detection, it will help textile industries to save time and money. It only works better with single-colored fabric. With few considerations, our method performs better and detection rate is 98% which is much satisfactory.

VI. Future Work

Many methods exist in the field of fabric defect detection. These methods are suitable for fabric only. But as our method is based on edge detection and it can also be used in other fields like vein detection or printed circuit board (PCB) defect detection. Some false detection is present in the experiment. We will try to improve the result in future.

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Work Output Level using ICT at in Twifo Atti-Morkwa District Assembly

By Mark Quaye Affum
Cape Coast Technical University

Abstract- The primary aim of this paper is to look at the speed level of Information and Communication Technology resources of staff of Twifo Atti-Morkwa District Assembly. The degree of impact of Information and Communication Technology have on activities of staff at TAMDA is about 70%. There is a relationship between work output, qualification, promotion and performance in the Assembly. From the findings and analysis of the data received, it was recommended the Assembly should look at adopting Information and Communication Technologies at the work place for an effective performance.

The civil organisations management should also consider engaging the services of staff with high Information and Communication Technology proficiency for good job delivery. The district assembly should as well look at creating Information and Communication Technology workshops for its employees to facilitate them with the needed skills and resources they require for a better work output.

Keywords: work output, proficiency, information and communication technology, twifo atti-morkwa district, application, impact.

GJCST-G Classification: B.4.1

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Keywords: work output, proficiency, information and communication technology, twifo atti-morkwa district, application, impact.

I. Introduction

According to Orimalade (1995), a computer is an electronic machine or a set of machines which accepts raw data given to it in a specific format carries out some operations on the data and produces results in a particular way as information for:

1. Signals to control some other machines
2. Decision making
3. Input into other machines

Adekunle (2003) adds that, a computer can be a machine or device under the control of a stored program which can take data in an agreed form, treat that data and supply the results as information in a specific form.

Computer is culled from the word compute which connotes calculate. Computers can be seen as a device which is capable of performing arithmetic and logical operations with ease within a short time. Computers can quickly process and save information and data for effective use. Since the invention of software, computers can now be used by social scientists apart from engineers and mathematicians. As a result Information Technology was then used to replace the name computer. The handling and processing of data using devices electronically is the work of Information Technology. NCET (1995), suggests that Information Technology creates an environment for the handling of text and images including figures, graphs, instructions, sound and music processing the data by configuring, sorting, saving, retrieving, examining, displaying and transferring then into information for communication purposes.

Oloruntoba (1997) additionally defines computer as an electronic machine which works under the influence of instructions saved in its memory. This machine according to Oloruntoba (1997) can accept data input, manipulate it with given instructions and produce results and save the results for future use.

Rana in 2009 suggest that the key to successful revolution of information services is the use of Information Communication Technology. The use of Information Communication Technology is abundant but particularly in changing existing hard copy information within the whole stages of saving, retrieval and distribution. Information Communication Technology offers commercial growth to the urban and deprived societies. One of the benefits of Information Communication Technology is that, it increases productivity and makes business more effective even though the effect of the growth of the economy is not going to be the same everywhere. Information Communication Technology has the ability to reach out to low level income earners. This is so because mobile phones can now be owned by individuals that duel in the developing countries especially rural areas.

Information Communication Technology has now become the major platform for the dissemination of gigabytes of information to both public and private individuals living in both urban and rural areas. For decades information relating to finance, education, health, entertainment was not available to rural population as result of the absence of connectivity both satellite and digital. The potential of wireless technologies has now influenced economic and social lives at different levels of rural activities. Current trends in the advancement of Information Communication Technology with regards to 5th generation (5G) internet connectivity are optimising performance and decision making within the various aspects of human endeavour. This has created business innovation, transformed public lifestyles Christine Zhen-Wei Qiang, (2009).

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II. Statement of Problem

In this study, the adverse setbacks of Information and Communication Technologies broadly would the centre of discussion. There is no question to the fact that Information and Communication Technologies devices affect the way employees of Twifo Atti-Morkwa District conduct their daily work activities since majority of staff of the district assembly are computer literates.

Yet the district assembly do not realise the maximum benefit of the use of Information and Communication Technologies within the district.

III. Objective(s) and Scope

The main objective of this study is to:

1. Find the impact of Information and Communication Technologies on work output at Twifo Atti-Morkwa District Assembly.
2. Determine the effect of ICT at Twifo Atti-Morkwa District Assembly's day to day activities and the speed of work
3. Reveal the accuracy of work output by the use of Information and Communication Technologies at Twifo Atti-Morkwa District Assembly's and the time it takes for processing a large amount of data
4. Uncover the relationship that exist between work output, qualifications, promotions, and work performance based on the skill level, accuracy of work done, level of impact on work output, and the training of staff of Twifo Atti-Morkwa District Assembly.

IV. Research Questions

1. What is the duration of data processing by staff of Twifo Atti-Morkwa District Assembly's?
2. What is the swiftness level of employees at the use of ICT resources?
3. At what level of impact does ICT have on the activities of employees at Twifo Atti-Morkwa District Assembly's?
4. Is there any connection between work output level, qualification, promotion and performance at Twifo Atti-Morkwa District Assembly's?

V. Limitation of this Study

This paper does not go beyond the boundaries of Twifo Atti-Morkwa District Assembly. This is because there is little time and funds available for the researcher to do the study.

VI. Delimitation of this Study

This study should have been extended to the whole Central region in the country. As a result of limited resources and funds of the researcher he could not get there. Additionally the researcher was working with limited time and without sponsorship therefore the studies was restricted to only Twifo Atti-Morkwa District Assembly.

VII. Literature Review

Development in Ghana largely depends on the nation's ability to drastically reduce poverty by creating wealth. The ability for a large population of the country to produce wealth sustainably guarantees the country's developmental status. The United Nations Commission on Science and Technology Development (UNCSTD) in partnership with IDRC projected five growth indicators that concentrated on the improvement of the quality of livelihood in June 1996. These indicators according to Cred and Mansell, (1998) include health, education, governance, technology and income. Considering these five crucial indicators of national development, Information Communication Technology can assist society to achieve all the five developmental indicators in Ghana. Information Communication Technology can only be useful only if they contribute to eradicating poverty through improved schooling and health.

The access to timely information is salient for the better use, equitable sharing of resources, and the raising of participation in decision making process.

Information Communication Technologies has created the foundation for the existence of mankind from onset. According to Ndukwe, (2002), man has therefore been looking at ways of improving the processing of Information and Communication to prospective individuals irrespective of geographical location, proximity and time. The access to timely, national and global information is a prerequisite for surviving in this information age. For any nation to grow and to continue to exist in this rapidly changing global environment, Information and Communication Technologies should be the foundation. As a result there is the challenge for experts to take up a host of challenges such as reliable infrastructure, skilled human capital, open governance and other important capacity building issues.

Computing and Technology are the two main branches within the heart of technology. The technologies of computing include computer system, electronic mail, internet, and mobile phone and fax machine.

VIII. Computers

Originally computers are used by scientists for number calculation purposes. This usefulness was seen in offices and industries. Madu (2000), states that recently, computers is being used in homes and schools regularly for various tasks such as homework, letters, research, exams, assignment and applications for easing obligations.

Computers are normally put to several uses according to Fapohunda, (1999). These include letter

and report writing, book printing, newspaper production, picture making, magazine production, drawing of diagrams, handling statistics, mathematics and financial records. Computers can additionally be used for traffic lights control, flying of planes, making and playing of music and music videos, sending instant messages anywhere around the globe.

IX. Internet

The worldwide collection of many types of computers and computer networks linked together is what we call the internet. Adesanya, (2002) suggests that, the internet is gradually becoming the solution to information challenges, digital marketing and information interchange. According to Eseyin (1997) the internet is seen as an integration of different services. Two most usually used internet service include the electronic mail (email) and the World Wide Web (www). The internet play a useful and valuable role in healthcare, education, agriculture, political issues, business, and the economy and news dissemination. Woherem (2000) suggests that with the internet connectivity, business activities can be conducted across the globe without the physical presence of both parties.

X. The E-mail

The electronic mail is one of the maiden means of internet communications. It is basically used to send and receive instant messages from friends and business partners. Nwosu (2004) asserts that, the Email is very simple to use. It is also described as the tool used to exchange text messages and computer files (audio, video, images and text) through communication networks such as the internet. According to Fapohunda (1999) the e-mail can be seen as the postal mailing system in the physical sense. The only difference that exist between the electronic mail and the postal service is time and cost. While electronic mail cost less and quick in delivery of information or message, the postal service is considerably costly and take more than three days for a message to be delivered. Oketunji (2000) states that, is an increasingly popular method of communication, specifically concerning official interaction.

XI. Mobile Phones

The mobile phone is defined as the telephone system that can move or easily be moved quickly from one place to another Bittner (1989). Mobile phones have now been advanced into smart phones which are currently the tools for shaping the changing the globe. Mobile phones were initially owned by only the rich, business executives and affluent in society who lived luxury lives. The impact of smart phones on the economy of countries, businesses, students, homes and schools is huge. The use of information communication technologies has now been limited to smart phones in the society. The presence of technology according to Marcelle (2000) has been the basis of change in societal development. Ghana and other African countries for instance have had enormous growth in its economy, political spheres, culture etc.

Tiemo (2006), states that the importance of information cannot be overemphasised. For decisions to carried out, there need to be planning with the need for information. There are approximately 90% of Ghanaians who need information in order to make better decisions with regard to the right food and water. Child care, family planning, the control and prevention of epidemic could be possible with timely information and the use of information communication technologies. The gathering and dissemination of information worldwide can be made possible through the use of current information communication devices playing a very crucial role. According to Oji-Okoro (2006) the use of mobile phones by individuals enables the communication with family and loved ones, clients and business partners. Large businesses can maximum profits through the use of smart phones and telecommunication services. Governments increase revenues through the use of communication technologies to receive taxes and duties. Smart phones have additionally become a means of providing livelihood for the jobless communities who are unemployed.

XII. The Fax Machine

The tele facsimile systems permit the transaction of images such as photos, printed pictures, maps, drawings and their reproduction on a paper to a remote receiver. The fax machine is not new in the technology circles. Since the advent of smart phones, microelectronics and other digital imaging technologies communication technologies there has been a sharp drop in its usage according to O'Brien, (1999). Any form of document, either handwritten or document that contains images, diagrams, graphs, charts or typed text can be sent at a very fast pace at a very low cost. The fax machine system is mostly present in companies and offices.

XIII. Methodology

The bar and pie chart will be used for data analysis. The bar chart is a type of graph where values are represented with rectangular bars. Frequency or value is represented by the corresponding height of the bars. The respective bars are spaced to create a clear and different category of frequency. The bar length is the difference between each value. In qualitative variables, bar charts are used to displays sets of data.

Pie charts on the other hand are circles with divisions that signify the various variables available. Pie charts are also used in qualitative analysis to display sets of data.

XIV. Data Analysis

Figure 1

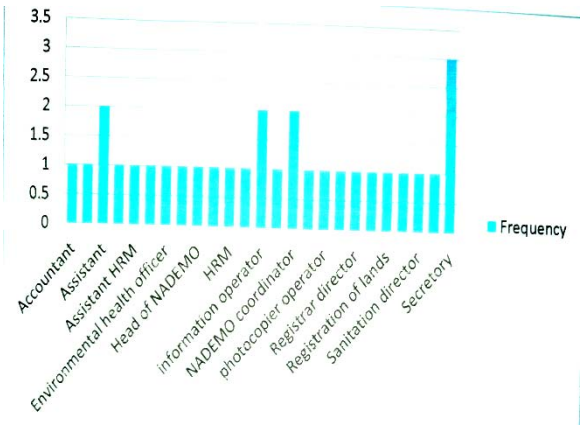

Figure 1: Field of Work of Respondents

According to the graph above, 3(10%) of respondents are secretaries, 6.7% are assistant to the various positions. 6.7% of each of the respondents are NADEMO coordinators and information operators respectively. The least number of positions are Human Resource Managers, Accountants, Sanitation officers, Registrar, Director, Registrar of Lands, Head of NADEMO and a photocopier operator each representing 3.3% according to the above figure.

Figure 2

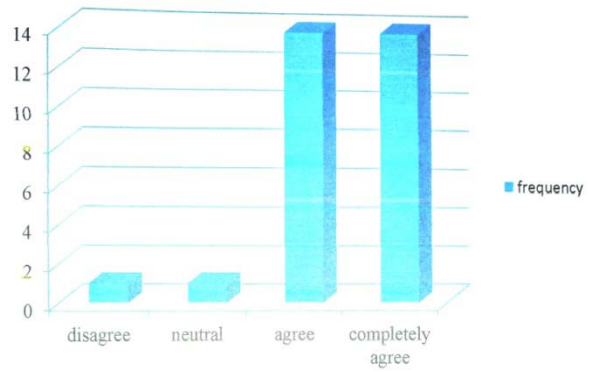

Figure 2: Computers Assist Respondents to Work Effectively

According to the graph above, 14 respondents representing 46.7% respondents agree and completely agree that computers help them to work effectively. 3.3% of respondents from various sections disagree and another 3.3% also disagree that computers help them to work effectively. Another 3.3% of the respondents stay neutral.

Figure 3

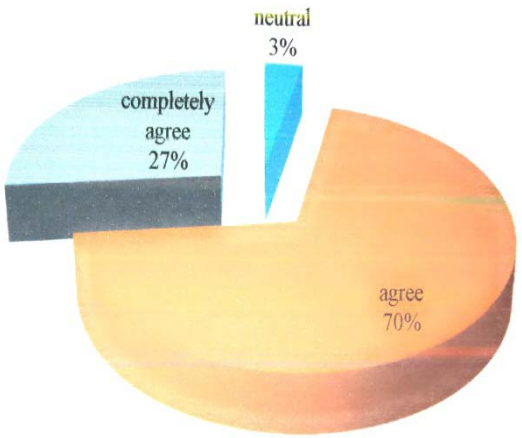

Figure 3: Showing ICT tools improve work output

The graph in figure 2, 14 respondents representing 46.7% respondents agree and completely agree that computers help them to work effectively. 3.3% of respondents from various sections disagree and another 3.3% also disagree that computers help them to work effectively. Another 3.3% of the respondents stay neutral. According to the above figure, 21 respondents representing 70% of respondents agree that working with certain information communication technology equipment such as computers and its accessories increase work output of the district assembly. Staff who also completely agree to this scenario is 27% whereas 3% of respondents are impartial.

XV. Discussions of Findings

According to the graph in figure 1, 3(10%) of respondents are secretaries, 6.7% are assistant to the various positions. 6.7% of each of the respondents are NADEMO coordinators and information operators respectively. The least number of positions are Human Resource Managers, Accountants, Sanitation officers, Registrar, Director, Registrar of Lands, Head of NADEMO and a photocopier operator each representing 3.3% according to the above figure.

According to figure 3, 21 respondents representing 70% of respondents agree that working with certain information communication technology equipment such as computers and its accessories increase work output of the district assembly. Staff who also completely agree to this scenario is 27% whereas 3% of respondents are impartial.

The study made use of descriptive statistical tool chats were used to describe the simulated data. Further analysis was made using the objectives of the study stated earlier in this research.

From the above analysis it was deduce that staff of Twifo Atti-Morkwa District Assembly possess the requisite knowhow and skills in using information communication technology resource at the assembly.

There is a proportional relationship that exists between work output, qualification, promotion and performance at Twifo Atti-Morkwa District Assembly.

XVI. Conclusion and Recommendations

A Relative percentage of staff do not have personal computers. Access to internet by staffof Twifo Atti-Morkwa District Assembly was mainly at public cyber café compared to other sources. Information Communication Technology has hugely assisted employees in the major areas of upgrading of knowledge and work output.

Twifo Atti-Morkwa District Assembly management should make accessible free, adequate training opportunity available to employees. Such opportunities should be focused on staff ICT areas of need identified in this research. With regards to the everyday change in technology, staff training a continuous development programme and not a one-shot programme and must be put in place to ensure that employees of the assembly is continuously improved within the information communication technology jurisdiction. The assembly should be funded adequately by government in order for ICT facilities available to function effectively thereby granting access to staff. It is additionally recommended that more studies need to be done with this jurisdiction for the development of Twifo Atti-Morkwa District Assembly.

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Machine Learning Algorithms for Predicting Reservoir Porosity using Stratigraphic-dependent Parameters

By Kachalla Aliyuda, Aliyuda Ali, Abdulwahab Muhammed Bello & Jerry Raymond

Gombe State University

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Keywords: *machine learning algorithms, reservoir porosity, sedimentology.*

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Abstract- Predicting reservoir porosity, permeability and other reservoir parameters are very important but arduous task in formation evaluation, reservoir geophysics and reservoir engineering. Recent successes in machine learning and data analytics in different geoscience disciplines provides the opportunity to offer cheaper and faster techniques of predicting reservoir properties. This study used gross depositional environments, reservoir depth, diagenetic impact, permeability and stratigraphic heterogeneity from a database of 93 reservoir to predict reservoir porosity. The data for this study includes numeric and categorical descriptions of 93 reservoirs across the UK and Norwegian sector of the North Sea. Five models were trained using linear regression, support vector machine (SVM), boosted tree, bagged tree and random forest algorithms. The performance of the different models was evaluated using R-squared (R^2), root mean square error (RMSE) and mean absolute error (MAE). Model trained using random forest algorithm with R^2 score of 0.75, RMSE of 0.118 and MAE of 0.0028 outperformed other models. A comparison between predicted porosity and the actual porosity in training data and testing data show a good match, indicating the ability of the random forest model to make prediction on unseen data. The machine learning technique presented in this study represents a pragmatic approach to the classical log conversion problem that over the years has caused dilemmas to generations of geoscientists and petroleum engineers. The method requires no underlying mathematical models or costly assumptions of linearity among variables. Predicting porosity by using sedimentological parameters can effectively reduce the high cost of using petrophysical methods such as nuclear magnetic resonance and other logging methods.

Keywords: *machine learning algorithms, reservoir porosity, sedimentology.*

I. Introduction

Porosity, permeability, oil, water and gas saturation are commonly obtained from logging and core data, however, reservoir parameters obtained by logging or coring are limited in extent, such data are only valid a few centimetres away from the wellbore. Due to reservoir heterogeneity and the complexity of the geologic conditions, well logging data often exhibit a very strong nonlinear characteristic and the relative relation between different data is intricate (Chen et al., 2017). Different depositional facies and depositional environments ultimately controls reservoir character (Mathew et al 2008; William and Milne 1991; Larue and Legarre 2004; Jian et al 2004; Skorstad et al 2005; Skorstad et al 2008). The primary depositional fabric of the rock is modified during burial by compaction and cementation. Consequently, reservoir depth of burial is very critical in understanding the reservoir quality. (Aliyuda et al. 2021; Cade et al. 1994).

Accurate prediction of reservoir flow properties especially porosity and permeability are very vital in oil and gas recovery, production design, well placement and optimization, Co_2 sequestration, radioactive waste disposal, and management of water aquifer. Prediction of reservoir porosity and permeability is also crucial for basin-wide evaluation of fluid-migration and in mapping potential pressure seals to reduce drilling hazards.

Reservoir porosity is a function of many geological factors, these factors include depth of burial, structural complexity, sedimentary environment, lithology, and diagenetic impact. There is a general non-linear relationship between porosity and some petrophysical log properties such as density log, sonic log, and compensated neutron logs (Singh et al 2016; Zhong and Carr 2019). Several relationships which can relate porosity to wireline readings are available, common among such relationships are the sonic transit time and density logs. However, the conversion from density and transit time to equivalent porosity values is not straightforward. The common conversion formulae contain terms and factors that depend on the individual location and lithology of the well, for example, clay content, pore-fluid type, grain density and grain transit time for the conversion from density and sonic logs, that in general are unknowns and must be determined from rock sample analysis.

Geophysical well logs generally provide a good representation of the in-situ conditions in a lithological unit. However, as with most well-logging measurements, the sonic log does not provide a direct measurement of reservoir porosity, the parameter with which it has been traditionally associated with. In like manner, porosity

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conversion from bulk density log requires that the grain density and fluid density be known (Vernik, 1997).

It seems obvious that no single log measurement is enough to obtain reliable values of porosity. Additional data would be required from the pore fluid and grain material, which normally are not at hand except for special studies in cored reservoir intervals.

Some conventional machine learning algorithms have been applied in predicting reservoir evaluation parameters, such as Back Propagation neural network (Leite and Vidal, 2011; Para et al, 2003; Shi et al, 2016; Wang et al, 2018), Support Vector Machine (Wang and Peng, 2018; Feng et al, 2020) and other shallow machine learning algorithms (Talkhestani, 2015; Wang and Peng, 2019; Haklidir, 2020; Mahmoud et al, 2020; He et al, 2020). Deep Learning methods specifically convolutional neural network (CNN), recurrent neural network (RNN), and stack auto encoder (SAE) were also successfully applied in predicting reservoir porosity (Zhang et al, 2021). However, most studies on predicting reservoir porosity were done using logs inputs. This study used sedimentological properties as inputs to predict porosity using a robust database of 93 reservoirs from the Norwegian continental shelf.

II. Database

The data for this study includes numeric and categorical descriptions of 93 reservoirs across the UK and Norwegian sector of the North Sea. 75 reservoirs from the Norwegian sector are from the Norwegian North Sea, Norwegian Sea, and the Barents Sea, while the remaining 18 reservoirsare from Viking graben on the UK sector. All the reservoirs were classified using the SAFARI schema into three gross depositional environments (Fluvial, Paralic/shallow marine and Deep marine). SAFARI is a Joint Industry Research Project between the University of Aberdeen and NORCE Research in Bergen, supported by a consortium of 16 companies, the Research Council of Norway and the Norwegian Petroleum Directorate. The goal of the SAFARI project is to develop a fully searchable repository of geological outcrop data from clastic sedimentary systems for reservoir modelling and exploration (www.safaridb.com). SAFARI uses a systematic hierarchical schema to classify sedimentary rocks into gross depositional environment (GDE), depositional environment (DE), sub-environment and architectural element (AE).

Further parameters which potentially influence permeability were also recorded for each of the reservoirs in the database that was used for this study. Parameters used for this study are gross depositional environments, reservoir depth, diagenetic impact, porosity, permeability, and stratigraphic heterogeneity (Table 1). Stratigraphic heterogeneity was defined on a scale of zero to eight, considering the vertical and horizontal heterogeneity of a given reservoir's depositional sub-environment following Tyler and Finley (1991), also summarized in Manzocchi et al. (2008). In this scheme, zero refers to a reservoir with no vertical and lateral heterogeneity while eight refers to a reservoir with high vertical and horizontal heterogeneity (Fig. 1).

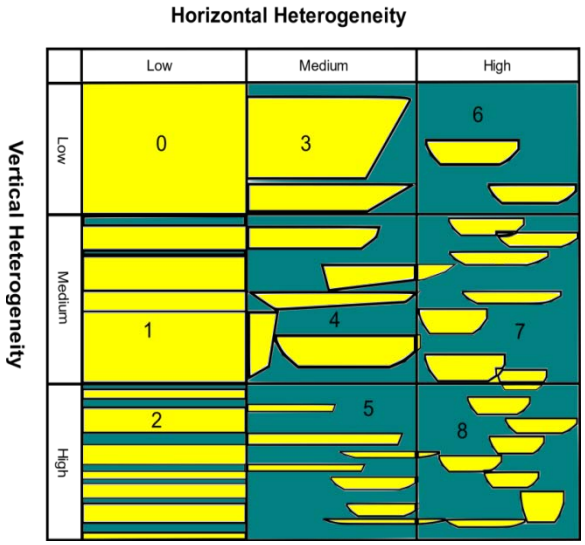

Figure 1: Depositional heterogeneity and flow unit diagram showing heterogeneity scale used for all the different Sub-environments, 0 = means low vertical and horizontal heterogeneity, highly connected sand reservoir with no clay or shale barriers. 8 = extremely heterogeneous, low net to gross reservoir sand bodies are isolated within clay or shale intervals (Modified after Tyler and Finley 1991; Aliyuda et al., 2020).

Table 1: Parameters used for the study, their range and definition.

Parameter	Description	Parameter range	Data source
Gross depositional environment	Specific environments of sediment deposition, reservoirs were classified further into Gross Depositional Environments (GDE) and Depositional-environment (DE) using the SAFARI classification Schema.	0.0 = Deep marine 0.5 Paralic/shallow marine 1 = Continental	NPD well reports, wireline logs, core images, literature
Diagenetic impact	Negative impact of reservoir sediments reconstitution and/or rearrangement resulting in a reduction of porosity and permeability only. It is classified into low, moderate or high impact. 0 = Low, 0.5 = Moderate, and 1 = High.	0 = Low 0.5 = Moderate 1 = High.	NPD well reports, literature
Stratigraphic heterogeneity	A measure of aerially extensive architecturally bounding surfaces that compartmentalize the reservoirs (after Tyler and Finley 1991). A scale of 0-8 was used with 0 = Very low heterogeneity and 8 = Extremely heterogeneous (Fig. 2.3)	0 = low vertical, low-horizontal heterogeneity 1 = low vertical, medium horizontal heterogeneity 2 = low vertical, high-horizontal heterogeneity 3 = medium vertical, low horizontal heterogeneity 4 = medium vertical, medium horizontal heterogeneity 5 = medium vertical, high horizontal heterogeneity 6 = high vertical, low horizontal heterogeneity 7 = high vertical, medium horizontal heterogeneity 8 = high vertical, high horizontal heterogeneity	NPD well reports, wireline logs, core images, literature
Porosity (%)	The average porosity of the reservoir interval	P10 porosity reported by field operators	NPD well reports, wireline logs, literature
Permeability (mD)	The average permeability of the reservoir interval	P10 permeability reported by field operators	NPD well reports, wireline logs, literature
Reservoir depth (m)	Highest point on reservoir units or interval		NPD well reports, literature

III. Methods

Five machine learning algorithms were used for the study; these are Linear Regression, Support Vector Machine (SVM), Boosted Tree, Bagged Tree and Random Forest. Boosted Tree and Bagged Tree are ensembles techniques of the Decision Tree methods.

Regressions are statistical technique that approximate the relationship between a dependent variable (the response) and one or more independent variables. Linear regression is mostly used for forecasting and finding out cause and response relationship between variables. Regression techniques mostly differ based on the number of independent variables and the type of relationship between the independent and dependent variables. Linear regression models are often plagued by a significant bias (Seber 1977; Mann 1987), where the predictor variables are cross correlated with each other and with the response variables, this results into the models reporting high accuracy but do not make accurate prediction of the new data. Some alternatives to linear regression are regularised linear regression approaches such as LASSO regression, Ridge regression, Elastic Net and Non-parametric regressors, usually based on decision trees.

Decision tree regression takes multiple columns of potential predictor variables and finds a subset of predictor columns that best account for the variance of the target column values (Fig. 2). Boosted Decision Tree regression algorithms together with Bagged Decision Tree are ensembles of regression decision trees. In boosted regression, the algorithm learns by fitting the residual of the trees that preceded it, thereby improving accuracy with some small risk of less coverage. Bagged regression assumes a basic model structure as the one developed in a decision tree regression. Then, it divides the source data into several bags or groups and fits the same assumed model structure to each bag of data. Bagged regression aggregates the model estimates for each bag of data into one overall model.

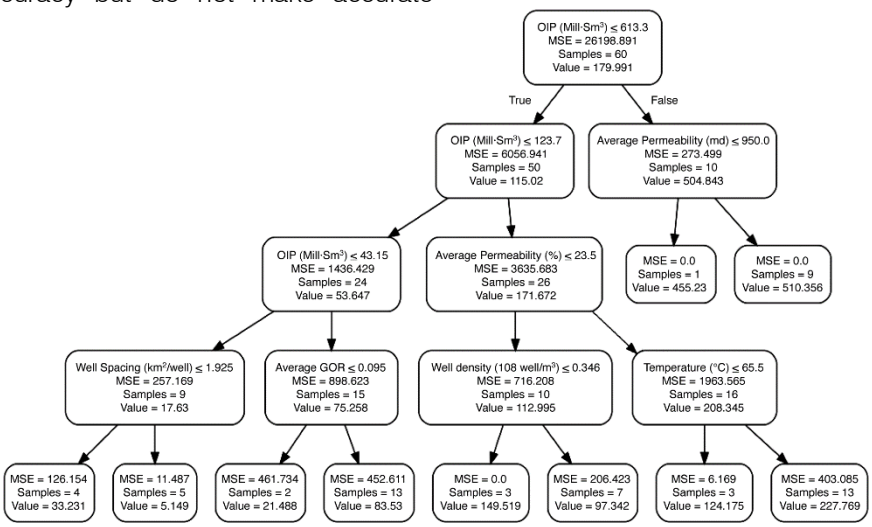

Figure 2: Decision tree regression schematic of a reservoir rate model, an example of a decision tree split at each node (Aliyuda et al., 2020).

Support vector machine (SVM) is a supervised machine learning algorithm that are commonly used to analyse data characteristic of both classification and regression problems. In SVM, each of the training data points is marked as one of two categories and then iteratively builds a region that will separate the data points in the space into two groups such that the data point in each region is well separated across the boundary with the maximum width. Support vector machine can generalize the characteristics that differentiate the training data that is provided to the algorithm. This is achieved by checking for a boundary that differentiates the two classes with the maximum margin. The boundary that separates the two classes is known as a hyperplane (Cortes and Vapnik 1995; Aliyuda and Howell, 2019; Ali et al., 2021a; Ali et al., 2021b).

Random forest is a common non-parametric regression approach which aggregates an ensemble of decision trees in order to arrive at a result. It predicts by taking the mean of the output from various trees. Increasing the number of trees increases the precision of the outcome.The decision trees are generated in parallel, and each split is made from random subsets of the dependent variables. Decision trees generated through taking random columns from the dependent variables are less prone to overfitting (Breiman, 2001). This technique allows random forests to be more robust than decision trees.

Data for this study were normalised using min-max method, other pre-processing techniques performed on the data include a split of the data into training and testing sets. These techniques prevent against over-fitting of the models. The training set is used to train the model, whereas the testing set is used to detect the accuracy of the model and output the predicted reservoir porosity.

Explained variance or R-squared (R2), square root of the mean squared error (RMSE) and mean absolute error (MAE) were used to estimate the performance and the accuracy of the trained models:

$$R^2 = \frac{N\sum xy - \sum x \sum y}{\sqrt{[N\sum x^2 - (\sum x)^2][N\sum y^2 - (\sum y)^2]}}, \quad \text{I}$$

$$RMSE = \frac{\sqrt{\sum_{i=1}^{N}(yi - pi)^2}}{N}, \quad \text{II}$$

$$MAE = \frac{\sum_{i=1}^{N}|yi - pi|}{N}, \quad \text{III}$$

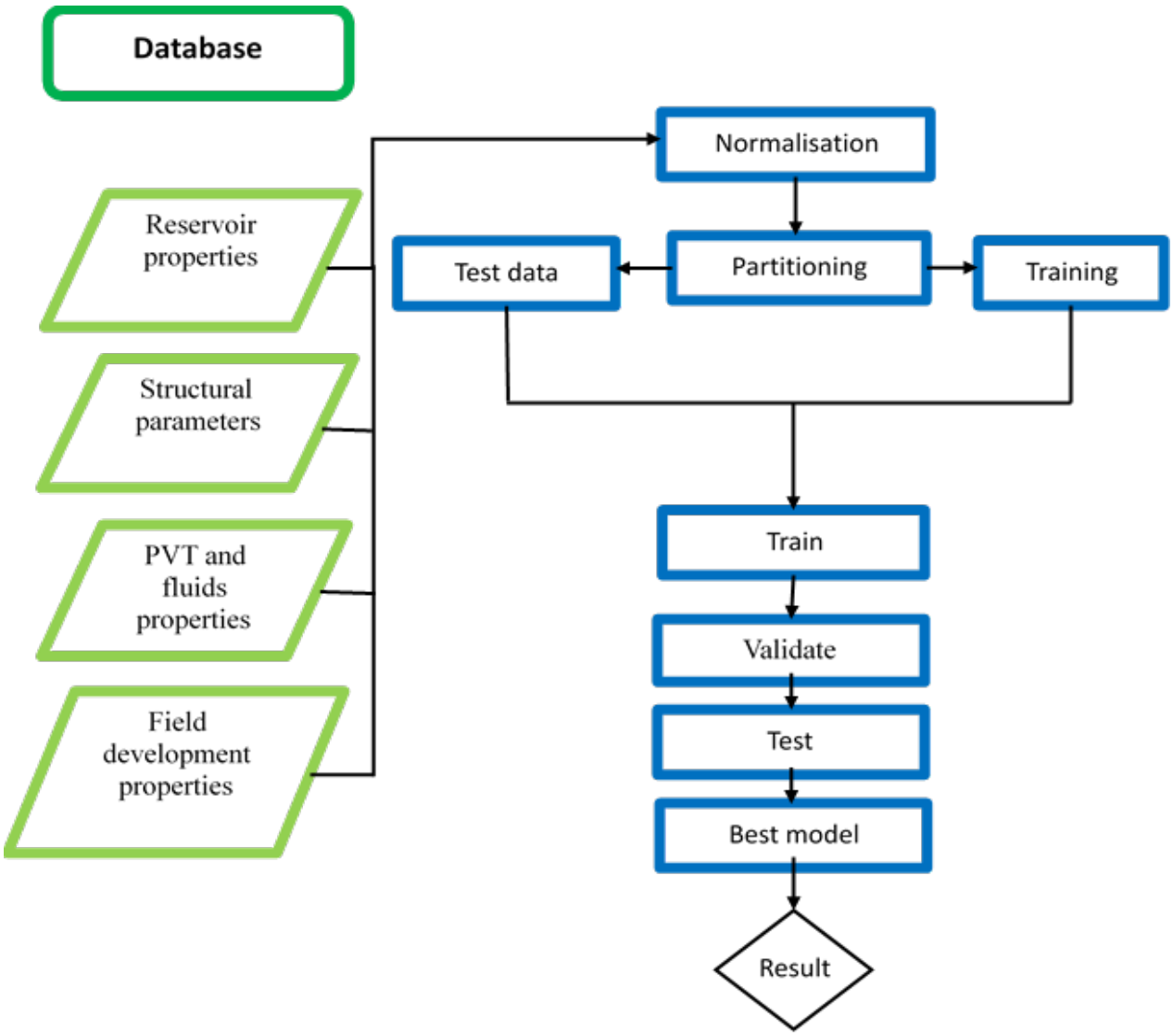

Figure 3: Workflow used to show the rundown of the procedure from building the database to training and testing of models (adopted from Aliyuda et al 2020).

IV. Results/Discussion

The distribution of some of the major predictors of the model is presented in Fig. 4, 5 and 6, these predictors are reservoir depth of burial (Fig. 4), gross depositional environments (Fig. 5) and reservoir stratigraphic heterogeneity (Fig. 6), as well as the response variable (Fig. 7).

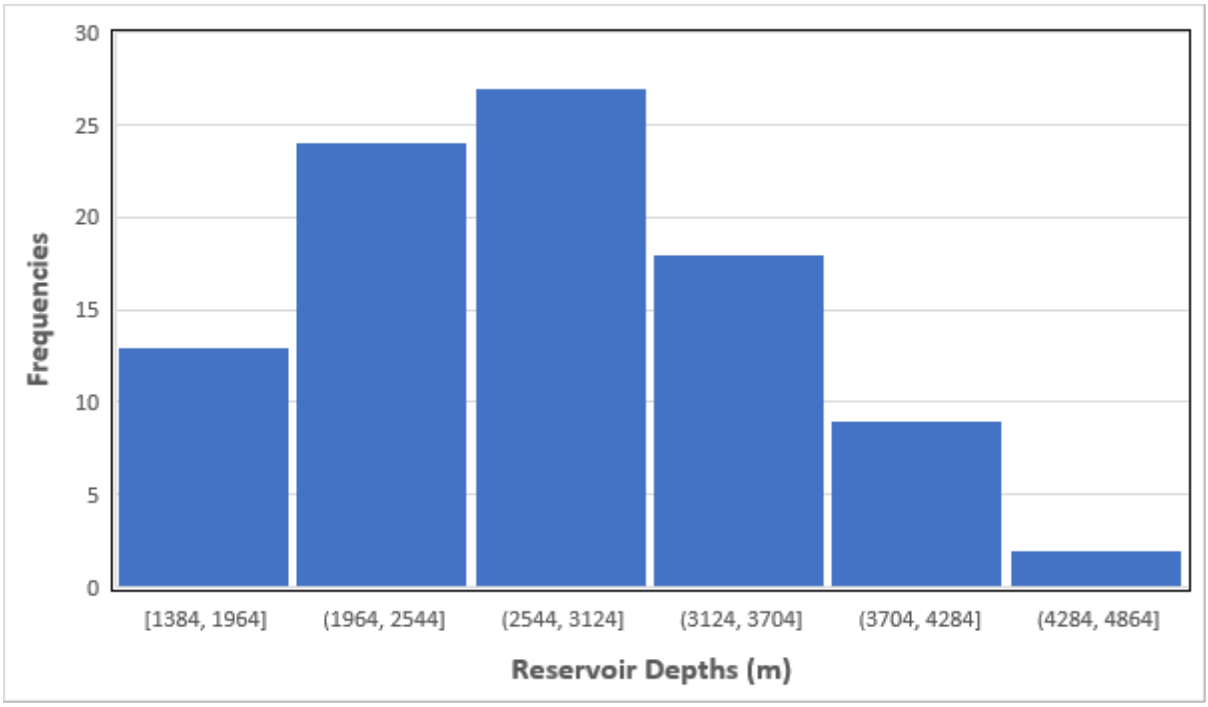

Figure 4: Distribution of reservoir depths of all the 93 reservoirs in the database. About half of the reservoirs are buried below 2,000 meters subsea.

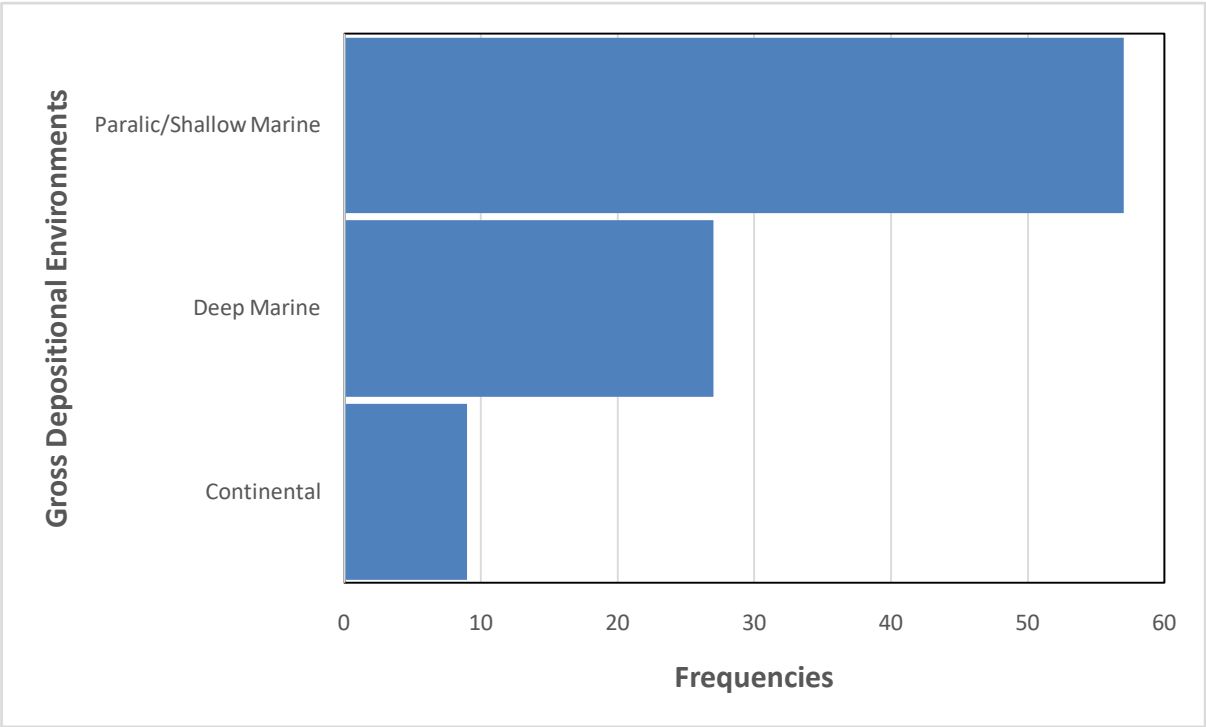

Figure 5: Proportion of the gross depositional environments of the reservoirs in the database.

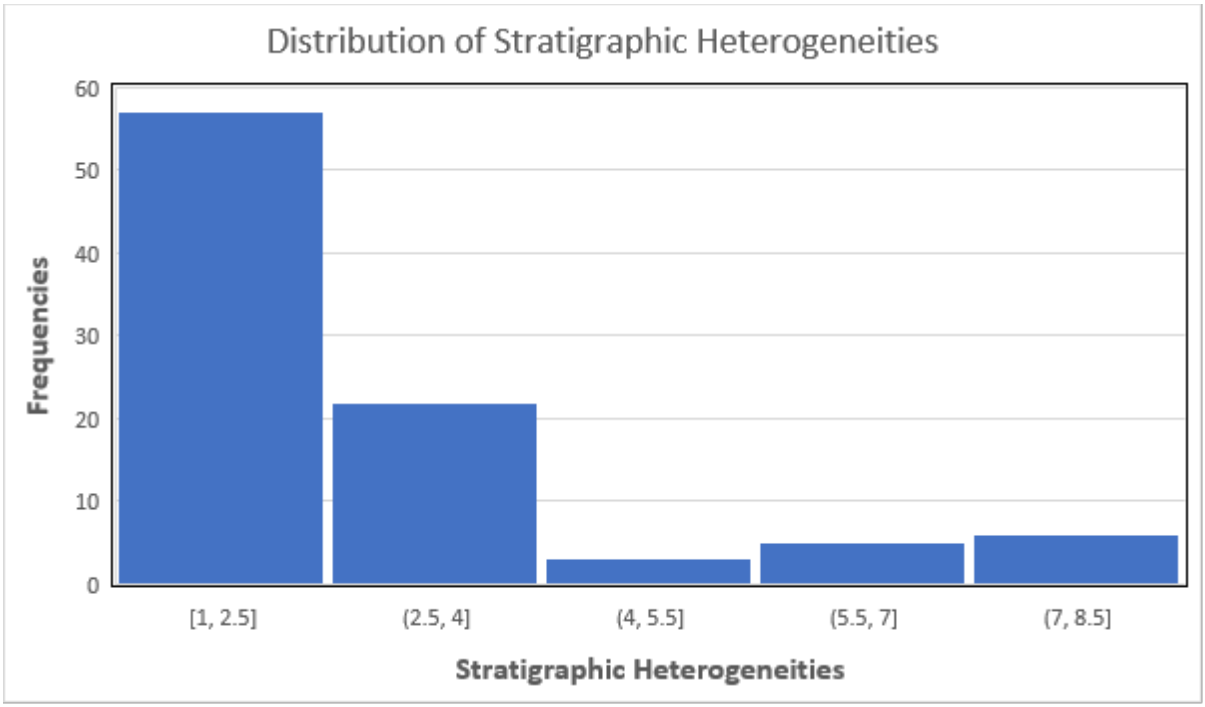

Figure 6: Distribution of stratigraphic heterogeneities in the database. Low values represent low heterogeneity, high values represent high heterogeneity.

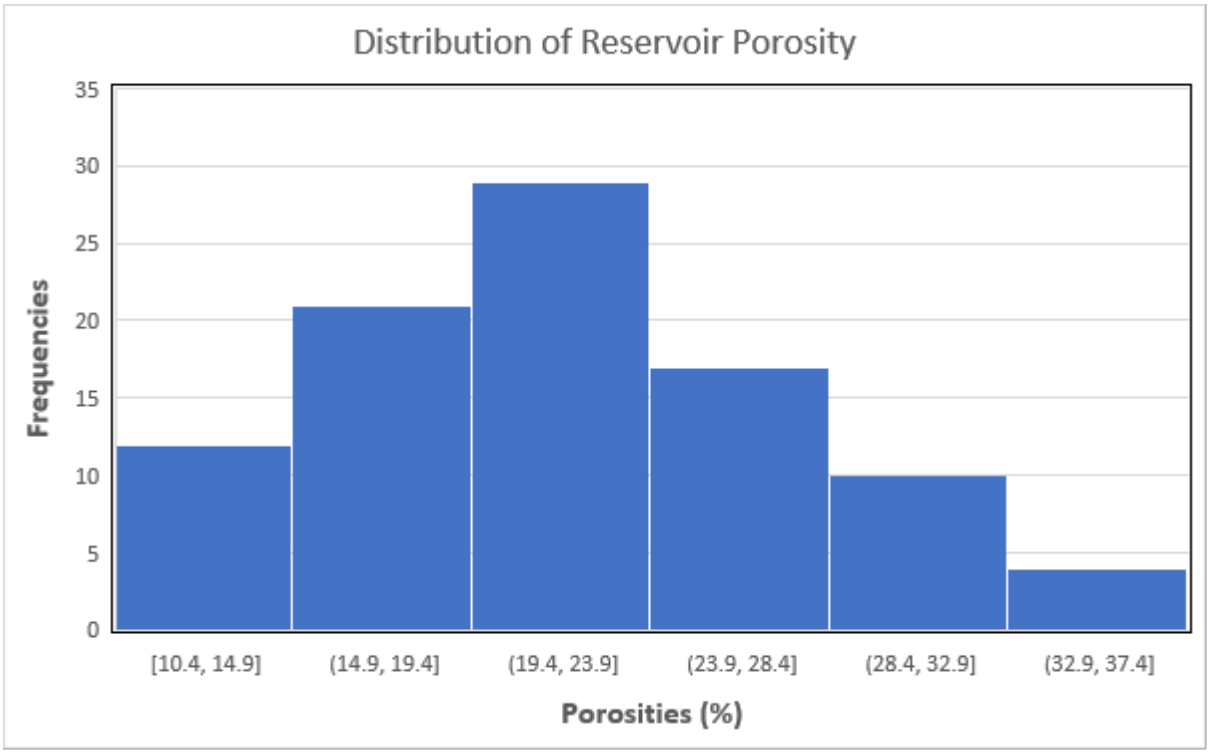

Figure 7: Porosity distribution of all reservoirs in the database. Reservoir porosity ranges from a minimum of 10% to a maximum of 37%.

Figures 8 and 9 demonstrate the correlation between two key predictors -reservoir depth of burial and stratigraphic heterogeneity with reservoir porosity. For the porosity against reservoir depth plot, it shows a slight decrease in porosity with increase in depth, except for a few outlier points which might indicate early migration of oil, halting reservoir porosity decline with increasing depth. The machine learning algorithms

learns from these data to make prediction. The relationship between porosity and reservoir stratigraphic heterogeneity (Fig. 9) is not as strong as the one between reservoir depth and porosity (Fig. 8), the plot still shows some level of correlation between the two variables.

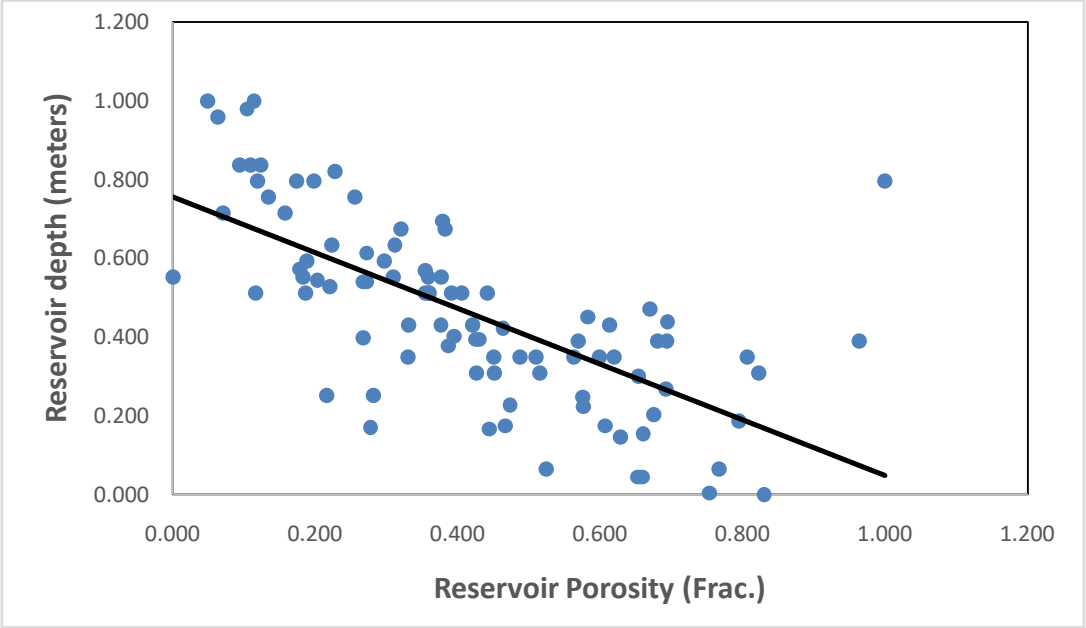

Figure 8: The relationship between reservoir depth and porosity, all measurements are in fraction (from 0 to 1).

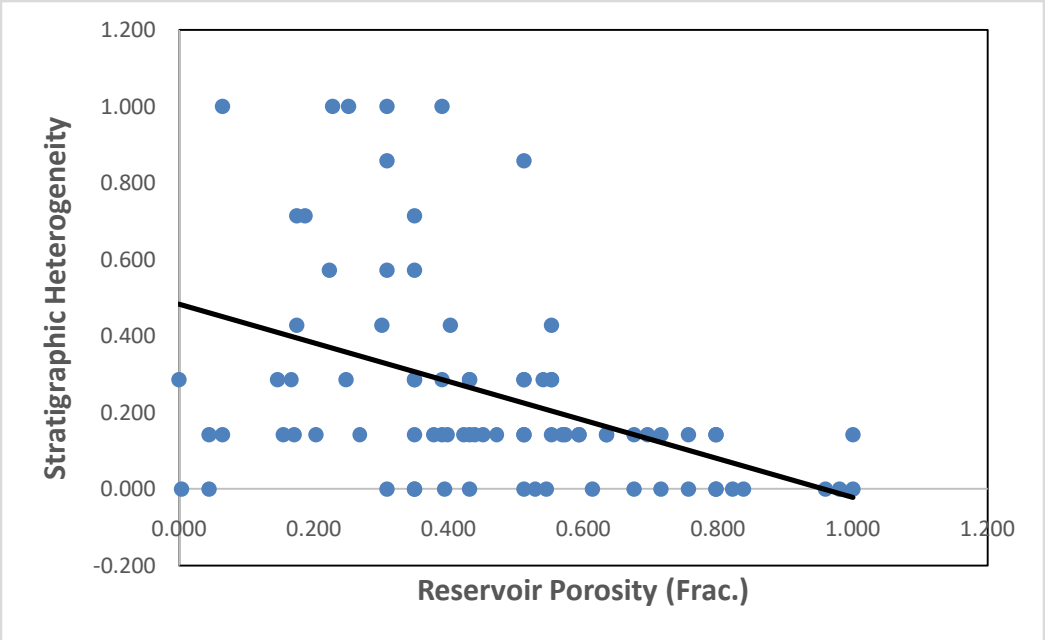

Figure 9: A plot of reservoir stratigraphic heterogeneity against porosity. Both measurements are in fraction.

We trained five different models using 5 different algorithms: Linear regression; support vector machine with a Gaussian kernel function, Boosted Tree with a minimum leaf size of 8, 30 number of learners and learning rate of 0.1; Bagged Tree with minimum leaf size of 8 and 30 number of learners; random forest regression with surrogate and 200 trees. The performance of the different models was compared using three metrics (Table 2), random forest model outperformed all other models. The comparison does not include model training time as no model took up to one minute to train.

Table 2: Performance of the different models trained compared using R-squared, root mean square error (RMSE) and mean absolute error (MAE).

Models	R2	RMSE	MAE
Linear Regression	0.57	0.155	0.116
Support Vector Machine	0.62	0.145	0.112
Boosted Tree	0.52	0.163	0.128
Bagged Tree	0.44	0.177	0.139
Random Forest	0.75	0.118	0.0028

Figures 10, 11 and 12 demonstrate the relationship between the predicted porosity and the actual porosity in the database for the random forest model. Fig. 12 shows a better match between the predicted porosity and the actual porosity in the test data with R^2 score of 0.87, compared to Fig. 10 and 11 with an R^2 of 0.75 and 0.71 respectively.

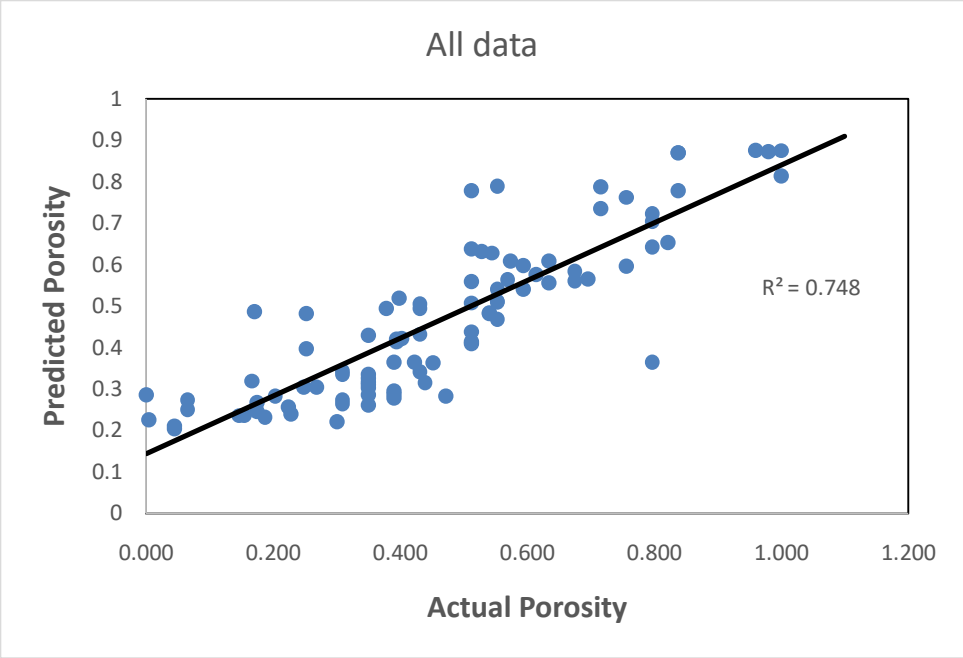

Figure 10: The relationship between predicted porosity and actual porosity for both training and testing data from the random forest model.

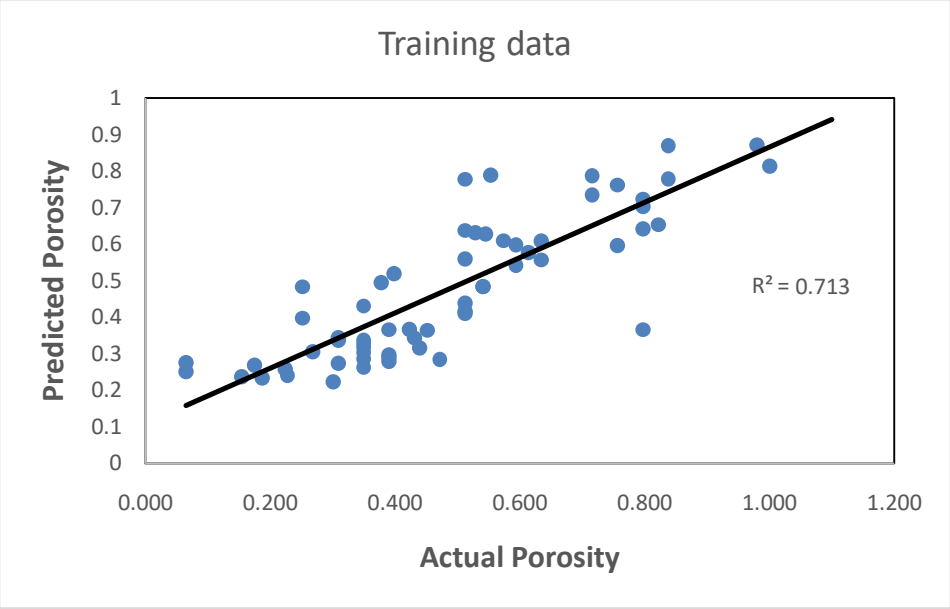

Figure 11: Cross plot of actual and predicted porosity for the training data.

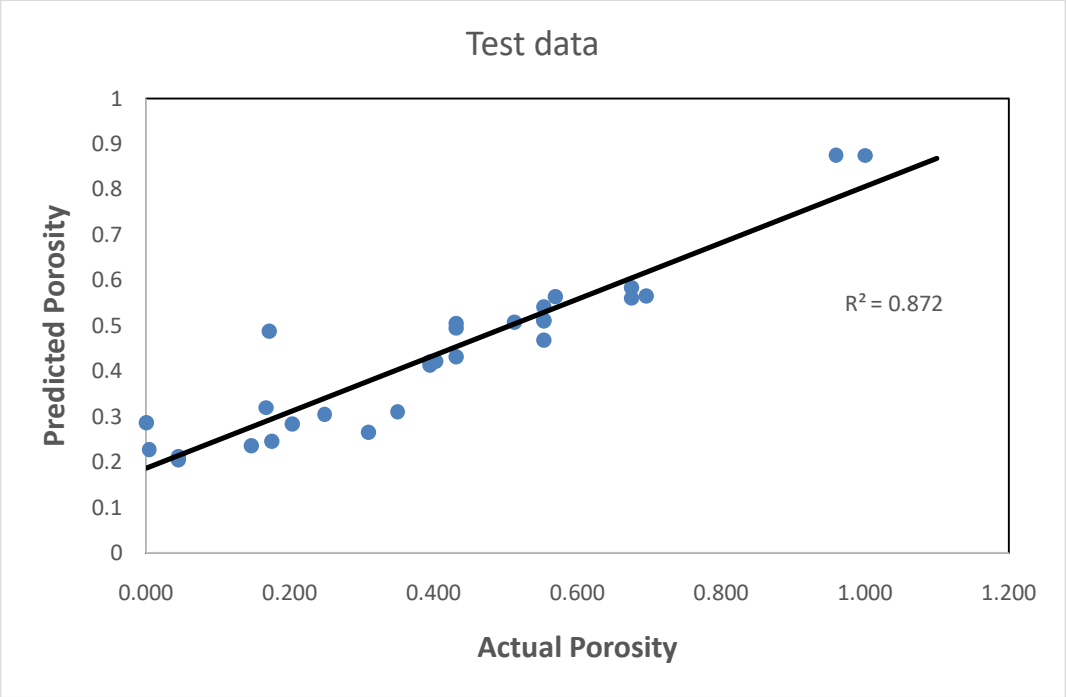

Figure 12: Relationship between the actual and predicted porosity for the test.

V. Conclusion

The machine learning technique of predicting porosity has numerous advantages over traditional techniques such as the empirical/semi-empirical formulae, Wyllie's equation and the density equation for porosity conversion where some suits of logs are used to predict porosity. The workflow shown in this study does not depend on any predetermined logs, it relays on a detailed characterization of the reservoir and its sedimentology. The machine learning approach represents a pragmatic approach to the classical log conversion problem that over the years has caused dilemmas to generations of geoscientists and petroleum engineers. The method requires no underlying mathematical models or costly assumptions of linearity among variables. Predicting porosity by using sedimentological parameters can effectively reduce the high cost of using petrophysical methods such as nuclear magnetic resonance and other logging methods.

The main limitation of the method is the amount of effort required to build a robust database, pre-processed the data and partition the data into training and testing sets, which is common for all models relying on real data, and the time to train and test the models. On the other hand, once established, the application of the models requires a minimum of computing time.

For the five porosity models trained, we find that models trained using random forest algorithm outperformed all the other models. The model has an R-squared score of 0.75 and MAE score of 0.0028.This study shows that machine learning has a strong potential to solve some important subsurface problems and could be an alternative to conventional methods of predicting porosity. This method can predict porosity not just around a wellbore but for some distance away from the well.

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Competing Interests Statement

There are no financial conflicts of interest to disclose.

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E-Marketing and its Influence in the Delivery of Services Atguaranty Trustbank (Gt Bank Cape Coast)

By Mark Quaye Affum

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In terms of GT Cash Machine (ATM), clients were satisfied about, how the machine works, always is on good condition and perfectly working. From the statistics it can be seen that 90% of the clients approved of their service through the ATM machine.

Overall, the management of GT bank should increase its activities on the internet and more sensitisation should be given to clients about its operation on the internet, so that clients will patronize its electronic services.

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GJCST-G Classification: *J.1*

Strictly as per the compliance and regulations of:

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I. Introduction

The influence of e-marketing in the service industry in general and marketing in particular has been examined from a different of perspective. Each of these has been concerned with the unique features of the medium through which the marketing n message is being transmitted and the effects of digital transactions or relationships between an organization and its customers.

The development of theories for strategic internet marketing have proliferated since 1999 and the acknowledgement of the growing sophistication of internet marketing in strategic planning has arguably had a strong influence on the quality of websites, services and other electronic messaging systems in communicating effectively with consumers.

E-marketing also involves strategic use of all available information devices, hard media and software applications for reading electronic text and graphical context. Further e-marketing strategies are not limited to business dependent upon or actively participating in e business, but they do contribute towards the transformation of a traditional organization into an e business. This research is designed to summaries literature pertaining to e-marketing and to demonstrate how it has influenced positively negatively on the services as well as products in the service industry.

Today, it is fashionable to talk about the new economy; we hear that businesses are operating in a globalized economy that things are moving at a nanoseconds pace that our markets are characterized by hyper competition that disruptive techniques are challenging every business and that business must adapt to the empowered consumer.

The old economy seemed simpler. It was based on the industrial revolution and on managing manufacturing industries. Manufacturers standardized products in order to bring down cost. They aimed to continually expand their market size to achieve economies of scale. They tend to relocate their producers and policies in every geographic market. In contrast, the new economy is based on the digital revolution and the management of information. It can be dispatched to a great number of people who are on a network and it can reach them with great speed. To the extent that information is public and accessible, people will be better informed and able to make better choices. The fact that today's economy and businesses are hybrid of the old economy and the new economy.

Businesses need to retain skills and competencies that have worked in the past, but they will also need to add new understanding and competencies if they hope to grow and prosper. Businesses are adjusting their marketing practices to meet new conditions. Businesses and their marketers are getting involved in electronic business and consumers' relationship management.

Electronic business describes the use of electronic means and platforms to conduct a company's business. The introduction of internet has greatly increased the ability of companies to conduct their business faster, more accurately over a wider range of time and space, at reduced cost and with the ability t0 customize and personalize customer companies have set up websites to inform and promote their product and services.

Electronic commerce is more specific than the electronic business and this has given rise to electronic marketing and electronic purchasing. Electronic marketing is the use of technology to enable more

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effective ways of achieving sales to new and existing customers. It also describes company effort to inform, communicate, promote and sell its products and services over the Internet. The Internet today functions as an information source, an entertainment sources, a communication channel, a transaction channel and even a distribution channel. One can use it as a shopping mall, a television set, a newspaper or a phone.

The Internet provides marketers and consumers with opportunities for much greater interaction and individualization. Bill Gates, chairman of Microsoft said, "The internet is not just another sales channel it will transform your business. The future company will operate with a digital nervous system".

The digital revolution has place a whole new set of capabilities in the hands of consumers and business. This has provided consumers with a substantial increase in buying power, a greater variety of available goods and service. Businesses are also benefiting in this digital revolution age as businesses can collect fuller and richer information about markets, customers, prospects and competitors.

The Internet provides a more accurate and faster way to send and receive information, orders, transactions and payments between businesses their partners and their customers. The Internet provides an array of opportunities enhance the sales process, the customer buying process and the customer operating process. This has cad to businesses adopting more efficient and receive information, orders, transactions and payments between busy partners and their customers. The Internet provides an array of opportunities enhance the sales process, the customer buying process and the Customer operating process. This has cad to businesses adopting more efficient and effective business techniques and cost effective measurers.

II. Statement of the Problem

The aim of every business is to maximize profit through the most cost effective measure. With the introduction of information technology, more businesses are taking advantage of the electronic marketing in the new economy.

Institutions such as Joy FM, Metro television, British Broad Casting cooperation, Peace FM,GT bank, standard charted bank among others are using the interest to reach millions of customer both loyal and potential within and without the country.

Businesses are using the Internet as a source of distributional channel, promotional campaigns. In terms of advertising, sales promotion, direct marketing to inform, persuade customers and potential customer on the availability of their product or service on the Internet. The Internet has become such a big enterprise that more people are embracing the use of the Internet to transact business and also to obtain valuable information.

A visit to any other cafe reviews the extent obsession with the use of the Internet through the member of people patronizing the technology. Given the number of advertisements that one sees on the Internet, it is fair to assume that hug amount of funds are invested in this venture (e-marketing). It is therefore important to establish whether the financial institution for example GT bank is recording higher patronage for their service as a result of the use of electronic marketing.

III. Objectives of the Study

The aim of the study is to

1. Determine the level of influence the Internet has on consumers in their choice and decision-making on financial service.
2. Determine the amount of expenditure service industry especially GT bank spent annually on the use of electronic marketing
3. Determine the profit maximization of the service industry especially GT bank since embarking on the use of electronic marketing.
4. To advice the financial institution especially GT bank on how to package its product on the Internet.

IV. Significance of the Study

1. The finding of the study will help the service industry especially GT bank to discover strategies to improve their sales process. For example though better market space, product targeting among others.
2. The study would also provide useful recommendation that would help financial institutions on how the package its products or service on the internet.
3. The study will also be useful for customers in their operating process. This will enable the customers to achieve more benefits while the product is in use.

V. Methodology

A qualitative research design will be using a structured questionnaire to obtain data on:

1. What qualities attract client to their choice of bank.
2. The things that really attracts consumers when using the Internet.
3. What consumers wok out for when browsing.

A combination of both close and open ended questionnaire will be administered can the sample respondent made up clients at the selected banking walls and as well as selected internet café users. Respondent will ask to answer question by self-administration in case of literate and interview interns of illiterate of the respondent. Secondary data will also be obtain from the banks management to ascertain the

banks level of business transaction in the use of electronic marketing and their perception of responds in the same area.

VI. Limitations of the Study

Although this research promises to be a good managerial tool for efficient and effective the service industries is burdened with several constraints.

1. The research work is solely financed by the researcher.
2. There are logistical constraints, in terms of acquiring resource materials.
3. The researcher is going through difficulties sourcing information from various respondents due to stigmatisation and victimization among the respondents in volunteering information. However this constraint will not restrain the researcher from carrying out this survey.

VII. Research Questions

1. Is e-marketing having positive or negative impact on the service industry?
2. Are customers benefiting from the use of the Internet?

This research work at the end of the day will either prove or disapprove these views about electronic marketing in the service industry.

VIII. Literature Review

a) Introduction to the marketing concept

The marketing concept holds that the key to achieving organisational goals lies in determine the needs and wants of the target market and delivering the desired satisfaction more efficiently than competitors.

The success of every company lies in first knowing who your clients are? In other words knowing your target market. Secondly, gearing all resources at your disposal to satisfy the needs of your target customers in other words having a deep sense of respect for the needs and expectation of your client and as a policy being client oriented. Thirdly, motivating your employees to achieve high morals among them and in turn produce high quality and valuable service to target clients.

The marketing concept rest on four (4) main pillars as has been analysed below;

The first of these is "market focus" it is said that no company can operate in every market and satisfy every need. As such companies must design their target markets carefully and prepare a tailored marketing programme for each every market and satisfy every need. As such companies must design their target markets carefully and prepare a tailored marketing programme for each target market.

*Customer Orientation" it is important to satisfy the needs of the clients, due to the high cost of client attraction as opposed to client retention."Customer Retention" is therefore more critical to an organization than Customer than Customer Attraction". The key to customer retention is customer satisfaction. A satisfied customer will visit the facility again. For banking services when the needs arises, and talk we favourably about the bank facility to others, pay less attention to competing bankers.

To ensure customer satisfaction, GT Bank, has given beyond satisfying its customers to delighting its customers. This will facilitate the favourable "word of mouth" for the institution. Dissatisfied customers spread negative word of mouth about the institution.Thirdly, another pillar of the marketing concept requires institutions to carry out internal marketing" as well as "External marketing". Internal marketing describes the work to train; motivate employees to serve customers well. Berry how argued that the most important contribution the marketing department can make is to "exceptionally" clever getting everyone else in the organization to practice marketing. External marketing describes the normal work to prepare; price distributes and promotes the service to consumers well. Internal marketing must be seriously pursued before embarking on external marketing.

b) The service concept

The service concept holds that consumers will favour those products that offer Managers in these service-oriented the most quality or performance. Organizations focus their energy on marking good product and quality service and improving them over time.

c) The nature of service

One of the mega trends of recent years has been the phenomenal growth of service. A service is any performance that one party can offer to another that is essentially intangible and does not result in the ownership of anything. Its production may or may not be tied to a physical product.

d) Types of service

Service organizations can be distinguished based on their nature of ownership. This is whether they are from the government sector with its courts, employment service, hospitals, loan agencies, and schools are in the service industries. The private non-profit sector with it museums, charities, churches, colleagues, hospitals, and foundations is in the service business. A good part of the business sector with its airline, bank, hotels, medical practices and realestate firms is in the service business. Many workers in the manufacturing sectors, such as computer operators, accountants and legal staff are really service providers.

e) Characteristics of services

In designing marketing programmes, a service organization such as GT bank must consider the under listed factors.

f) Intangibility

Unlike physical products, services cannot be seen, tasted, fell, heard or smelled before they are bought. Example, a person investing in the bank cannot see the exact result before the purchase. To reduce uncertainty buyers will look for evidence of the service quality. They will draw inferences about quality from the place, people, equipment, communication, materials, symbols and price that they see. Therefore the service provider's task is to manage the evidence to "tangibilise the tangible".

Service marketers are challenged to add physical evidence and imagery to abstract others. For example, suppose a bank wants to position itself as the "fast" bank. It could make this positioning strategy tangible through a number of materials tools. Place, people, equipment, communication material, symbol, price. Service marketers must be able to transform intangible services into concrete benefits.

g) Inseparability

Service inseparability means that services cannot be separated from their providers that are services that are typically produced and consumed simultaneously. If a person renders a service then the provider is part of the service. Because the client is also present as the service is produced provider. Client interaction is a special feature of service marketing. For example in the bank, the customer service manager, bank manager, the cashiers and so on are part of the service.

The second feature of service inseparability is the presence or involvement of clients. For example in the banking institution, of the customer complaint desk where other clients are present whilst one is being attended to. The third feature is how the service providers work fast. For example the clients coming to redraw money in the bank should be attended quickly. The service organisation can train more service providers and build up client confidence to avoid dissonance.

h) Variability

Service variable means that the quality of service depends on who provider then as well as when, where and how they are provided. Services are highly variable. For example Banking institutions such as GT bank, standard chartered bank, Eco bank have a reputation for providing better service than most banking institution.

Service buyers are aware of this variability and often talk to others before selecting a service provider. Service firms can take three steps toward quality control. The first is investing in good hiring and training procedures. The Recruiting the right employees and providing them with excellent training is crucial regardless of whether employees are highly skilled professionals or how skilled workers.

The second step is standardizing the service performance process throughout the organisation. This is done by preparing a service blue print that depicts events and processes in a flow chart with the objective of recognizing potential points. The third step is monitoring customer satisfaction through suggestion and complaints systems, customer surveys and comparison shopping.

i) Perishability

Service perishability means that services cannot be stored for later sale or use. The perishability of service is not a problem when demand is steady. When demand fluctuates, service firms have problems. For example, during the working days, banks complementary services such as television for client waiting to be served.

j) Lack of ownership

Service products lack the quality of ownership. The Service Consumer often has access to the service for a limited period of time. Example, the client does not visit the bank unless he or she has to transact business. Due to the lack of ownership of service, service providers must take a special effort to reinforce their brand identity and affinity with the consumer by turning the disadvantage of non-ownership into benefit. For example, customers complaint manager can se his skills to help client solve their problem about their insecurity they are having with the banking services.

k) The service triangle

Transaction marketing is part of a larger idea called relationship marketing. Relationship marketing has the aim of building mutually satisfying long-term relations with customers, suppliers, distributors or order to earn and retain their business. Relationship marketing builds strong economic, technical and transaction costs and time. The ultimate outcome of relationship marketing 1sthe building of a unique company asset called marketing network. Five different levels of relationships can be formed with clients who have purchased on institution services.

First, we have the basic, where bank professional offers the service but does not follow up in anyway.

Secondly, the relative relationship is where the bank professional offers the service and encourages the client to complain through the customer complain line if he or she has a problem. Third, accountable relationship with client is where the bank professional's follow-up or call the client a short time after transacting business with the bank to check where the client is satisfied with the

service offered. Fourthly, proactive relationship is where the bank professional in the bank contact the clients from time to time about the new service issues.

Fifthly, partnership relationship is where the bank works continuously with the client to discover ways to provide better value of services. It must be noted however that relationship marketing depends on how many clients the bank has and their profitability.

VIII. Internet Marketing- Principle of Internet Marketing

Every now and then a technology comes along that is so profound, so universal, that its impact will change everything. It will transform every institution in the world. It will create winners and losers, it will change the way we do business, the way we teach our Children Communication and interact with individuals" said by Lou Gerstner, chairman of IBM. Internet refers to the network of linked computers around the world.

Internet is a tool that is being used to assist business processes taking place behind the séances out of the public eye. Marketing is about communicating between a business offering product or Service to a market that may recognize these goods or services.

Long before the growth of web, it was essential for businesses if they were to compete successfully to think about how their products were going to meet the needs of the people who might buy them. The marketing principles are aimed at satisfying customer needs profitably and they apply at all-time whether a business is online, or offline. These principles under pin the tactical tools described earlier as the 4ps. The principles include.

1. Listening to customers; finding out what they want from your products.
2. Getting as close to customers as possible
3. Involving customers
4. Serving customers well
5. Seeking out the best customers
6. Trying to nurture customers into a lifelong relationship with your firm and working to repeat this every time you do business.
7. Constantly testing the market, measuring and improving.
8. Adding value in everything you do for customers.

IX. Marketing-the Difference Between E-marketing and Internet Marketing

a) Marketing principle online

E-marketing refers to the use of ICT as a vehicle for marketing practice as well as the creation of new form of electronic product. The Internet helps business to acquire a good knowledge of customers because it is a way of connecting everyone who is online. According to Dave Chaffey (2002) forecast of global users of the Internet show dramatic growth over the next few years and research complied by Nua Internet surveys in Sep 2002 showed a worldwide total 605. 6 million people online.

The Internet is a "pull medium" meaning that on the whole it is Individual Consumer Choice to visit the website they are interested in ad to pull out the goods or services they want. The specific purpose of marketing online business is to offer something that makes visitors want to stay ad look around a website.This is often referred to as the stickiness of a site.

X. The E-marketing Remix in b2c Markets (Business to Consumer)

a) Online product

It is not possible to touch, smell or taste products on the internet, so a powerful attraction for private consumers to purchase many tangible products. The full range of human senses is absent on the web. The inter net on the other hand is ideal for adding considerable value to every pro9duct made available online and marketers have to think of the ways this can be done. One method of doing this is to build into the product exclusive and relevant information often personalized for the customer. Example @www.gt.com, the consumer can seek technical advice on investment, savings, purchasing of shares, bills, among others. Product can be entered online in various ways.
These include:

* Extensive product endorsement from previous customers Lists of customers Warranties Money back offers

Additional customer back-up services cross selling or related or complementary products

* Expect advice
* Improving the online experience of the private customer and encouraging a length ithe

b) Online price

Traditional pricing model, could work out desirable price base on production cost plus and profit margin or on set profit targets or base prices on the prices of the competition in the market. Businesses selling on the web have greater capacity to vary prices, and new pricing models are tending to be based upon the old question.

Prices can be stored digitally in databases and software. The effect of Internet technology on the ability of marketers of marketers to establish and maintain a pricing strategy has been dramatic. Internet marketers have to acknowledge that increasingly prices are being directly set by consumer and not just accepted by them. Finally prices can nowadays be set automatically based on the level of demand and upon the stage a product is within its own life cycle.

c) Online place

The place element of traditional marketing has been significantly changed in the online economy. Consumers now have many more online options. For purchasing, consumers can go directly to a supplier's site. However, new types of middleman are appearing on the Internet. These can be neutral intermediate site that functions to bring buyers and sellers together or they can be intermediaries. That is sites holding information that is of benefit to both customers and suppliers. The significance of getting products to customers is obviously huge.

One of the most successful products in the physical world for example is Coca Cola. This success is not just base on an excellent product; it is also base on excellent distribution. Coke is available almost everywhere people might want to drink it. The same approach applies in the online world. If gt.com wants to sell financial advice, shares, bills, loans, they have to consider placing links to their sites in many other places on the web where they feel people might wish to buy its product or services.

d) Online physical evidence

Customers often make a choice of whether or not to purchase goods or services simply based upon how the business works or feel to them. All physical things connected with the business should therefore give out positive images. The first piece' of physical evidence is the web site itself. In experiencing the website, consumers need to feel they are in a professional environment. In much respect the website represent the brand. Because we all have certain brand loyalties or preferences and a brand is often seen as a solidly reassuring thing. The marketing intention is to help create a quality online brand using the website. A site needs to be professionally designed, have dear and easy navigational aids and have a consistent look about it.

e) Online processes

The ideal situation with private online consumers does not attract them to a website but to convert the visit to a sale. In ensuring that all customers orders are fulfilled, Internet marketers will have to consider a subset of processes that will lead to accurate and helpful information being available both internal to the business and external to customers. The following set of processes is vital for online sales success:

- The process of responding to an enquiry
- The process of ordering
- The process of updating and recording stock available.
- The process of updating website information.
- The process of acknowledging an order.

The Internet Marketing functions needs to coordinate these processes, because ultimately they all concerned with the relationship with the online customer.

f) Online promotion

The promotion remix in Internet includes presentation and involves two aspects that is promoting the fact that a business website exist and promoting specific offering from a website. There are several ways of communicating a marketing message to private consumers.

These includes:

* Banner Advertisements Web public relations
* Direct e-mails
* Affiliate Programmes
* Pop up advertisements)

g) Banner Advertisements

A space across the top of a web page, usually with animated content, advertising products or services from another business is known as a "banner ad". Banner ads can be exchange between sites that offering complementary products or service or that can specifically target onto sites, where it is felt that the audience will be appropriate. Banner ads can be accurately targeted on to sites that are likely to have the audience a business is hoping to attract. For example, in consumer markets a business selling gardering products can target an online gardering publication and have their banner places in a prominent page. Retired people can also be targeted through sites geared towards the elderly. The choice for online markets is based upon which sites attract most of the relevant target audience and where, within those sites most visitors will view your advertisement.

h) Web page relation (PR)

A cheap and easy way of achieving publicity on the web is by releasıng news, stories of interest to the online public. The Internet is a "pull" medium, meaning that the whole rationale of having an online presence is that web surfers approach a website in order of extract or "pull" out information. Markets must consider the perspective of the various consumers of Internet information.

i) Direct e-mailing

The practice of sending out unrequested e-mail is spamming. It is the easiest thing in the world to send out hundreds even thousands of e-mails to unsuspecting people. The trouble is that sending out ten thousand e-mails might get 50 people interested in whatever product or service one has to offer and 9,950 people thoroughly annoyed.

If Internet marketers are going to tap suite the potential benefit of e-mail, they need to consider ways of

by passing any accusations of spamming. To do this they might use option mailing. This means that before sending anyone any mail they seek permission first, hence the sometimes used term 'permission marketing'. The benefits of permission based e-mailing are considerable according to a survey quoted in e-marketer (October2002).

The survey by Quires, found that sixty seven percent of consumers believe that the quality of opt-in e-mails positively influenced their opinions about the companies sending them and fifty three percent said that such e-mails had on influence on what they purchase. Permission mailing can initiate positive customer relation and enable tailored offers to customers. Marketers must be extremely careful when considering both e-mailing and RR on the Internet. Because the Internet is a network, the effect is that news travels very fast.

j) Marketing services

A Service is still a product, even though it is something that we cannot see or touch. Online services include banking, insurance, tourism, information, financial and legal advice, education and many more. Online service businesses exploit the essence of the Internet as a context driven network.

A major difference between marketing a service product and a tangible one is that whereas a tangible product order has to be fulfilled through storage and distribution to the purchasers, a service product, an online business is often entering into an ongoing relationship with client overtime rather than merely opening and closing a single transaction. For example online banking is one of the most successful businesses available through the Internet. A customer can access his or her accounts, view transaction histories, transfer funds and pay bills at his or her own convenience.

The Internet is also an ideal medium for delivering insurance information and it is possible online to get details of many types of insurance cover. Everything from cars, life, pets, business, and holidays can be insured. The Internet also offers auctions. A traditional auction would be held in a specific location and potential bidders would have to travel there, examine the .The Internet also offers auctions.

k) The e-marketing remix in b2b markets

Internet marketing is not of course just confirmed to business selling products to private consumers. It's also important to businesses selling to other businesses the money value of online transactions between businesses is greater than the value of transactions with private consumers.

XII. Benefits of Internet Marketing in the Financial Services

The benefits derived by various online customers therefore tend to be different. In business to business (B2B) markets, businesses are trying to serve and meet the needs of other businesses and transactions are offered based on long term agreements to do business with each other. In business to consumer (B2C) markets, private consumers tend to buy for social reasons to do with personal tastes and preferences. All online businesses need to engage in marketing whether their customers are other businesses or private individuals.

a) The potential benefits of Internet marketing is customisation

Customisation is the experience that each of us can now enjoy a personal offer from a website that is tailored to suit our individual preferences. Customisation is important because it gets to the heart of what marketing is about, that is meeting customer's needs.

b) Secondly, interactive shopping

The experience of buying a product online can never be exactly the same as buying in shop in town. Some online businesses are attempting to use web based technology to create a more interactive experience for the shopper and in doing so create a relationship that will keep them. It is far more productive to attract and retain customers that acquire new ones.

c) Thirdly, ability to compare and select product

In both B2C and B2B markets, the Internet offered greater opportunities to compare the offers of online business. Several electronic market places exist where consumers can compare and select competitors' products.

d) Fourthly, dynamic pricing

The price is automatically altered to suit the particular circumstances either of the markets or the buyer and everyone involved in a transaction has the chance to gain.

e) Fifth, digital complaints and chat

Online complaints services exists to make a business out of assisting consumers in any complaint about an online product or service. Consumer's benefit by being able to add their complaint to those gathered by the specialist firm and there by achieve added collective effect. A fee is paid to the complaint service company who are able to write to the online firm concerned and elaborate the concerns.

f) Sixth, payment systems

A major benefit to online consumers is the ease and speed, with which transactions can be completed ever the Internet. A decision on the part of the private to purchase tickets for an event can be quickly converted

to a firm booking through a secure credit card transaction.

g) Accessibility

For some people the Internet is simply not accessible at all. These people have some form of disadvantage that just prevents them from taking full advantage of the benefit the Internet offers.

XIII. Opportunities for Internet Marketing in the Financial Service

The Internet offers several new opportunities for businesses to re-establish themselves online. To be able to serve a market more importantly a particular segment of a market, an online business needs to know all about, it. It must be an intelligent business in terms of being well informed about trends or changes. There are several ways in which Internet marketing generates new in opportunities.

a) These involve acquiring marketing intelligence

The Internet is an ideal research tool for an online business. It is possible to gather business information from all over the world to monitor competitor activities, find out opinions and feelings of potential customers.

b) Secondly, affiliate marketing

The process of carrying links from one website to another business is affiliate marketing and this is an agreed business to track how many visitors pass through a particular link on another site to their own site. The affiliate business carrying the link will be paid either a flat fee or commission if a sale is generated from the referral. Commissions vary depending on the sale.

c) Third, analysis of competitors' activity

The Internet offers the opportunity for careful and accurate analysis of what competitors are doing online. Each company that goes online immediately becomes open and transparent as they do so. By its nature, the Internet is open and everyone can view its content. Marketing activities have to include keeping a close eye on the tactics, the ideas and offerings of competitors firms.

d) Last but not the least, identifying customers

Online businesses sell to either private consumers or business clients and need to know as much as about them as they can.

XIV. The Challenges of Internet Marketing in the Financial Services

Whilst the Internet is offering marketing benefits and opportunities on a massive scale it also throws up many challenges. The challenges have to be face and overcome if a business is to compete in the online world. The Internet offers a new channel through which the processes involved in adding value take place. But just as the Internet represents a new channel of opportunities, so it causes potential conflict and challenges.

a) Meeting customer expectations

The constant availability and convenience of the Internet has been reinforced with increased personalisation and price transparency.

b) Online merchandise

Secondly, through the Internet, merchandise is becoming available in mass customised form allowing customers to enter personal measurements for parts before ordering or allowing computer manufacture to encourage customers to configure their machines online as they order. Customers will increasingly demand or expect this one to one online attention.

c) Thirdly, information overload

Because marketing requires a business to focus beyond and outside of it, to discover information about the market it hopes to serve, its customers and its competitions, the business will naturally be awash with data. Employees and system can be overloaded. There is therefore the need at the outset to consider the kind of data that is crucial to the business and from that to think of the processes and information systems that will be required to handle data.

d) Fourth, keeping pace with technological change

As the global world of e-business gather pace, every business is having to face up to the challenge of what to do, when to do it and how.

e) Fifth, security and payments systems

The Internet has become a global phenomenon because it is an open network, but it is also an insecure network. Despite this, millions of the Internet based business transactions are taking place every minute. Confidential, sensitive and potential demand company details increasingly, being made available to Internet based access. Virus hackers and other undesirables are constantly a danger. The challenge for business leaders is therefore a plan for security.

f) Impact of e-marketing on business especially financial institution

The Internet is having a growing impact on the choices available to consumers in both business to consumer and business to business market in the financial industry. Online Consumers have a vastly increased variety of services conveniently available from the Internet both product goods as well as services such as finance. For example, consumers have had the chance to access different types of online banking of their choice and select which institution services conform to their needs. Secondly, consumers have the opportunity of customisation themselves with information on product or service alternatives, Products

comparisons, guarantees, offers, promotions and deals offered by the financial institutions.

g) Thirdly, increased opportunity for e-learning

The Internet is turning onto be a major method of delivering electronic learning to people of all ages. The Internet provides the opportunity for consumers of financial services to learn about the activities processes, new changes of their bankers.

Fourth, the Internet has increased the ability to engage online discussions. Customers not only have an increased range of products and services available from the Internet, they also have an increased ability to engage in online discussions about products or services. These discussion forums make use of discussions about products or services. They also make use of the ability of the Internet to enable 'synchronous' communication. This is text-based chat between different users who are logged on at the same time. Consumers can compare experience of products and seek advice.

h) The power of Internet

Consumers are encouraged by their ability to make online comment both about specific products and about particular markets.

Fifth, consumers have the opportunity of dynamic pricing of the services or product of the institutions.

Dynamic pricing means that data from the Internet can be used by software tools to constantly change prices according to market conditions. In markets, data about consumer's competitor's prices, high and low prices for the week or month is added to the firm's own knowledge about what1S or is not an acceptable price for a product. Sixth, the Internet is having a growing impact on how government sees the service industry.

The Internet is allowing an increased flow of information from government departments to business and permitting business to get in touch with one of the most relevant government departments to them, the department for trade and industry.

Seventh, the Internet gives the level playing field of equality of Internet presence. A well designed website, small businesses have the confidence to communicate message much more effectively, by passing prejudices that might otherwise distort the message. For example, small businesses who wants to contract loan, seek advice from their bankers can access the Internet without any prejudices. Last but not the least, consumers have instant feedback of the problems, comments, complaints that they put across to the organisation. The Internet is having a growing impact on the business that is selling, secondly, the product or service that is offered for sale and thirdly the consumer that is, the business or individual wishing to purchase the product.

XV. Methodology

a) Company mission

The mission of management and stag of GT Bank is to be an innovative, customer focuses group that delivers superb products and services, ensure excellent careers for our people and contributions positively to the communities in which we live and work. The primary goal is consistently to deliver top quality total shareholder return versus our peers overtime. The operating philosophy is "Managing for value". They follow and the actions they take are aligned to value creation for all stakeholders.

b) Company vision

The main vision of GT Bank is "to empower our businesses to deliver top quality customer experience and service, through world class operational performance and transformation expertise. We will drive to this goal through truly expect leadership capacity and professional market leading specialist skills.

The management and staff believe that the only reason for the bank existence is its clients. These clients need services of high quality, accessible and readily available at all times, listening employees, problem solving management and totally satisfied customers. In addition the bank provides financial advice on saving, investment, and loans, share-buying among others to clients.

All these activities which relate to the provision of good customer service to the client need to be organized, coordinated and directed by a truly expect leadership and professionals that have customers delighted and this is the responsibility of the management and staff of the bank.

c) Strategies

To achieve its policy objectives of ensuring quality service to its clients, the following strategies have been put in place by the bank.

1. Establishment of 24 hours GT Cash Machines (ATM)
2. Improvement in their marketing. Thus the bank has invested heavily in its employee's quality and performance through effective training and motivating its customers. Contact employees and all the supporting service people to work as a team to provide customer satisfaction.
3. Establishment of complaint desk, hot lines for customers to channel their complaints and problems to the bank.
4. The bank has made it easy and accessible for customers and service providers to have interactive communication to achieve a satisfactory service transaction by the customer.

d) Company objectives

The objective of the bank is to:

1. Put a smile at the face of a client daily.
2. Provide high quality service standards to customers.
3. Motivate employees as well as customers to provide customer relations.
4. Be customer focused, customer orientation, and customer attractive and over all be able to retain our customers.
5. Bring out innovative service for our customers.
6. Satisfy customer needs that win enduring customer loyalty

e) Organizational set-up

A few management teams comprising the Board of Directors, Directors, Deputy Directors, Senior Management, Managers, Supervisors and the Junior staffs.

f) Management

Findings from the research conducted on the management indicating that even though 76% of the respondent do not have any idea about the operations on the internet Services, but according to management maximum sales return 1Sachieved on it internet services event if its service are not patronized by 1tsclients. The internet service is paid through the charges of ATM cards users and other charges from the bank. According to management the internet services was connected for its clients and the entire employees in the organization. Therefore not every information can be put on the organizations websites.

g) Data analysis and presentation

Fifty clients at the bank were interviewed. It consists of both staff and clients of the banks. The questionnaire consist of the customer, bank services, telephone banking, new service provided by the bank, suggestions and complaints from customers and among others. In all therefore, 50 questionnaires were administered.

h) Customerage distribution

AGEGROUP	NO. OF RESPONDENTS	PERCENTAGE
Below 18		
18-30	29	58%
31-40	14	28%
41-50	3	6%
50+	4	8%
Total		100%

On the age distribution, it can be deduced that almost all the respondents interviewed are among the working class.

i) Service

Internet users

NO. OF RESPONDENTS	YES	PERCENTAGE	NO	PERCENTAGE
50	12	24%	38	76%

In terms of internet users of the bank, clients do not have any 1dea about the operations of the bank on the internet. But the few who have idea about its1nternet operations were generally satisfied with the services provide by the bank on the internet.

j) Gt Cash Machine (ATM)No. of yes

NO. OF RESPONDENTS	YES	PERCENTAGE	NO	PERCENTAGE
50	45	90%	5	10%

In terms of GT Cash Machine (ATM), clients were satisfied about, how the machine works, always is on good condition and perfectly working. From the statistics it can be seen that 90% of the clients approved of their service through the ATM machine.

k) Suggestions for services and complains

NO. OF RESPONDENTS	COMPLAINTS	PERCENTAGE	SATISFIED	PERCENTAGE
50	18	36%	32	64%

Respondents were generally satisfied with the operations of the bank from the statistics given above. There were however some complaints about the banks operation. Some of the clients' complaints were about the high minimum balance.

NO. OF RESPONDENTS	COMPLAINTS	PERCENTAGE	SATISFIED	PERCENTAGE
50	44	88%	6	12%

l) Telephoning your branch

On the telephoning the branch, 88% of the clients were satisfied. However 12%of the clients were dissatisfied with the telephoning services. They believe that not much attention is given to them when they call their branches.

Overall, the management of GT bank should intensify its operations on the internet and more education should be given to clients about 1s operation on the internet, so that clients will patronize its services on the internet.

XVI. Summary, Recommendations and Conclusion

a) Introduction

In the previous chapter, the data collected were presented and analysed to investigate "E-marketing and its influence in the delivery of services". The findings of the study were discussed. This part ends by giving conclusion and recommendations for consideration and suggestions for future studies.

b) Summary of findings

In general 88% of the 50 respondents interviewed were satisfied with the service offered in terms of telephone your branch, GT cash machine service (ATM), staff reception and general services provided by the bank. However, 76% of the respondents interviewed do not have any idea about the operations of the bank on the internet, but few who have idea about its internet operation which constitute 24% were generally satisfied with the service provided by the bank on the internet.

The respondents were mainly of the working class of 18-57 and above and constitute 100% of the total sample size of 50.The research findings have contributed positively to the operations of internets service of GT bank.

The under listed were the main findings of the study. Firstly, most clients of the bank do not have any idea about the operations of the bank on the internet. Secondly, it was also generally perceived by the interview that clients do not have any knowledge about new service introduced by the bank to its clients through the internet or any promotional medium. Thirdly, the clients also complained about the procedures you will go through to access or secure a loan from the bank with high interest on the loans. Fourthly, some clients also complained about high minimum balance, high bank rate. Fifthly, some of the respondents were also of the view that there was the need to train their staff. Sixthly, some of the respondents were also of the view that the number of GT Cash Machines (ATM) was not enough.

c) Recommendations

In terms of interest operations, the management of GT bank should intensify its operations on the internet and more education should be given to clients about its operations on the internet and clients should be encouraged through the provision of new services, programmes, information about clients and through other medium such as newspapers, company magazines, noticeboards, billboards so that clients may have the interest to patronize its services on the internet.

Secondly, there was a general view that the management should inform, educate clients through newspapers, telephoning clients, television, radio about any new services introduced by management such as the business master facility, business solution boost, the business, cash passport operation.

Thirdly, management of GT bank should also listen to the plight customers and reduce the minimum balance. Management can segments its customers into working classes such as students, worker, aged, and this will help management distribute its charges on the segmented balance attracts high interest rate.

Management of the bank should make it easy and less bureaucratic for customers to access loans from the bank.

Fifth, management should also make available more ATM machines advantage points to customers. Customers should also be encouraged by management to patronise the ATM cards service, this will reduce the pressure faced in the bank by clients at certain working days. Sixthly, management should continue to train its staff to provide good customer service for its clients. The training can be in the form of customers' reception, service, job, and design among others.

d) Conclusion

Out of the total of 50 clients interviewed, 76%% of the respondents do not have any idea about the operations of the bank on the interests. However 24% of the clients have an idea about the operations of the bank on the internet. It can be seen that the internet does not have any influence on the choice and decision making of customers in the financial services.

Although much is spent on internet services operations by the bank, from the data presented customers do not have idea about the operations of the

bank on the internet. I he target market of its internet operations are organization cooperate executives, institutions among others. Therefore the bank maximizes its profits on its operations on the internet.

The banks revenue may come from several sources like advertising income, sponsorship income, membership and subscription income among others. To encourage repeat visits, management of the bank needs to package its websites to be attractive on first viewing ana interesting encourages repeat visits. Management needs to pay attention to context, that is, the layout and design, contents, that is, text picture, sound and video, the site contains, community that is how the site enables user to user communication, comments, that is, site capabilities to enable commercial transactions. This will help GT bank to package its product or services well on the internet to encourage repeat visits. It can be deduced that it is profitable today, to operate e-banking services on the internet.

e) Recommendation

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Crop Production Modeling System for Diverse Physiographical Areas in Nueva Vizcaya

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Abstract- The wide range of environmental factors affecting cropping is very difficult to ascertain most especially with the absence of climate monitoring equipment and dissemination of an up-to-date weather data forecasting. Due to climate change, irregular weather patterns cause major disruptions in agricultural activities and heavy damage to crop yields. There is limited data available to anticipate and adapt to climatic changes due to insufficiency of monitoring systems.

The proposed system entitled “Crop Production Modeling System” then integrates the use of available state-of-the art climate sensing and monitoring system to gather and interpret data and establish current pattern of weather. Portable and unique Field Monitoring Systems (FMS) installed in strategic locations of the different municipalities of Nueva Vizcaya will be utilize to effectively monitor variations in the weather patterns. These weather patterns will be used as a tool to determine the optimal cropping season. In addition, the system provides different graphical presentations as reports readable and understandable to the users especially to the agricultural sectors. Moreover, the said system will be accessible and portable to the users in all cases because its internet dependability.

Keywords: crop modeling system, field modeling system, portable, weather pattern, nueva vizcaya.

GJCST-G Classification: C.0

Strictly as per the compliance and regulations of:

Crop Production Modeling System for Diverse Physiographical Areas in Nueva Vizcaya

Rodemelia B. Bangat [α], Fidel G. Patricio Jr [σ] & Joan Hazel V. Tiongson [ρ]

Abstract- The wide range of environmental factors affecting cropping is very difficult to ascertain most especially with the absence of climate monitoring equipment and dissemination of an up-to-date weather data forecasting. Due to climate change, irregular weather patterns cause major disruptions in agricultural activities and heavy damage to crop yields. There is limited data available to anticipate and adapt to climatic changes due to insufficiency of monitoring systems.

The proposed system entitled "Crop Production Modeling System" then integrates the use of available state-of-the art climate sensing and monitoring system to gather and interpret data and establish current pattern of weather. Portable and unique Field Monitoring Systems (FMS) installed in strategic locations of the different municipalities of Nueva Vizcaya will be utilize to effectively monitor variations in the weather patterns. These weather patterns will be used as a tool to determine the optimal cropping season. In addition, the system provides different graphical presentations as reports readable and understandable to the users especially to the agricultural sectors. Moreover, the said system will be accessible and portable to the users in all cases because its internet dependability.

The present system can be customized to address not only agriculture concerns but also health and safety, and disaster and risk management. The system has the potential for up scaling and adoption by other provinces or municipalities due to its very promising capabilities.

CCS Concepts: • Hardware → Communication hardware, interfaces and storage → Sensor applications and deployments •

CCS → Information systems → Information retrieval → Evaluation of retrieval results → Presentation of retrieval results

Keywords: crop modeling system, field modeling system, portable, weather pattern, nueva vizcaya.

I. Introduction

Computer is one of the powerful electronic devices, which have abridged the world by bringing its practicality and usefulness to people of all ages regardless of the status of living. It performs a wide range of functions that it became part of one's life whether in business, education, medical field, and the like. Recently, innovations have been accelerating the convergence between these industries including agriculture. With these emerging technologies, farmers can use them to increase their productivity or improve their farming strategies that could lead to increase their crop yields.

According to study of (Sun Chin, et.al, 2009), environmental factors such as temperature, humidity, solar radiation, CO2, and soil moisture are essential elements which influence on growth rate, productivity of crops produce in agricultural field. If we manage these environmental factors efficiently, we can increase the production of agricultural products. One significant invention that greatly helped the agricultural industry that will monitor these environmental factors is the use of a field monitoring system. The system collects environmental data directly obtained from environment sensors, soil sensor and CCTV camera. To implement a stand-alone system, the researchers will apply a solar cell panel to operate this system without power source. A Global Positioning System (GPS) module will be installed on the system to indicate the location of this system. So, the FMS will monitor the field conditions by using various facilities and correctly operates without helping external supports.

In the early 1980s, researchers began to apply knowledge-based approaches to problems in agriculture and Natural Resources Management. In recent years, interest has intensified in the integration of knowledge-based approaches with conventional computer methodologies to increase the power, utility, and user friendliness of these systems. However, implementing the technology in a dispersed and computer-poor industry is difficult.

Nueva Vizcaya is located in the northcentral part of Luzon in Region 2. It is surrounded by notable mountain ranges such as the Sierra Madre on the east, Caraballo on the south, and Cordillera on the west. The province has several principal rivers: Magat, Matuno, Marang, Sta. Fe, and Sta. Cruz. All these rivers are tributaries of the Magat River which flows into the Cagayan River. The province is bounded on the north and northeast by the province of Ifugao and Isabela, on the east and southeast by Quirino and Aurora, on the south by Nueva Ecija, and on the west by Benguet and Pangasinan.

Nueva Vizcaya is relatively dry from November to April and relatively wet during the rest of the year. Maximum temperature ranges from 22-25 degrees

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Celsius. December and January are the coldest months when temperature falls to about 20 degrees Celsius while the warmest months are April and May. Nueva Vizcaya is often referred to as lowland Baguio because of its pleasant climate.

Among the crops produced in the province of Nueva Vizcaya, rice and corn are the primary crops that contribute more than half of the total food grain production in the province. Thus, the study on the various impacts of climate changes on these crop yields is urgently required for planning the future food supply in the province.

In this research project, the researchers intend to develop a crop production modeling system that will analyze and interpret the data collected from the field monitoring system that will serve as guide for the farmers to design and improve their farming strategies in order to produce more crops yield.

II. Methodology

a) *Research Design*

There are already existing FMS installed and maintained by NVSU in the selected municipalities of Nueva Vizcaya. Mainly, the FMS consists of (1) field router, which collects data from the data logger and sends to the server through an Internet connection; (2) data logger, which stores primary data; and (3) weather elements sensors that take measurements of different weather elements at a pre-programmed interval. These sensors include thermometer, rain gauge, solar radiation sensor, soil sensor, wind vane and anemometer.

b) *Instrumentation*

The fundamental principle of a monitoring system is to capture data, process it and disseminate results in a systematic way. These monitoring systems enable us to measure trends of various indicators based on the data collected in the field. With our proposed system, different FMSs that were installed will be utilized to gather data as a basis in determining the optimal cropping season of a particular crop in a specific location. These FMS data contain temperature, humidity, soil moisture, wind direction and rain readings.

c) *Data Gathering Procedures*

The response of crops to climatic changes is the takeoff point in designing adaptation strategies for crops on climate change that is why it is an imperative and is useful to design adaptation strategies in agriculture like adjustment of cropping calendar, timing of cultural and management activities, and attempts to minimize agricultural damage due to natural calamities. Data monitoring and establishment of climatic patterns in the different micro-climatic zones (MCZs) are essential for localized weather forecasting and development of early warning system for agricultural production. Thus, the modification of existing cropping and farming systems shall be the key to adaptation strategies that will be adopted in the different land utilization types (LUTs).

Cagayan Valley, particularly the province of Nueva Vizcaya has heterogeneous elevation because it is bounded by different mountain systems. This indicates great variability in weather between just small adjacent areas. Using elevation as reference, the province will be mapped and delineated into conceptual MCZs. These MCZs are assumed to have differing weather patterns due to differences in their elevation.

Different FMSs were installed in each of the MCZs. The FMS will then monitor the different weather elements i.e. atmospheric temperature, rainfall, relative humidity, solar radiation, among others. Most importantly, soil data such as soil pH, organic matter, and other chemical properties will be regularly monitored since it is the main element in crop production. The FMS is composed of sensors that collects climate data from the different weather elements and stores it into the data logger. The field router (FR) collects photographs of the current environmental condition and collects the data from the data logger and transmit it to the database server through the use of internet. It is self-sustaining and requires a very minimal user intervention. With these weather elements, software will be developed to interpret and analyze data from the FMS to support decision-making of farmers in their agricultural activities, and for other users such as planners and policy makers in the formulation of adaptation strategies in the local level.

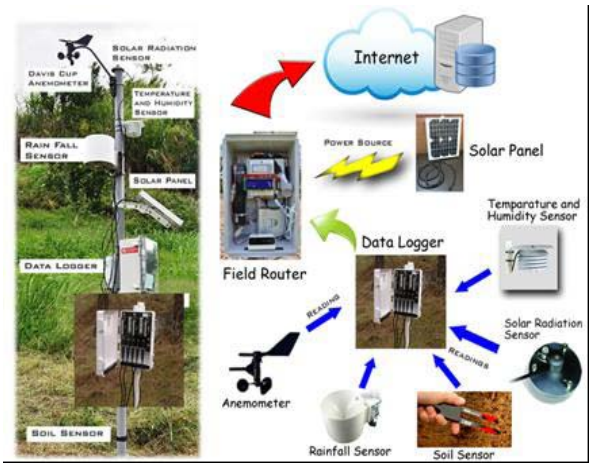

Fig. 1: The data collection schema of FMS

Fig. 2: The data transmission schema of FMS

The CPMS is dependent on the data coming from the different FMS devices installed in the selected municipalities of Nueva Vizcaya. Data is generated from the weather sensors of the said FMS device. These weather sensor elements include: thermometer, rain gauge, solar radiation sensor, soil sensor, wind vane and anemometer. The following figures then are sample data coming from the FMS device.

EM29256	Port 1	Port 1	Port 2	Port 3	Port 4	Port 4	Port 4	Port 5	Port 5	Port 5
17160 records	VP-3 Hur	VP-3 Hur	ECRN-10	PYR Sol	Davis Cu	Davis Cu	Davis Cu	5TE Moi	5TE Moi	5TE Moistu
Measurement Time	RH	°C Temp	mm Prec	Solar W/	m/s Win	m/s Gust	° Direct	m³/m³ VV	°C Temp	mS/cm EC
29 Jun 2015 2:00 PM	0	0	0.0	0.0	0.0	0.0	0	0	0	0
30 Jun 2015 11:00 AM	0	0	0.0	0.0	0	0	0	0	0	0
30 Jun 2015 12:00 PM	3.426	104.0	0.4	805.7	0.9	1.5	40	0.046	36.8	0.00
30 Jun 2015 1:00 PM	2.056	104.0	0.0	983.3	0.9	1.4	7	0.076	30.8	0.00
30 Jun 2015 2:00 PM	0.343	104.0	0.0	913.7	0.8	1.8	41	0.076	30.4	0.00
30 Jun 2015 3:00 PM	2.056	104.0	0.0	767.2	1.0	1.9	45	0.075	30.3	0.00
30 Jun 2015 4:00 PM	1.370	104.0	0.0	575.0	0.8	1.8	29	0.075	30.2	0.00
30 Jun 2015 5:00 PM	2.741	104.0	0.0	355.2	0.6	1.2	19	0.075	30.3	0.00
30 Jun 2015 6:00 PM	0.343	104.0	0.0	78.7	0.5	2.2	123	0.076	30.4	0.00
30 Jun 2015 7:00 PM	2.741	104.0	0.0	3.7	0.6	2.2	[illegible]	0.076	30.5	0.00
30 Jun 2015 8:00 PM	0.343	104.0	0.0	0.0	0.2	0.9	[illegible]	0.076	30.7	0.00
30 Jun 2015 9:00 PM	0.343	104.0	0.0	0.0	0.2	0.6	195	0.076	30.8	0.00
30 Jun 2015 10:00 PM	0.343	104.0	0.0	0.0	0.1	0.5	218	0.076	30.9	0.00
30 Jun 2015 11:00 PM	0.343	104.0	0.0	0.0	0.1	0.5	221	0.076	30.9	0.00
1 Jul 2015 12:00 AM	0.343	104.0	0.0	0.0	0.1	0.6	245	0.076	31.0	0.00
1 Jul 2015 1:00 AM	0.343	104.0	0.0	0.0	0.1	0.4	272	0.076	31.0	0.00
1 Jul 2015 2:00 AM	0.343	104.0	0.0	0.0	0.0	0.4	261	0.076	31.0	0.00
1 Jul 2015 3:00 AM	0.343	104.0	0.0	0.0	0.1	0.6	255	0.076	30.9	0.00
1 Jul 2015 4:00 AM	0.343	104.0	0.0	0.0	0.0	0.3	255	0.076	30.9	0.00
1 Jul 2015 5:00 AM	0.343	104.0	0.0	0.0	0.1	0.4	255	0.076	30.9	0.00
1 Jul 2015 6:00 AM	1.713	104.0	0.0	5.5	0.1	0.5	255	0.076	30.8	0.00
1 Jul 2015 7:00 AM	0.343	104.0	0.0	159.3	0.0	0.4	271	0.076	30.8	0.00
1 Jul 2015 8:00 AM	0.343	104.0	0.0	408.3	0.2	0.8	71	0.076	30.7	0.00
1 Jul 2015 9:00 AM	1.028	104.0	0.0	635.4	0.6	1.8	26	0.076	30.6	0.00

Fig. 3: Sample XLS data from the FMS device

This data was created from the FMS device situated at Diadi, Nueva Vizcaya. The recorded data was generated starting June 2015 at an hourly basis as presented in the first column of the table. The succeeding columns are utilized for the ten (10) sensors in an FMS device. Table now shows the different results established by each sensor. It can be noted in the given table that zero (Ø) values are also recorded. This would mean that a particular sensor loses its signal during data transmission. Another reason would be the physical device is non-functional at all. A picture interpretation of the data collected in each sensor is then provided below for better understanding of the patterns provided by the sensors.

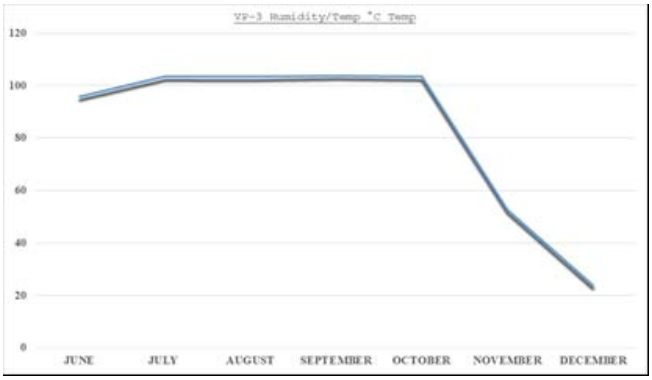

Fig. 4: Sample graph for humidity

The provided graph shows that humidity in the months of June to October is at 100% then slowly going down by the end of October until December. This would mean a cold or rainy season for the months of October to December, which is not suitable for planting palay.

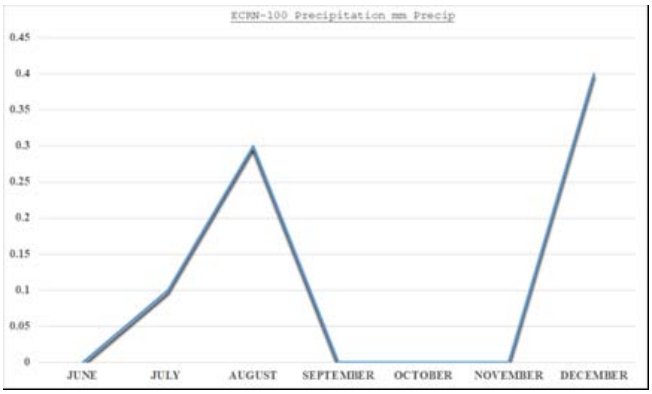

Fig. 5: Sample graph for rain gauge

The graph in Figure 5 shows the amount of rain (water) being measured. It can be observed that by the end of June, no amount of water was recorded as that in the mid of September to mid of November.

III. Results and Discussion

Climate change refers to significant changes in global temperature, precipitation, wind patterns and other measures of climate that occur over several decades or longer. These significant changes in the environment contribute a great impact most especially in the agricultural sector. That is why climate change adaptation requires more than simply maintaining the current level of performance from the agricultural sector, but rather developing a set of responses that allow the sector to improve performance under the changing conditions climate change implies. Because agricultural production remains the main source of income for most rural communities, adaptation of the agricultural sector to the adverse effects of climate change will be imperative to protect and improve the livelihoods of every human being. Today, crop production is increasingly vulnerable to risks associated with climate

change. This is because climate change is causing variations in environmental conditions that are posing significant challenges to farmers, over and beyond those that are experienced "normally". Even under population pressure and the dwindling productive agricultural areas, crop yields should be maintained still. This explains why the agricultural sector bears one of the heaviest burdens to adapt and mitigate climate change. However, with the availability of the state-of-the-art technology like the FMS and the Crop Production Modeling System, there is a huge potential for crop production practices to adapt to, and contribute to the mitigation of climate change. With this study, different FMSs installed in strategic locations of the province will effectively monitor variations in weather patterns that will be used as a basis in determining the optimal cropping season of a particular crop in a specific location. For easier understanding on the part of the farmers, different reports in graphical presentations and heat maps will be created by the system proposing the optimal crop to plant including the target location. As a result, the interface of the Crop Production Modeling System is provided below for easier understanding.

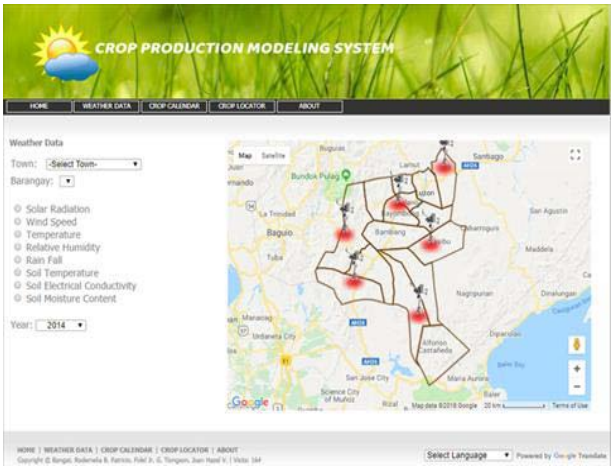

Fig. 6: CPMS Weather Data Screen

As mentioned in this study, six FMSs were installed in the selected municipalities of Nueva Vizcaya namely: Bayombong, Diadi, Dupax del Sur, Kasibu, Kayapa and Santa Fe. The said FMSs consist of (1) field router; (2) data logger; and (3) weather elements sensors that take measurements of different weather elements at a pre-programmed interval.

Fig. 7: Weather Data with Graph

This screen shows the graphical representation of the data coming from the sensors of a particular FMS device situated at a strategic location. Data gathered were in CSV or XLS format that will be interpreted/converted in a human readable format like the graph for easier understanding. This report is generated by the system that can be used as one tool in the decision-making process of the farmers.

	A	B	C	D	E	F	G	H	I	J	K
1	EM29256	Port 1	Port 1	Port 2	Port 3	Port 4	Port 4	Port 4	Port 5	Port 5	Port 5
2	17160 records	VP-3 Hur	VP-3 Hur	ECRN-10	PYR Sol	Davis Cu	Davis Cu	Davis Cu	5TE Mois	5TE Mois	5TE Mois
3	Measurement Time	RH	°C Temp	mm Prec	Solar W/	m/s Win	m/s Gust	° Directio	m³/m³ VV	°C Temp	mS/cm E
4	29 Jun 2015 2:00 PM	0	0	0.0	0.0	0.0	0.0	0	0	0	0
5	30 Jun 2015 11:00 AM	0	0	0.0	0.0	0	0	0	0	0	0
6	30 Jun 2015 12:00 PM	3.426	104.0	0.4	805.7	0.9	1.5	40	0.046	36.8	0.00
7	30 Jun 2015 1:00 PM	2.056	104.0	0.0	983.3	0.9	1.4	7	0.076	30.8	0.00
8	30 Jun 2015 2:00 PM	0.343	104.0	0.0	913.7	0.8	1.8	41	0.076	30.4	0.00
9	30 Jun 2015 3:00 PM	2.056	104.0	0.0	767.2	1.0	1.9	45	0.075	30.3	0.00
10	30 Jun 2015 4:00 PM	1.370	104.0	0.0	575.0	0.8	1.8	29	0.075	30.2	0.00
11	30 Jun 2015 5:00 PM	2.741	104.0	0.0	355.2	0.6	1.2	19	0.075	30.3	0.00
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13	30 Jun 2015 7:00 PM	2.741	104.0	0.0	3.7	0.6	2.2	171	0.076	30.5	0.00
14	30 Jun 2015 8:00 PM	0.343	104.0	0.0	0.0	0.2	0.9	174	0.076	30.7	0.00
15	30 Jun 2015 9:00 PM	0.343	104.0	0.0	0.0	0.2	0.6	195	0.076	30.8	0.00
16	30 Jun 2015 10:00 PM	0.343	104.0	0.0	0.0	0.1	0.5	218	0.076	30.9	0.00
17	30 Jun 2015 11:00 PM	0.343	104.0	0.0	0.0	0.1	0.5	221	0.076	30.9	0.00
18	1 Jul 2015 12:00 AM	0.343	104.0	0.0	0.0	0.1	0.6	245	0.076	31.0	0.00
19	1 Jul 2015 1:00 AM	0.343	104.0	0.0	0.0	0.1	0.4	272	0.076	31.0	0.00
20	1 Jul 2015 2:00 AM	0.343	104.0	0.0	0.0	0.0	0.4	261	0.076	31.0	0.00
21	1 Jul 2015 3:00 AM	0.343	104.0	0.0	0.0	0.1	0.6	255	0.076	30.9	0.00
22	1 Jul 2015 4:00 AM	0.343	104.0	0.0	0.0	0.0	0.3	255	0.076	30.9	0.00
23	1 Jul 2015 5:00 AM	0.343	104.0	0.0	0.0	0.1	0.4	255	0.076	30.9	0.00
24	1 Jul 2015 6:00 AM	1.713	104.0	0.0	5.5	0.1	0.5	255	0.076	30.8	0.00
25	1 Jul 2015 7:00 AM	0.343	104.0	0.0	159.3	0.0	0.4	271	0.076	30.8	0.00
26	1 Jul 2015 8:00 AM	0.343	104.0	0.0	408.3	0.2	0.8	71	0.076	30.7	0.00
27	1 Jul 2015 9:00 AM	1.028	104.0	0.0	635.4	0.6	1.8	26	0.076	30.6	0.00

Fig. 8: Sample XLS data collected from the FMS device

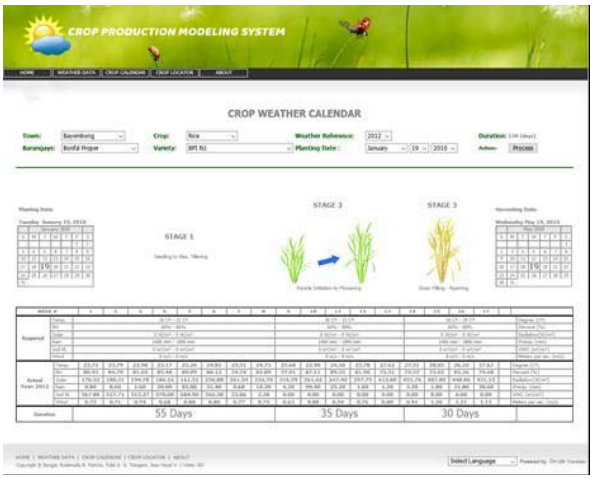

Fig. 9: Crop Weather Calendar

The above picture is also a system generated report that shows a pattern of growth of a particular crop in a particular location. This will be of great help to the farmers because specific calendar dates are provided to determine the optimal cropping season. Also, the patterns of data gathered from the FMS device are presented in this report to serve as a tool for the farmers to decide in their next cropping endeavor.

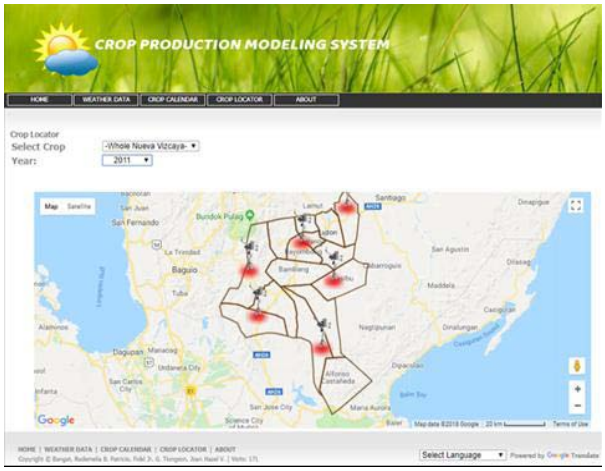

Fig. 10: Heat Map of Nueva Vizcaya

This figure presents the map of Nueva Vizcaya containing the selected municipalities where the different FMS devices are situated. This part of the system then serves as a reference for the farmer on what particular crop gave the best production in a particular year given the data coming from the FMS device. Also, with this report, farmers now can decide what crop to plant and when to plant in order to obtain the optimal harvest.

IV. Conclusions

In conclusion, the developed portable, mobile, and easy to maintain internet-based weather monitoring system is useful to establish weather differences in Nueva Vizcaya. This system allows small spatial scale weather databases which could be transformed into usable data essential to create a localized climate change adaptation strategy for agriculture in Nueva Vizcaya. Also, the data parsing software (FMS parser) written allows the FMS raw data to be interpreted and translated into forms usable by intended users and beneficiaries of information.

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We give credit to Dr. Maria Visitation N. Gumabay who pushed us with this piece of work.

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Instrumental System of Distance Learning DL.GSU.BY and Examples of its Application

By Michael Dolinsky
Gomel State University

Abstract- The basic capabilities of the distance learning instrumental system DL.GSU.BY (hereinafter DL) are described, such as: presentation of the theory/references to students; presentation of tasks to students/sending by them files-solutions; acceptance and automatic verification of the solutions; checking files of arbitrary structure with arbitrary extensions by specialized programs; interactive tasks; manual verification of solutions; assignment of tests; differentiated presentation of tasks; flash lectures and flash tasks integrating learning with control; forum for academic subjects; surveys; control works; exams; supervised student authentication; special tools for creating tasks; the ability to set new tasks by students; input of results of manual checks (control of the theory, bonuses); flexible result tables; automatic rating; automatic formation of statements of examinations and tests. The word instrumental means that it can be used as a tool for automating distance learning in a wide variety of subject areas. In addition, the paper presents examples of the use/ application of DL, such as: developmental education for preschoolers, teaching text programming (in Pascal) in elementary school, teaching programming in middle and high school; teaching students of the faculty of mathematics and technology of programming of the Gomel State University named after F. Skorina.

Keywords: distance learning instrumental system, blended learning, programming, fundamentals of digital electronics.

GJCST-G Classification: DDC Code: 620.0028 LCC Code: TA165

Strictly as per the compliance and regulations of:

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I. Introduction

In preparing the article, the author analyzed materials on blended learning, which involves the use of not only traditional classes in classrooms, but also classes using computers and the Internet. This has become especially relevant in connection with COVID-19 (Simbolon, 2021). Considerable attention is paid to reviews of literature/resources/sources on blended learning (Aznam 2021; Jones2021; Khan 2021;Mekhitarian 2021;Tan 2021; Zaugg 2021) and surveys of students, teachers and university administrators about the advantages and disadvantages of blended learning in different countries, including such as : United Arab Emirates (Alsalhi, 2021), Ghana (Antwi-Boampong, 2021), Norway (Bokolo, 2021), Indonesia (Darma, 2021), Canada(Lane, 2021), Vietnam (Le, 2021), Hong Kong (Lim, 2021), China (Lu, 2021), Belgium (Poelmans, 2021), France(Porter, 2016), Malaysia (Tan, 2016), Greece (Tzatsou, 2021).

Among the most frequently mentioned problems are: lack of knowledge in IT, lack of time, technical limitations (Jerry, 2021), lack of training course programs focused on blended learning (Muhuro, 2021), insufficient quality of online courses (Lomer, 2021).

As the most constructive, we can note the works that describe examples of real blended learning: chemistry (Chamberlain, 2021), the basics of medicine (Lovey, 2021), museum work (Lee, 2020), the study of brain structures (Nathaniel, 2021), Euclidean geometry (Stahl, 2021), introduction to educational technologies (Musawi, 2021), the course of Islamic and Asian civilization (Norhapizah, 2021).

Of particular interest are works that describe general ideas such as: the use of learning systems Moodle (Antwi-Boampong 2021; Oktaria 2021), Google Classroom (Astarilla, 2021), the introduction of forums for communication between students and teachers (Barbato 2020; Karamzadeh 2021), problem-based blended learning (Rahmawati, 2020), pre- and post-tests (Setyowati, 2021), a rating system for monitoring the progress of students at all levels (Kolegova, 2021).

Note that almost all the positive aspects noted above are implemented in the DL system, which also contains many additional features.

The distance learning instrumental system DL, developed under the guidance of the author at the faculty of mathematics and technologies of programming of F. Skorina Gomel State University since 1997, not only allows you to create electronic learning tools, but also integrate them into a single educational environment, provide remote access to them for students, teachers and management personnel using the Internet, as well as the collection, processing and presentation of learning outcomes. Thus, on the basis of the DL system, it is possible to build a new technology of the educational process based on the use of network computer technologies and personal computers. This technology provides individualization of the educational process, dynamic adaptation of educational material to the current level of development of the student and powerful tools for analyzing the educational process.

The following article describes the basic capabilities of the DL system, as well as examples of its application.

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II. Basic Capabilities of the Distance Learning Instrumental System

The word instrumental in the name of the distance learning system means that DL can be used as a tool for automating distance learning in a wide variety of subject areas.

The most significant features of the DL system are described below:

Presentation of the theory/references to the students: Each training course can have its own tree-organized theoretical material, including test, audio and video materials and links to third-party sources. The theory is available during collective and individual lessons and can be left available or disabled by the teacher during tests.

P*resenting tasks to students/sending solutions:* The student can independently take the task, complete it, saving the result of the execution in a file with the required extension, and send this solution file for verification;

Automatic verification/tests concession: As a rule, within a minute the solution is checked by the DL system, and the result is reported to the student. If the solution is wrong, the student can take a test (input data and correct result), on which his solution gives an incorrect answer;

Checking files of arbitrary structure with arbitrary extensions by specialized programs: Currently, programs are checked in the following programming languages: Pascal (Turbo, Free, ABC.Net, Delphi); C++ (GCC, MS Visual), Java, Kotlin, C#, JavaScript, CoffeeScript, Clojure, ClojureScript, Perl, QBasic; assembler for microprocessors/microcontrollers Intel 8051, Intel 8086, Atmel AT90S2313, Atmel AT90S2323, Motorola M68HC05 and Motorola M68HC08; C-MPA (C-like microprogramming language). It also provides verification of functional diagrams of digital devices, solutions of chess and mathematical problems.

Interactive tasks: The student is supposed to perform some sequence of actions with the mouse/keyboard. For example: input of output values on the contacts of the presented functional circuit according to the given input values or drawing up a picture from its fragments.

Manual verification of solutions: There is a special type of jobs, when the submitted files are queued in chronological order. The person, who checks these tasks, at a convenient time for him, can take a solution file, analyze it visually or using a program and give an assessment. Everything else (entering into the test protocol, modification of the table of results, etc.) occurs in the same way as in the case of automatic verification of solutions.

Differentiated presentation of tasks: Hierarchical means of grouping tasks allow you to organize the management of the sequence of tasks for each student, providing individual navigation through the set of tasks for each student, depending on his level of training and motivation; in particular, if auxiliary tasks are prepared for some task, then when the text of this task is shown, the “I don’t know” button appears, clicking on which takes you to the first auxiliary task, and in the auxiliary tasks, the “I understand” button appears, by clicking on which you can return to problematic task.

Flash lectures and flash tasks integrating learning with control: Special the effectiveness of training is ensured by the use of flash programming tools, which allow not only to present theoretical and practical educational material to the student in a colorful and dynamic form, but also to provide interactive learning with built-in control and self-control tools. In connection with the termination of support for flash technology, browsers with flash support and auto-update disabled have been collected, exclusively for working on DL, links to them are given in the news and on the DL forum.

Forum for academic subjects: Since September 2006, forums have appeared in DL and immediately began to be used in the educational process to transfer additional educational and organizational information to students; discussing ways to complete tasks; questions of students and answers to them from other students and teachers;

Available videos: Video materials are prepared to solve such problems when "it's easier to see once than hear a hundred times", in particular, on the following topics: creating and debugging circuits in HLCCAD (high-level design of digital electronics functional circuits); solution in HLCCAD tasks 1-10 control 1 on the design of functional diagrams; solving the basic tasks of option 6 of the control slice, examples of search and elimination and errors (ie debugging) in solving problems of option 6 of the control slice; a tutorial on downloading and installing a virtual machine from a DL, fixing sources (for the development of a DL), and porting fixes to a real DL.

Polls: Surveys are used to obtain/accumulate and statistically process the opinions of students on various issues of organizing the educational process;

Individual assignments: These tasks are collected in folders and subfolders corresponding to the topics and subtopics of the training course. Each task is credited to only one student - the one who passed it before everyone else. When the task tree is displayed, there is written to whom and when the solution of each task is credited. The absence of such information means that the task has not yet been credited to anyone, and it can be solved. For any tasks subfolder teacher can directed that each student can be counted no more than one task from this subfolder - to provide students to solve tasks for all subtopics of the course.

Control works: Control works are tasks (the same for all students) that are opened for a limited period of time

and serve to check the quality of assimilation of educational material, they also provide automatic operational verification of sent solutions; At the same time, the sameness of tasks for all students allows them to discuss problems and their solutions after class. With the permission of the teacher, discussions can also be held during tests.

Exams: Exams are tasks (a random individual option for each student) that open for a limited period of time and serve to check the quality of assimilation of educational material, they also provide automatic online verification of sent solutions;

Supervised student authentication automation: During the control works/exams, students are required to log into the network under a special account, in which access to all network resources is closed, except for DL. The DL system ensures that students comply with this rule. If the student is not logged into the network under this special account, he will not be able to submit the solutions of the control works/exams.

Special tools for creating tasks: Initially, a job was a folder in the file system containing the job's configuration file and all the necessary files for a job of that type. Therefore, it was possible to create tasks using any file manager and any text editor. Then, for tasks of various types, special tools for their creation appeared, simplifying and speeding up the creation of tasks, up to the Flash Task Constructor.

Special software tool for managing training courses and assignments: It allows you to create, copy and move courses and assignments, automatically download task package archives, and perform many service functions for working with training courses and assignments.

Possibility of setting new tasks by students: The ease of setting new tasks in DL provides the ability to set tasks by the students themselves - and therefore one of the types of learning activities can be the preparation of new tasks. This approach has the following advantages: the educational material is developed and replenished by the students; the range of proposed tasks is expanding; students are given the opportunity to show their creativity.

Input of results of manual checks (control of the theory, bonuses): The DL system supports simple entry of data on manual verification of educational activities, absences/attendance of training sessions, etc., which allows all data on the educational process to be integrated into a single statement;

Automatic system for monitoring absenteeism: The teacher marks passes after each lesson. The student, at any time convenient for him, works out the pass by completing the tasks specified by the teacher, then by clicking on the special icon selects the date of the used pass, after which a message is automatically generated about the work-out of the pass, containing a link to the work-out protocol. The teacher, by clicking on this link, can evaluate the work done and whether or not to recognize this work.

Flexible result tables: They are automatically formed and replenished in accordance with the task tree, allowing teacher and srudents to analyze the results both for the entire course as a whole and for any course subtree.

Automatic rating: According to the tables of results of the training course, all kinds of rating tables can be automatically built with rating schemes specified by the teacher;

Automatic generation of sheets of exams and tests: Among such rating schemes can be directly examination and test sheets.

Statistical tables for teachers and students: The sheer number of tasks (measured in the thousands) enrolled in the main courses makes the main tables inconvenient for teachers and students to analyze. Therefore, a tool for registering a teacher was developed, as well as specifying a teacher in the personal information of a student, as well as many tables filtered by students of a particular teacher. In the 2020-2021 academic year, 47 teachers are registered with the DL and they teach over 7,500 students.

III. DL use Cases & Applications

Developmental education for preschoolers: It is concentrated in the Learning to Think 2012 task package of the Informatics 2015 training course. The main goal is to obtain stable skills to perform basic mental operations. At the moment, the authors propose the following basic mental operations (in the amount of 21 pieces):

Operations on pairs: comparison, ordering, association.

Operations on sets: union, intersection, subtraction.

Operations on a set: classification, structuring, generalization.

Boolean operations: negation, conjunction, disjunction, equivalence, implication.

Complex operations: synthesis, memorization, analysis, imagination, analogy, abstraction, positioning.

Obviously, it is quite difficult to come up with tasks that develop the stated basic mental operations separately. At the same time, you can come up with tasks in which one of the qualities will be dominant. In addition, the course propose concentric training, when the exercises are also divided into difficulty levels, and at first all qualities are developed at the first level of complexity, then at the second, etc. The ability to read is not required to complete the vast majority of tasks. Tasks are intuitive for preschoolers and are performed mainly by mouse clicks in certain areas of the task or by dragging/rotating drawings with the mouse and the right/left arrow keys.

For the most complex tasks, the addition of auxiliary training tasks based on the principles of differentiated learning is widely used.

For those children who encounter serious difficulties in basic education, special auxiliary task packages (called Technical Minimums) have been developed on the following subtopics: “Tangram. (Parts 1-3)”, “Analogy”, “Learning to count”, “Differences”, “Learning to think 0”, “Learning to work with the mouse”.

Teaching text-based programming (in Pascal) in elementary school: It is based on the successive completion of the following task packages in the Informatics 2015 training course: “Learning to think 2012”, , “Propaedeutics of words”, “Learning words”, “Number”, “Symbol”, “String”, “All Together”, “String Length”, "Character positions", "Built-in functions and procedures", “One Dimensional Array”, “Two Dimensional Array”, “Geometry”, “Strings-2”, “Sorting”, “Debugger”, “Input and Output Files””. All task packages are built on the principles of differentiated learning. Additionally, there are task packages "Mathematics (Programs) 1-5 classes" and Charis (Drawing Language). Every year, on the basis of the computer science cabinet of school 27 of Gomel, under the guidance of the author, all interested students of elementary school 27 and other educational institutions in Gomel do such training. In addition, similar classes are held in other schools in Gomel and the Gomel region. Finally, due to free access to all training courses on the DL, anyone can take similar training, and, at the time of this writing, 13497 students from Belarus, Russia, Ukraine were recorded in the table of results of the Informatics 2015 training course. In addition, all students are strongly recommended to check and improve their mathematical preparation by solving problems in the course "Mathematics", which contains various problems in mathematics, including Kangaroo (2001-2020), Beaver (2013-2018), etc.

Online classes for teaching programming for junior schoolchildren in Russia: At the time of writing, such circles were organized by Strizhenkov R.V. (St. Petersburg) for younger students in such Russian cities as: St. Petersburg (2556 students), Moscow (672), Ufa (208), Orenburg (108), Ivanovo (87), Obninsk (80), Astrakhan (40). And the company "Astral" (Kaluga) organized similar circles for younger schoolchildren in Kaluga and the Kaluga region (1015 students). In addition to the DL materials, the organizers of the circles have created groups in contact, special websites and video materials.

Regional Olympiads in programming: They are held 5 times in the academic year: in the fall two (school and city) in three age divisions (grades 1-4, grades 5-8, grades 9-11) and in the spring three (school, city, regional) also in three age divisions (1-4 grade, 5-7 grade, 8-9 grade). Topics of assignments are fixed as follows: Grade 1-4 (in autumn and spring), 20 tasks, all tasks for 5 points

No Type - Approximate content of the task

1. Introduction to programming - numbers 1
2. Introduction to programming - numbers 2
3. Introduction to programming - numbers 3
4. Introduction to programming - symbols
5. Introduction to Programming - strings
6. Introduction to programming - lengths
7. Introduction to programming - symbol with a number
8. Introduction to programming - DELETE
9. Introduction to programming - COPY
10. Introduction to programming - POS
11. One-dimensional array - summation
12. One-dimensional array - counting
13. One-dimensional array - maximum
14. One-dimensional array - minimal
15. One-dimensional array - search
16. Two-dimensional array - standard algorithm
17. Geometry - coordinates/distances + standard algorithm
18. Strings - non-standard algorithm
19. Sorting
20. Text problem

Grade 5-8 in autumn and Grade 5-7 in spring, 10 tasks, all for 40 points

1. Introduction to programming
2. One-dimensional array
3. Two-dimensional array
4. Geometry
5. Strings
6. Sorting
7. Text task
8. Research / brute force / elements of number theory
9. Greedy
10. Queue

It can be seen that problems 3-7 in the middle division are the same as problems 16-20 in the junior division. Moreover, since 2016, these are the same tasks. Thus, students in grades 1-4 are gradually preparing for the transition to the middle and senior division olympiads, and the best even participate and successfully perform simultaneously in several divisions. Tasks 1-2 in the middle division also correspond to the knowledge gained in teaching the topics "Introduction to Programming" and "One-Dimensional Array" in the junior division.

9th-11th grade in autumn, 8th-9th grade in spring, 15 tasks all for 40 points

1. Introduction to programming
2. One-dimensional array
3. Two-dimensional array
4. Geometry
5. Strings

6. Sorting
7. Text task
8. Research / search / elements of number theory
9. Greedy
10. Queue
11. Recursion
12. Dynamic Programming
13. Graphs
14. Complex data structures
15. Complex DP

It can be seen that tasks 1-10 in the senior division are the same in terms of topics as tasks in the middle division, moreover, since 2016 these are the same tasks. Thus, schoolchildren of the middle division are gradually preparing to participate in the olympiads of the senior division, and the most advanced ones participate and successfully participate in the olympiads of both divisions.

Fixed task topics, on the one hand, offer teachers and students a training program, and on the other hand, allow them to assess regularly the current level of students' learning.

Teaching programming in middle and high school: The teaching method has changed during the operation and development of the DL, so in fact there are many methods and training routes. Let's point out some of them. Pupils, starting from the 5th grade, are invited to subscribe to the training course "Basic Programming", and in it choose the package of tasks "Accelerated Course 2013". It includes 8 topics corresponding to the first 8 tasks in the olympiads of the middle and senior age divisions: introduction to programming, one-dimensional array, two-dimensional array, geometry, strings, sorting, text problem, research/brute force/elements of number theory. Each topic contains folders of problems with the names "Technical minimum", "Olympiads of 1-4 classes", "Olympiads of 5-8 classes". The "Technimum" folder contains tasks with differentiated learning, covering the necessary basic knowledge on this topic. Olympiad tasks are arranged by subtopics in order of increasing complexity of subtopics and complexity of tasks in subtopics. The next stage of training is a package of tasks "Olympiads of grades 9-11", which contains problems of regional olympiads of grades 9-11 on the topics of tasks 9-15, namely: greedy algorithm, queue, recursion, dynamic programming, graphs, complex data structures, complex DP. Tasks within each topic are structured by subtopics in order of increasing complexity, and within subtopics, tasks also go in ascending order of complexity. At the moment, the author considers this path "Accelerated course 2013" - "Olympics of grades 9-11" to be the main training route for his students. In real practice, other training routes are also used. For example, for students who struggle with “Accelerated Course 2013”, there are two easier routes - the easiest is to fall back to “Informatics 2015” and start there, and then move on to Basic Programming. Another slightly more complicated option is to undergo differentiated training in "Basic Programming", sequentially on each of the topics "Introduction to Programming", "One-Dimensional Array", etc. Students/teachers who prefer a freer way of learning can work in the Algorithmic Methods course, where tasks are also grouped by topic and subtopic, but in reverse chronological order.

Automation of learning in arbitrary programming languages: In the summer of 2016, the IOI raised the issue of removing the use of Pascal as the IOI programming language. Since one of our goals is to prepare the best students to perform successfully at the IOI, the question arose of switching to another programming language and developing the corresponding training. We solved this problem in the following way: a program was developed that generates training tasks on the fly, similar to those performed manually for Pascal. To do this, the task folder should contain the author's solution in the desired programming language, and the program folder should contain a file of correspondences for this language - a Russian/English word. In addition, a package of tasks "Accelerated Course 2016" was formed based on the current, at that time, the status of the “Accelerated Course 2013” task package. At the same time, the tasks were reorganized into four folders: "Technical minimum", "Control", "Control *", "Training". For C++, the author himself developed all author's solutions, for other languages (Java, Kotlin, C#, Python, JavaScript) author's solutions were developed by students and were not implemented for all tasks. The transition to C ++ by the students of the author is carried out at the request of the student, as a rule, after the successful completion of the package of tasks "Accelerated Course 2013". Therefore, to speed up the transition, the "Control *" and "Training" folders can be skipped.

Weekly training Olympiads: At the end of each week, from 8.00 Saturday to 20.00 Sunday, two training Olympiads are held: "Programming-beginners" (for students in grades 1-4) and "Programming-professionals (individual)" (for students in grades 5-11), in which successively regional olympiads of previous years are opened. This allows each student and teacher to “look in the mirror” weekly and find out which topics are well covered, which are poorly, which have not yet been studied at all. In addition, for the guys who are preparing for the regional and republican Olympiads, from the beginning of December (after the final of the Open Russian Teams Olympiad for Schoolboys/ORTOS) and until the beginning of April (after the Belarusian Republican Olympiad), the tasks of national and international Olympiads, which are open on Sunday, are added to the "Programming Professionals" course from 9.00 to 14.00. Additionally, in the interval

from the beginning of April to the beginning of December, a special course "Programming-professionals (team)" is opened to prepare for the selection and final of the ORTOS, which offers various team Olympiads of past years. For both personal and team Olympiads, those for which there are author's analyzes are selected. After the Olympiads, all problems are open for completion in special courses for working on errors: Programming-beginners (W/O)", "Programming-professionals (personal) (W/O)", "Programming-professionals (com)" (W/ O).

Seasonal Cups (according to nominations): Organized to increase motivation for the implementation of educational work in the courses "Informatics 2015", "Basic Programming", "Mathematics". The competition is about who will solve the main problems the most (not in "I don't know" folders) for the corresponding season (Autumn, Winter, Spring, Summer) and the entire academic year. In the 2020-2021 academic year, 829 students participated in the Informatics 2015 competition, 268 in Basic Programming, 525 in Mathematics.

From 2020-2021, two new nominations have been added: "Programming-Professionals (private)" (who will score the most points in the Sunday "difficult" Olympiads), "Programming-Professionals (team)" - which team will solve the most problems in Sunday team olympiads.

Teaching university students such subjects as: "Programming", "Organization and functioning of computers", "Architecture of computers". Currently, all the possibilities of DL are used in the educational process of the cycle of disciplines related to the study of hardware at the F. Skorina Gomel State University at the Faculty of Mathematics and Programming Technologies:

"*Organization and functioning of computers*": (1st year, specialty "Applied Informatics"/PI; 2nd year, specialty - information technology software/PO and "Informatics and programming technologies"/IT;

– "Architecture of computers" (PI2, IT3, PO4).

In all cases, examination/test sheets are automatically built, in which the following results affect the assessment: control cuts, weekly one and a half hour tests in practice, weekly team tests on theory, solving individual problems, setting new tasks, bonuses for an active and creative position on theoretical and practical classes, during the performance of individual tasks.

The theoretical part of the hardware courses includes the following topics: number systems, logic functions and Karnaugh maps, combinational circuits, automata, a quick dive into the Intel 8086 assembler, the Intel 8086 instruction set, Intel 8086 instruction formats, the algorithm for executing programs by the processor, microprogramming, synthesis of an operating machine, a rigid logic control machine, a programmable logic control machine, the development of the architecture of the Intel processors from 8086 to 80586, non-Intel processor architectures: digital signal processors, database processors, transputers, computers controlled by data flows , vector and matrix supercomputers.

The practical part includes the development of digital circuit designs, verified by the HLCCAD high-level chip design system; development of low-level (assembler) programs for various microcontrollers, verified by the Winter multiprocessor simulation system; development of microprograms for S-MPA. Allthe above mentioned software packages are integrated into the DL system.

The DL system is also used for disciplines related to teaching programming: "Fundamentals of Algorithmization and Programming" (1st year, specialties - PO and IT), "Fundamentals of Program Design" (1st year, specialties - PO and IT), "Programming" (1st year , specialty - PI).

The theoretical part includes the study of the following issues: introduction to programming, debugger, one-dimensional array, two-dimensional array, geometry, strings, sorting, queue, recurrence relations, recursion, graphs. At the same time, the last three topics are studied without lecture material with the help of independent study of the corresponding chapters from textbooks.

The practical part includes the following components.

Training: For all theoretical questions from the introduction to programming to the queue, automatic differentiated learning is provided. Everyone is offered the same tasks to solve and everyone gets points for solving each of the main problems.

Technical minimum: To simplify the integration into the educational process of students with minimal prior training in computer science, some of the simple tasks are placed in an additional assessment area.

Individual assignments: Students who consider themselves well-prepared can skip the training (and the minimum) and go straight to individual tasks. In the "Individual tasks" section it is clear by name, despite the fact that the tasks are offered to everyone the same, points for solving the problem are counted only to the one who FIRST solved it correctly.

For the convenience of working with individual tasks, it is recommended to select the "Unsolved Tasks" task tree type. In this case, in the task tree, opposite the name of the task, there is the last name of the person who solved it and the date when the task was solved. If there is no surname-date, then this task has not yet been solved by anyone and one can try to get ahead of everyone in solving it. The proposed individual tasks are of five types:

Tasks for freshmen these are tasks, conditions and tests for which the freshmen of 2005–2008 developed.

Thematic tasks: these are tasks from Internet Olympiads for schoolchildren studying programming on the following topics: one-dimensional array, two-dimensional array, geometry, strings, sorting, queue.

Control works: At the end of each week, a test of 10 tasks for an hour and a half is carried out, the assessment for the control work corresponds to the number of tasks completely solved.

Exams: This is a test in which each student is presented with their own set of 10 tasks. The final score on the exam cannot be higher than this score. The exam can be rewritten at the request of the student on a weekly basis. This approach to a large extent provides protection against unscrupulous approach of students to learning and at the same time ensures the adequacy of examination marks to the knowledge and practical skills of students.

New tasks: The student has the right to develop and install new tasks in the DL system, inventing conditions, tests and an author's solution.

*Special course "WEB-technologies for beginners"(*with automatic verification of solutions, all tasks contain examples of solutions (under the spoiler) and links to the theory) includes:

- Tasks for the development of html files: commenting, text formatting, lists, tables, links, document blocks, splitting the page into parts on the screen, user interaction, attributes;
- Tasks for the development of css-files: tag selectors;
- JavaScript DOM assignments: Attributes, adding and deleting, event handlers, searching and modifying by tag, class, ID, name, frames - JSP/ servlet assignments - Introduction to WEB programming languages, where the minimum technical assignments from "Accelerated Course 2016" are offered on the topics: introduction to programming, one-dimensional array, two-dimensional array, geometry, string sorting, perform in one of the following languages:

JavaScript, Clojure, ClojureScript, CoffeeScript, JSP, Python, Java, Kotlin, C#, Python, Ruby.

Development of DL as training in WEB-development: All DL functionality was created by schoolboys, students, undergraduate and graduate students. Working on the DL helped them greatly improve their professional training and subsequently easily find a well-paid and interesting job.

IV. Conclusion

This paper describes the basic capabilities of the distance learning instrumental system DL (dl.gsu.by), as well as examples of its application for teaching programming to junior, middle and older schoolchildren, first-year students, as well as teaching the basics of digital electronics to students of three specialties (information technology software, computer science and programming technology, applied computer science) on Faculty of Mathematics and Programming Technologies in Gomel State University named after F. Skorina.

Compliance with Ethical Standards

Conflict of Interest – None

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No informed consent is required

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ASSOCIATE OF COMPUTER SCIENCE RESEARCH COUNCIL is the membership of Global Journals awarded to individuals that the Open Association of Research Society judges to have made a 'substantial contribution to the improvement of computer science, technology, and electronics engineering.

The primary objective is to recognize the leaders in research and scientific fields of the current era with a global perspective and to create a channel between them and other researchers for better exposure and knowledge sharing. Members are most eminent scientists, engineers, and technologists from all across the world. Associate membership can later be promoted to Fellow Membership. Associates are elected for life through a peer review process on the basis of excellence in the respective domain. There is no limit on the number of new nominations made in any year. Each year, the Open Association of Research Society elect up to 12 new Associate Members.

To the institution

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Global Journals sends a letter of appreciation of author to the Dean or CEO of the University or Company of which author is a part, signed by editor in chief or chief author.

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Career | Credibility | Reputation

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Associate	Fellow	Research Group	Basic
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Preferred Author Guidelines

We accept the manuscript submissions in any standard (generic) format.

We typeset manuscripts using advanced typesetting tools like Adobe In Design, CorelDraw, TeXnicCenter, and TeXStudio. We usually recommend authors submit their research using any standard format they are comfortable with, and let Global Journals do the rest.

Alternatively, you can download our basic template from https://globaljournals.org/Template.zip

Authors should submit their complete paper/article, including text illustrations, graphics, conclusions, artwork, and tables. Authors who are not able to submit manuscript using the form above can email the manuscript department at submit@globaljournals.org or get in touch with chiefeditor@globaljournals.org if they wish to send the abstract before submission.

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Authors must ensure the information provided during the submission of a paper is authentic. Please go through the following checklist before submitting:

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2. Authors must accept the privacy policy, terms, and conditions of Global Journals.
3. Ensure corresponding author's email address and postal address are accurate and reachable.
4. Manuscript to be submitted must include keywords, an abstract, a paper title, co-author(s') names and details (email address, name, phone number, and institution), figures and illustrations in vector format including appropriate captions, tables, including titles and footnotes, a conclusion, results, acknowledgments and references.
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6. Proper permissions must be acquired for the use of any copyrighted material.
7. Manuscript submitted *must not have been submitted or published elsewhere* and all authors must be aware of the submission.

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2. Drafting the paper and revising it critically regarding important academic content.
3. Final approval of the version of the paper to be published.

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The corresponding author should mention the name and complete details of all co-authors during submission and in manuscript. We support addition, rearrangement, manipulation, and deletions in authors list till the early view publication of the journal. We expect that corresponding author will notify all co-authors of submission. We follow COPE guidelines for changes in authorship.

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Unless specified in the notification, the Editorial Board's decision on publication of the paper is final and cannot be appealed before making the major change in the manuscript.

Acknowledgments

Contributors to the research other than authors credited should be mentioned in Acknowledgments. The source of funding for the research can be included. Suppliers of resources may be mentioned along with their addresses.

Declaration of funding sources

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Preparing your Manuscript

Authors can submit papers and articles in an acceptable file format: MS Word (doc, docx), LaTeX (.tex, .zip or .rar including all of your files), Adobe PDF (.pdf), rich text format (.rtf), simple text document (.txt), Open Document Text (.odt), and Apple Pages (.pages). Our professional layout editors will format the entire paper according to our official guidelines. This is one of the highlights of publishing with Global Journals—authors should not be concerned about the formatting of their paper. Global Journals accepts articles and manuscripts in every major language, be it Spanish, Chinese, Japanese, Portuguese, Russian, French, German, Dutch, Italian, Greek, or any other national language, but the title, subtitle, and abstract should be in English. This will facilitate indexing and the pre-peer review process.

The following is the official style and template developed for publication of a research paper. Authors are not required to follow this style during the submission of the paper. It is just for reference purposes.

Manuscript Style Instruction (Optional)

- Microsoft Word Document Setting Instructions.
- Font type of all text should be Swis721 Lt BT.
- Page size: 8.27" x 11'", left margin: 0.65, right margin: 0.65, bottom margin: 0.75.
- Paper title should be in one column of font size 24.
- Author name in font size of 11 in one column.
- Abstract: font size 9 with the word "Abstract" in bold italics.
- Main text: font size 10 with two justified columns.
- Two columns with equal column width of 3.38 and spacing of 0.2.
- First character must be three lines drop-capped.
- The paragraph before spacing of 1 pt and after of 0 pt.
- Line spacing of 1 pt.
- Large images must be in one column.
- The names of first main headings (Heading 1) must be in Roman font, capital letters, and font size of 10.
- The names of second main headings (Heading 2) must not include numbers and must be in italics with a font size of 10.

Structure and Format of Manuscript

The recommended size of an original research paper is under 15,000 words and review papers under 7,000 words. Research articles should be less than 10,000 words. Research papers are usually longer than review papers. Review papers are reports of significant research (typically less than 7,000 words, including tables, figures, and references)

A research paper must include:

a) A title which should be relevant to the theme of the paper.
b) A summary, known as an abstract (less than 150 words), containing the major results and conclusions.
c) Up to 10 keywords that precisely identify the paper's subject, purpose, and focus.
d) An introduction, giving fundamental background objectives.
e) Resources and techniques with sufficient complete experimental details (wherever possible by reference) to permit repetition, sources of information must be given, and numerical methods must be specified by reference.
f) Results which should be presented concisely by well-designed tables and figures.
g) Suitable statistical data should also be given.
h) All data must have been gathered with attention to numerical detail in the planning stage.

Design has been recognized to be essential to experiments for a considerable time, and the editor has decided that any paper that appears not to have adequate numerical treatments of the data will be returned unrefereed.

i) Discussion should cover implications and consequences and not just recapitulate the results; conclusions should also be summarized.
j) There should be brief acknowledgments.
k) There ought to be references in the conventional format. Global Journals recommends APA format.

Authors should carefully consider the preparation of papers to ensure that they communicate effectively. Papers are much more likely to be accepted if they are carefully designed and laid out, contain few or no errors, are summarizing, and follow instructions. They will also be published with much fewer delays than those that require much technical and editorial correction.

The Editorial Board reserves the right to make literary corrections and suggestions to improve brevity.

Format Structure

It is necessary that authors take care in submitting a manuscript that is written in simple language and adheres to published guidelines.

All manuscripts submitted to Global Journals should include:

Title

The title page must carry an informative title that reflects the content, a running title (less than 45 characters together with spaces), names of the authors and co-authors, and the place(s) where the work was carried out.

Author details

The full postal address of any related author(s) must be specified.

Abstract

The abstract is the foundation of the research paper. It should be clear and concise and must contain the objective of the paper and inferences drawn. It is advised to not include big mathematical equations or complicated jargon.

Many researchers searching for information online will use search engines such as Google, Yahoo or others. By optimizing your paper for search engines, you will amplify the chance of someone finding it. In turn, this will make it more likely to be viewed and cited in further works. Global Journals has compiled these guidelines to facilitate you to maximize the web-friendliness of the most public part of your paper.

Keywords

A major lynchpin of research work for the writing of research papers is the keyword search, which one will employ to find both library and internet resources. Up to eleven keywords or very brief phrases have to be given to help data retrieval, mining, and indexing.

One must be persistent and creative in using keywords. An effective keyword search requires a strategy: planning of a list of possible keywords and phrases to try.

Choice of the main keywords is the first tool of writing a research paper. Research paper writing is an art. Keyword search should be as strategic as possible.

One should start brainstorming lists of potential keywords before even beginning searching. Think about the most important concepts related to research work. Ask, “What words would a source have to include to be truly valuable in a research paper?” Then consider synonyms for the important words.

It may take the discovery of only one important paper to steer in the right keyword direction because, in most databases, the keywords under which a research paper is abstracted are listed with the paper.

Numerical Methods

Numerical methods used should be transparent and, where appropriate, supported by references.

Abbreviations

Authors must list all the abbreviations used in the paper at the end of the paper or in a separate table before using them.

Formulas and equations

Authors are advised to submit any mathematical equation using either MathJax, KaTeX, or LaTeX, or in a very high-quality image.

Tables, Figures, and Figure Legends

Tables: Tables should be cautiously designed, uncrowned, and include only essential data. Each must have an Arabic number, e.g., Table 4, a self-explanatory caption, and be on a separate sheet. Authors must submit tables in an editable format and not as images. References to these tables (if any) must be mentioned accurately.

Figures

Figures are supposed to be submitted as separate files. Always include a citation in the text for each figure using Arabic numbers, e.g., Fig. 4. Artwork must be submitted online in vector electronic form or by emailing it.

Preparation of Eletronic Figures for Publication

Although low-quality images are sufficient for review purposes, print publication requires high-quality images to prevent the final product being blurred or fuzzy. Submit (possibly by e-mail) EPS (line art) or TIFF (halftone/ photographs) files only. MS PowerPoint and Word Graphics are unsuitable for printed pictures. Avoid using pixel-oriented software. Scans (TIFF only) should have a resolution of at least 350 dpi (halftone) or 700 to 1100 dpi (line drawings). Please give the data for figures in black and white or submit a Color Work Agreement form. EPS files must be saved with fonts embedded (and with a TIFF preview, if possible).

For scanned images, the scanning resolution at final image size ought to be as follows to ensure good reproduction: line art: >650 dpi; halftones (including gel photographs): >350 dpi; figures containing both halftone and line images: >650 dpi.

Color charges: Authors are advised to pay the full cost for the reproduction of their color artwork. Hence, please note that if there is color artwork in your manuscript when it is accepted for publication, we would require you to complete and return a Color Work Agreement form before your paper can be published. Also, you can email your editor to remove the color fee after acceptance of the paper.

Tips for writing a good quality Computer Science Research Paper

Techniques for writing a good quality computer science research paper:

1. Choosing the topic: In most cases, the topic is selected by the interests of the author, but it can also be suggested by the guides. You can have several topics, and then judge which you are most comfortable with. This may be done by asking several questions of yourself, like "Will I be able to carry out a search in this area? Will I find all necessary resources to accomplish the search? Will I be able to find all information in this field area?" If the answer to this type of question is "yes," then you ought to choose that topic. In most cases, you may have to conduct surveys and visit several places. Also, you might have to do a lot of work to find all the rises and falls of the various data on that subject. Sometimes, detailed information plays a vital role, instead of short information. Evaluators are human: The first thing to remember is that evaluators are also human beings. They are not only meant for rejecting a paper. They are here to evaluate your paper. So present your best aspect.

2. Think like evaluators: If you are in confusion or getting demotivated because your paper may not be accepted by the evaluators, then think, and try to evaluate your paper like an evaluator. Try to understand what an evaluator wants in your research paper, and you will automatically have your answer. Make blueprints of paper: The outline is the plan or framework that will help you to arrange your thoughts. It will make your paper logical. But remember that all points of your outline must be related to the topic you have chosen.

3. Ask your guides: If you are having any difficulty with your research, then do not hesitate to share your difficulty with your guide (if you have one). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work, then ask your supervisor to help you with an alternative. He or she might also provide you with a list of essential readings.

4. Use of computer is recommended: As you are doing research in the field of computer science then this point is quite obvious. Use right software: Always use good quality software packages. If you are not capable of judging good software, then you can lose the quality of your paper unknowingly. There are various programs available to help you which you can get through the internet.

5. Use the internet for help: An excellent start for your paper is using Google. It is a wondrous search engine, where you can have your doubts resolved. You may also read some answers for the frequent question of how to write your research paper or find a model research paper. You can download books from the internet. If you have all the required books, place importance on reading, selecting, and analyzing the specified information. Then sketch out your research paper. Use big pictures: You may use encyclopedias like Wikipedia to get pictures with the best resolution. At Global Journals, you should strictly follow here.

6. Bookmarks are useful: When you read any book or magazine, you generally use bookmarks, right? It is a good habit which helps to not lose your continuity. You should always use bookmarks while searching on the internet also, which will make your search easier.

7. Revise what you wrote: When you write anything, always read it, summarize it, and then finalize it.

8. Make every effort: Make every effort to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in the introduction—what is the need for a particular research paper. Polish your work with good writing skills and always give an evaluator what he wants. Make backups: When you are going to do any important thing like making a research paper, you should always have backup copies of it either on your computer or on paper. This protects you from losing any portion of your important data.

9. Produce good diagrams of your own: Always try to include good charts or diagrams in your paper to improve quality. Using several unnecessary diagrams will degrade the quality of your paper by creating a hodgepodge. So always try to include diagrams which were made by you to improve the readability of your paper. Use of direct quotes: When you do research relevant to literature, history, or current affairs, then use of quotes becomes essential, but if the study is relevant to science, use of quotes is not preferable.

10.Use proper verb tense: Use proper verb tenses in your paper. Use past tense to present those events that have happened. Use present tense to indicate events that are going on. Use future tense to indicate events that will happen in the future. Use of wrong tenses will confuse the evaluator. Avoid sentences that are incomplete.

11. Pick a good study spot: Always try to pick a spot for your research which is quiet. Not every spot is good for studying.

12. Know what you know: Always try to know what you know by making objectives, otherwise you will be confused and unable to achieve your target.

13. Use good grammar: Always use good grammar and words that will have a positive impact on the evaluator; use of good vocabulary does not mean using tough words which the evaluator has to find in a dictionary. Do not fragment sentences. Eliminate one-word sentences. Do not ever use a big word when a smaller one would suffice.

Verbs have to be in agreement with their subjects. In a research paper, do not start sentences with conjunctions or finish them with prepositions. When writing formally, it is advisable to never split an infinitive because someone will (wrongly) complain. Avoid clichés like a disease. Always shun irritating alliteration. Use language which is simple and straightforward. Put together a neat summary.

14. Arrangement of information: Each section of the main body should start with an opening sentence, and there should be a changeover at the end of the section. Give only valid and powerful arguments for your topic. You may also maintain your arguments with records.

15. Never start at the last minute: Always allow enough time for research work. Leaving everything to the last minute will degrade your paper and spoil your work.

16. Multitasking in research is not good: Doing several things at the same time is a bad habit in the case of research activity. Research is an area where everything has a particular time slot. Divide your research work into parts, and do a particular part in a particular time slot.

17. Never copy others' work: Never copy others' work and give it your name because if the evaluator has seen it anywhere, you will be in trouble. Take proper rest and food: No matter how many hours you spend on your research activity, if you are not taking care of your health, then all your efforts will have been in vain. For quality research, take proper rest and food.

18. Go to seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

19. Refresh your mind after intervals: Try to give your mind a rest by listening to soft music or sleeping in intervals. This will also improve your memory. Acquire colleagues: Always try to acquire colleagues. No matter how sharp you are, if you acquire colleagues, they can give you ideas which will be helpful to your research.

20. Think technically: Always think technically. If anything happens, search for its reasons, benefits, and demerits. Think and then print: When you go to print your paper, check that tables are not split, headings are not detached from their descriptions, and page sequence is maintained.

21. Adding unnecessary information: Do not add unnecessary information like "I have used MS Excel to draw graphs." Irrelevant and inappropriate material is superfluous. Foreign terminology and phrases are not apropos. One should never take a broad view. Analogy is like feathers on a snake. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Never oversimplify: When adding material to your research paper, never go for oversimplification; this will definitely irritate the evaluator. Be specific. Never use rhythmic redundancies. Contractions shouldn't be used in a research paper. Comparisons are as terrible as clichés. Give up ampersands, abbreviations, and so on. Remove commas that are not necessary. Parenthetical words should be between brackets or commas. Understatement is always the best way to put forward earth-shaking thoughts. Give a detailed literary review.

22. Report concluded results: Use concluded results. From raw data, filter the results, and then conclude your studies based on measurements and observations taken. An appropriate number of decimal places should be used. Parenthetical remarks are prohibited here. Proofread carefully at the final stage. At the end, give an outline to your arguments. Spot perspectives of further study of the subject. Justify your conclusion at the bottom sufficiently, which will probably include examples.

23. Upon conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print for the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects of your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form which is presented in the guidelines using the template.
- Please note the criteria peer reviewers will use for grading the final paper.

Final points:

One purpose of organizing a research paper is to let people interpret your efforts selectively. The journal requires the following sections, submitted in the order listed, with each section starting on a new page:

The introduction: This will be compiled from reference matter and reflect the design processes or outline of basis that directed you to make a study. As you carry out the process of study, the method and process section will be constructed like that. The results segment will show related statistics in nearly sequential order and direct reviewers to similar intellectual paths throughout the data that you gathered to carry out your study.

The discussion section:

This will provide understanding of the data and projections as to the implications of the results. The use of good quality references throughout the paper will give the effort trustworthiness by representing an alertness to prior workings.

Writing a research paper is not an easy job, no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record-keeping are the only means to make straightforward progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear: Adhere to recommended page limits.

Mistakes to avoid:

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- Submitting a manuscript with pages out of sequence.
- In every section of your document, use standard writing style, including articles ("a" and "the").
- Keep paying attention to the topic of the paper.
- Use paragraphs to split each significant point (excluding the abstract).
- Align the primary line of each section.
- Present your points in sound order.
- Use present tense to report well-accepted matters.
- Use past tense to describe specific results.
- Do not use familiar wording; don't address the reviewer directly. Don't use slang or superlatives.
- Avoid use of extra pictures—include only those figures essential to presenting results.

Title page:

Choose a revealing title. It should be short and include the name(s) and address(es) of all authors. It should not have acronyms or abbreviations or exceed two printed lines.

Abstract: This summary should be two hundred words or less. It should clearly and briefly explain the key findings reported in the manuscript and must have precise statistics. It should not have acronyms or abbreviations. It should be logical in itself. Do not cite references at this point.

An abstract is a brief, distinct paragraph summary of finished work or work in development. In a minute or less, a reviewer can be taught the foundation behind the study, common approaches to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Use comprehensive sentences, and do not sacrifice readability for brevity; you can maintain it succinctly by phrasing sentences so that they provide more than a lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study with the subsequent elements in any summary. Try to limit the initial two items to no more than one line each.

Reason for writing the article—theory, overall issue, purpose.

- Fundamental goal.
- To-the-point depiction of the research.
- Consequences, including definite statistics—if the consequences are quantitative in nature, account for this; results of any numerical analysis should be reported. Significant conclusions or questions that emerge from the research.

Approach:

- Single section and succinct.
- An outline of the job done is always written in past tense.
- Concentrate on shortening results—limit background information to a verdict or two.
- Exact spelling, clarity of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else.

Introduction:

The introduction should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable of comprehending and calculating the purpose of your study without having to refer to other works. The basis for the study should be offered. Give the most important references, but avoid making a comprehensive appraisal of the topic. Describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will give no attention to your results. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here.

The following approach can create a valuable beginning:

- Explain the value (significance) of the study.
- Defend the model—why did you employ this particular system or method? What is its compensation? Remark upon its appropriateness from an abstract point of view as well as pointing out sensible reasons for using it.
- Present a justification. State your particular theory(-ies) or aim(s), and describe the logic that led you to choose them.
- Briefly explain the study's tentative purpose and how it meets the declared objectives.

Approach:

Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done. Sort out your thoughts; manufacture one key point for every section. If you make the four points listed above, you will need at least four paragraphs. Present surrounding information only when it is necessary to support a situation. The reviewer does not desire to read everything you know about a topic. Shape the theory specifically—do not take a broad view.

As always, give awareness to spelling, simplicity, and correctness of sentences and phrases.

Procedures (methods and materials):

This part is supposed to be the easiest to carve if you have good skills. A soundly written procedures segment allows a capable scientist to replicate your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order, but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt to give the least amount of information that would permit another capable scientist to replicate your outcome, but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section.

When a technique is used that has been well-described in another section, mention the specific item describing the way, but draw the basic principle while stating the situation. The purpose is to show all particular resources and broad procedures so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step-by-step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

Materials may be reported in part of a section or else they may be recognized along with your measures.

Methods:

- Report the method and not the particulars of each process that engaged the same methodology.
- Describe the method entirely.
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures.
- Simplify—detail how procedures were completed, not how they were performed on a particular day.
- If well-known procedures were used, account for the procedure by name, possibly with a reference, and that's all.

Approach:

It is embarrassing to use vigorous voice when documenting methods without using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result, when writing up the methods, most authors use third person passive voice.

Use standard style in this and every other part of the paper—avoid familiar lists, and use full sentences.

What to keep away from:

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings—save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part as entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Use statistics and tables, if suitable, to present consequences most efficiently.

You must clearly differentiate material which would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matters should not be submitted at all except if requested by the instructor.

Content:

- Sum up your conclusions in text and demonstrate them, if suitable, with figures and tables.
- In the manuscript, explain each of your consequences, and point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation of an exacting study.
- Explain results of control experiments and give remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or manuscript.

What to stay away from:

- Do not discuss or infer your outcome, report surrounding information, or try to explain anything.
- Do not include raw data or intermediate calculations in a research manuscript.
- Do not present similar data more than once.
- A manuscript should complement any figures or tables, not duplicate information.
- Never confuse figures with tables—there is a difference.

Approach:

As always, use past tense when you submit your results, and put the whole thing in a reasonable order.

Put figures and tables, appropriately numbered, in order at the end of the report.

If you desire, you may place your figures and tables properly within the text of your results section.

Figures and tables:

If you put figures and tables at the end of some details, make certain that they are visibly distinguished from any attached appendix materials, such as raw facts. Whatever the position, each table must be titled, numbered one after the other, and include a heading. All figures and tables must be divided from the text.

Discussion:

The discussion is expected to be the trickiest segment to write. A lot of papers submitted to the journal are discarded based on problems with the discussion. There is no rule for how long an argument should be.

Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implications of the study. The purpose here is to offer an understanding of your results and support all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of results should be fully described.

Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact, you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved the prospect, and let it drop at that. Make a decision as to whether each premise is supported or discarded or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."

Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work.

- You may propose future guidelines, such as how an experiment might be personalized to accomplish a new idea.
- Give details of all of your remarks as much as possible, focusing on mechanisms.
- Make a decision as to whether the tentative design sufficiently addressed the theory and whether or not it was correctly restricted. Try to present substitute explanations if they are sensible alternatives.
- One piece of research will not counter an overall question, so maintain the large picture in mind. Where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

When you refer to information, differentiate data generated by your own studies from other available information. Present work done by specific persons (including you) in past tense.

Describe generally acknowledged facts and main beliefs in present tense.

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Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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