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Vehicles for Change

Inverse Linear Regression

Highlights

Ambient Intelligence in Healthcare

Emerging Virtualization Technology

Discovering Thoughts, Inventing Future

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CONTENTS OF THE ISSUE

Vehicles for change

By Richard Scroggins

Walden University

Introduction- Projects, especially IT projects, can be very powerful vehicles for change. They can bring change to an individual, an organization, or to an entire community. Projects can be vehicles for desired changes, or required projects can bring changes that must be adapted to. Project management can be thought of as change management from the perspective that a project is simply a series of changes that combine to make the whole. From this perspective, part of the basis of project management theories are existing change management theories. A theory of change refers to the processes by which changes come about. Within an organization, changes can be considered as organizational change. Therefore, project management at that level is organizational change management. In fact and practice it is difficult to completely separate organizational change management from project management. Andrews, Cameron, and Harris (2008) write, "The skills and knowledge which managers found most useful were those that enabled them to "make sense" of the organizational change" (p. 300).

GJCST-H Classification: I.2.9

VEHICLESFORCHANGE

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Vehicles for change

Richard Scroggins

I. Introduction

Projects, especially IT projects, can be very powerful vehicles for change. They can bring change to an individual, an organization, or to an entire community. Projects can be vehicles for desired changes, or required projects can bring changes that must be adapted to. Project management can be thought of as change management from the perspective that a project is simply a series of changes that combine to make the whole. From this perspective, part of the basis of project management theories are existing change management theories. A theory of change refers to the processes by which changes come about. Within an organization, changes can be considered as organizational change. Therefore, project management at that level is organizational change management. In fact and practice it is difficult to completely separate organizational change management from project management. Andrews, Cameron, and Harris (2008) write, "The skills and knowledge which managers found most useful were those that enabled them to "make sense" of the organizational change" (p. 300). Social aspects of projects and the changes that they affect are also a part of the overall view of project management. Social factors drive projects and technology adoption, and those projects in turn affect society on some scale. The Diffusion of innovations theory is a technology acceptance theory, being first proposed by Rogers (1962), and the Diffusion of innovations theory evaluates how the deployment of new technology relates to social systems. "Diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system" (Rogers, 1962, p. 5). The social system drives the spread of the technology and the technology drives the evolution of the social system.

II. Managing Change

What is change? Webster's dictionary defines change as, "to make a shift from one to another." ("Change", 2016). Change, therefore is a shifting from one state to another and this shifting involves a process. What project managers and team members do is initiate change and manage to through this shifting process. This is why project management can be thought of as change management. Change management can include directing the processes and people that are effecting the shifting process or managing the expectations, acceptance, or understanding of the people within an organization that is changing. The project is the vehicle for change in the sense that the project contains or should contain all of the elements needed to properly complete the needed change, which may be a negative or positive change. However, being a vehicle for change also means that a project can be undertaken simply be the free will of an organization to be a purely positive endeavor that brings social benefits beyond the organization. The later idea is a more accurate way to envision the social construct of using something like a project as a vehicle for change. While change, especially social change is an integral part of modern life in a highly political and interconnected world, even change at the organizational level can have an impact on people's lives.

III. Managing the Organization

How a project is managed and sold largely determines the perceptions of those involved or impacted by organizational change. Vakola (2014) writes, "The readiness level may vary on the basis of what employees perceive as the balance between costs and benefits of maintaining a behavior and the costs and benefits of change." (p. 195).Every person within an organization will be effected is some manner by organizational change, and will have some level of readiness to the change. Those closer to the change process or who may be impacted more by the change will likely also have a perception of the impact of the organizational change. These perception need to managed as part of the change management process as well as the actual impacts to people within the organization. Managing the attitudes, acceptance, and expectations of the stakeholders within an organization are as much a part of a project as are the functional steps that make up the project. The project team must provide support for organizational members to digest and accept change. For a project to be successful and meet all of the needs of an organization, the human elements cannot be ignored and to truly use a project as a vehicle for change a public relations element is needed. It could be considered as a wise choice to have someone from an organization's public relations department on the project team to champion the organizational change, relate it to the people, and provide counsel before and after the change. (Exploring the role of public relations in organizational change, 1994).

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2

IV.   MANAGING COMMUNICATION

In order for a project to connect with an organization's members, they must understand the impact of the change and see the benefit to themselves and the organization. One method to control the opinions, perceptions, and acceptance of the people regarding a project is through the use of public relations and managed communication. On the success of a project phase, Uta-Micaelaand Sriramesh (2004)write, "This was only possible because of the integration of the communication department right from the start of the strategy process. The management recognized that an integrated communication approach to the corporate identity process coupled with intensive public relations is a decisive factor in managing change successfully." (p. 372).Managing the relationship between the project team and the public, what is usually considered public relations, is in reality managing the communications related to the project. Managing these communications could be related to many elements of the project. One area for instance might be training. Negative perceptions about the project or change might be created when people are afraid that they will not have the knowledge to use a particular system after the changes are made. Early and informative communications about the changes to that system, details about the training that will be given, and a positive spin could eliminate these negative perceptions before they are able to for or take hold. This concept is applicable to many types of projects or scenarios. Aubert, Hooper, and Schnepel(2013) write, "Communication quality is repeatedly listed among the top success factors to consider when implementing an ERP system." (p. 64).

V.   MANAGING THE OUTCOME

Whether it is described as change management or project management, the goal is the same, to manage the outcome. Regardless of the title that it is given, both of these ideas are related to managing the outcome. Managing the outcome means using all of the tools available and the elements that relate to project management to set a goal and achieve it. Setting yourself up for success in a project is like stacking the deck in your favor. This starts by understanding the change and the organization undergoing it. It includes understanding the needs of the organizations stakeholders through collecting data from them. It means finding the right people for the project team and then setting realistic goal and keeping the project of track to meet those goals. And it also means managing the scope of the project and protecting the organization from themselves and their own management in terms of unrealistic goals or timelines. Much of this falls on the shoulders of the project manager and as such the choice of project manager can make or break a project, so it is an important role. Anantatmula (2010) writes, "In spite of advances in the project management profession, research studies have shown that many projects fail, underlining the importance of the project manager's role as manager. Specifically, the manager's leadership role is of great importance in motivating people and creating an effective working environment in order for the project team to meet greater challenges in today's global economy." (p. 13). While the specific traits of what makes a good and successful project manager might be difficult to separate as valid independent variable related to project success, the leadership role of the project manager is important to success factors related to project performance. Project success and the success of the project manager do vary, for instance you can perfectly manage a project and not meet every goal because of the technology and variations between each organization. While project success and project management success are not the same thing, success in project management or a successful project manager contributes to project success. Regardless of the elements of what makes a project successful, managing the outcome requires the full understanding and attention to all or them.

VI.   SUMMARY

There are many factors that make a projects successful and many factors that can make a project a vehicle for change. It is the direction that the project is given, the quality of the management, and the intent of the organization that determine the value and success of each project. Change in any form can be positive or negative, it can be constructive or destructive, it can be outward facing or inward facing, and it can be reluctant or purposefully undertaken. It is when change is purposefully undertaken with the goal to have a positive and constructive outcome that the world moves forward and progress is made. Often real progress is made slowly and takes many working together to accomplish. However, when people do work together in a common goal and through teamwork, there is nothing that cannot be accomplished by the human mind, spirit, and will. Linnartz2008 writes, "Teamwork includes cooperation, collaboration and coordination plus it greatly increases interactions of support and a sense of belonging and pride. Working as a team provides maximum opportunity for contributions to be made by individuals that benefit the team and organization. It also creates a powerful dynamic of synergy of sharing, creating and productivity." (p. 1). Managing outcomes through teamwork is an important element in ensuring a successful project and in using a project to drive change.

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Personal Health Record of an Individual in Ethiopia

By Dr. Mahammad Shafi, R. Mengistu Ketema & Prabhakar Gantela

Mizan-Tepi University

Abstract- Personal Health Record (PHR) is a proposed application, which creates and manages patient health/ medical records and allow access at anytime from anywhere. PHR are broadly considered as means by which an individual's personal health information can be collected, stored, and used for diverse health management purposes. It is an electronic record of an individual in Ethiopia, which provides identifiable health information that can be drawn from multiple sources. PHR can be managed, shared, and controlled by an individual or their Care Givers and Health Care Providers.

Keywords: personal health record, electronic health record, ındividual, health services.

GJCST-H Classification: J.3, K.4.1

PERSONALHEALTHRECORD OFANINDIVIDUALINETHIOPIA

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Personal Health Record of an Individual in Ethiopia

Dr. Mahammad Shafi ^α, R. Mengistu Ketema ^σ & Prabhakar Gantela ^ρ

Abstract- Personal Health Record (PHR) is a proposed application, which creates and manages patient health/ medical records and allow access at anytime from anywhere. PHR are broadly considered as means by which an individual's personal health information can be collected, stored, and used for diverse health management purposes. It is an electronic record of an individual inEthiopia, which provides identifiable health information that can be drawn from multiple sources. PHR can be managed, shared, and controlled by an individual or their Care Givers and Health Care Providers.

Keywords: personal health record, electronic health record, ındividual, health services.

I. Introduction

Personal health records are broadly considered as means by which an individual's personal health information can be collected, stored, and used for diverse health management purposes. In some concepts, the PHR includes the patient's interface to a healthcare provider's electronic health record (EHR). In others, PHRs are any consumer/patient-managed health record. This lack of consensus makes collaboration, coordination and policymaking difficult. It is quite possible now for people to talk about PHRs without realizing that their respective notions of them may be quite different. Recognizing the variety of attributes and possibilities and being very specific about what is being discussed would enable those engaged in collaboration and policymaking to conduct more nuanced discussions of PHRs and to collaborate more effectively.

A framework will provide a foundation for public education effortsto highlight the benefits and risks of PHR, which aimed not only at an individual and patients but also at healthcare providers and other stakeholders.

Today people need to monitor, track and evaluate their individual health strategies as we are identifying increased number of diseases and their cure.

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By providing complete, updated and easily accessible health records, people can play a more active role in their health care as well as that of family members. PHR offers instant simple affordable solution. PHR is a web-based application, which creates and manages individual health/ medical records and allow access at anytime from anywhere. PHR provides,

- Complete and accurate summary of individual's medical history.
- Facilitates better and timely treatment by Doctors.
- Better communication between patients and doctors.
- In emergencies, a PHR can quickly provide timely medical information for better treatment.

II. Initial Framework for PHR Attributes

a) *Scope and Nature of the Content*
- Some PHR systems just have consumer health information, personal health journals, or information about benefits and/or providers, but no clinical data about the individual.
- Some PHR systems have clinical information. Of these, some are disease specific, some include subsets of information such as lab reports, and some are comprehensive.

b) *Source of Information*
- Data in PHR systems may come from the individual, patient, caregiver, healthcare provider, or all of these.
- Some PHR systems are populated with data by EHR.

c) *Features and Functions*
- PHR systems offer a wide variety of features, including the ability to view personal health data, exchange secure messages with providers, schedule appointments, renew prescriptions, and enter personal health data; decision support such as medication interaction alerts or reminders about needed preventive services and the ability to transfer data to or from an electronic health record and the ability to track and manage health plan benefits and services.

d) *Custodian of the Record*

- The physical record may be operated by a number of parties, including individual or patient, an independent third party, a healthcare provider, an insurance company, or an employer.

e) *Data Storage*

- Data may be stored in a variety of locations, including an Internet-accessible database, a provider's EHR, individual/ patient's home computer, a portable device such as a smart card or thumb drive, or a privately maintained database.

f) *Data Access Control*

- Individual or patients always have access to their own data, they do not always determine who else may access it. For example, PHR that are "views"

into a provider's EHR follow the access rules set up by the provider. In some cases, consumers do have exclusive control.

III. Methodology

The Methodology consists of the following few tasks which are considered for analysis, design and implementation of PHR and addresses lacunae in present manual health record management at Tepi Region. The services of PHR are depicted in Fig-1.

Fig.1: Services of PHR

a) *Timely Access to Health Data*

PHR can enable us to,

- View Medicines
- View Lab Results
- View Allergies
- View Problem List and
- Administration and Security necessary to enable timely access

b) *Engage Patients, Families and More*

- Patient/ Family Member can create an online account and Logs into PHR
- With the help of unique id of the patient, PHR seeks patient information from PHR Server
- PHR Server displays patient data like Medications, Allergies, Problems, Lab Reports, etc.,
- PHR provides simple quick affordable solution

c) *Increasing Electronic Synergies*

- Transmit information about Hospital Administration
- Precautionary measures of some of the diseases

- Export PHR information as a text file or send to a Printer
- Online Videos
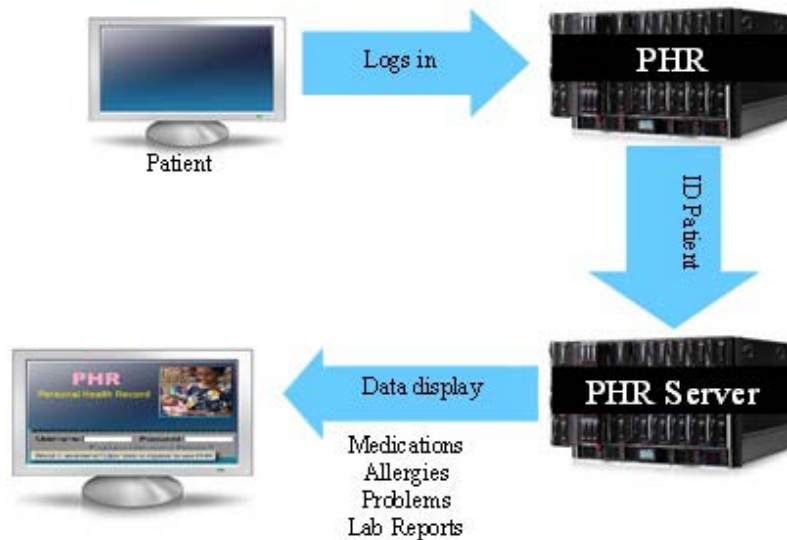
Fig. 2: Working Process of PHR

IV. National Scenario of PHR in Ethiopia

Ethiopia has a total population of 91.73 million (2014) and is one of the poorest countries in the world, with a per capita annual income of US$ 90 (2003). Percentage of population living in urban areas is 17% and population proportion between ages 30 and 70 years is 26.4% (2014). The probability of dying between ages 30 and 70 from four main Non-Communicable Diseases (NCD) is 15% (2014). The four main NCDs considered were Cancers, Diabetes, Cardiovascular diseases and Chronic respiratory diseases [2].

In 2004/05, there were 126 hospitals, 519 health centres, 1,797 health stations, 2899 health posts and1,299 private clinics in the country. Although there is no data available on the number of traditionalhealers in the country, it is well known that many Ethiopian households use them for various healthproblems.The population per primary health care (PHC) facility was 24,513 and this was three times higher thanthe population per PHC in the rest of sub-Saharan Africa. The total number of hospital beds was13,469, which meant that there was only one bed for a population of 5,276 and this was about fivetimes higher than the average for sub-Saharan Africa. The limited number of health institutions, inefficientdistribution of medical supplies and disparity between urban and rural areas have made it difficultto increase people's access to health-care services [4].

Ethiopia is experiencing recurrent problems as a result of droughts and conflicts. Drought has become a chronic occurrence, affecting the country periodically once every 7–10 years since 1983. The current drought is only exasperating the needs resulting from the 2003 drought, leaving presently 3.8 million people in desperate need for emergency food relief and another

5.2 million chronically food insecure assisted through a productive safety net program [4].

The incidence of certain diseases increases during droughts. The main diseases most commonly encountered are: malaria, diarrhea, intestinal helminthiasis, acute respiratory infections including pneumonia, tuberculosis and skin diseases. Outbreaks of meningitis, measles and diarrhoeal diseases including cholera are also common during droughts.

Periodically, the dry lands experience heavy seasonal rains, which cause flooding leading to internal displacement and increased risk for diseases related to stagnant waters such as malaria and cholera.

The widespread food shortages associated with these natural disasters further results in malnutrition and under-nutrition. In order to address chronic poverty and persisting food insecurity, the Ethiopian government is since 2003 conducting a massive resettlement programme, under which 2.2 million people will be moved to more productive areas.

The progress in health status of the population indicates that about 80% of diseases in Ethiopia are attributable to preventable conditions related to infectious diseases, malnutrition; and personal and environmental hygiene. The prevalence of TB in Ethiopia is estimated to be 241 with incidence of 247 per 100 000 populations. The adult HIV prevalence is 1.5% in 2011 (4.2% for urban and 0.6% for rural) and is higher among females (1.9%) than males (1%). Environmental risk factors contribute to 31% of the total disease burden in the country.

The right to health for every Ethiopian has been guaranteed by the 1995 Constitution of the Federal Democratic Republic of Ethiopia (FDRE), which stipulates the obligation of the state to issue policy and allocate ever increasing resources to provide public health services to all Ethiopians.

Ethiopia follows a decentralized health care system, development of the preventive, promotive and curative health care delivery by public, private for profit and not-for profit players in the health sector. The Ethiopian health care delivery, organized in to three-tier system, puts the health extension program, the innovative community-based service delivery, as a center of focus for the provision of primary health care services to broad masses. Primary health care (PHC) potential coverage stands at 90%, reaching most of the rural areas in the country.

a) *Top 10 Causes of Deaths in Ethiopia*

Table 1: Top 10 Causes of Deaths in Ethiopia (Source: [3])

Lower respiratory infections	12%
HIV/ AIDS	12%
Perinatal conditions	8%
Diarrheal diseases	6%
Tuberculosis	4%
Measles	4%
Cerebrovascular disease	3%
Ischaemic heart disease	3%
Malaria	3%
Syphilis	2%

V. POTENTIAL BENEFITS OF PHR

a) *Individuals and their Care Givers*

- Support wellness activities
- Improve understanding of health issues
- Increase sense of control over health
- Increase control over access to personal health information
- Support timely, appropriate preventive services
- Support healthcare decisions and responsibility for care
- Strengthen communication with providers
- Verify accuracy of information in provider records
- Support home monitoring for chronic diseases
- Support understanding and appropriate use of medications
- Support continuity of care across time and providers
- Manage insurance benefits and claims
- Avoid duplicate tests
- Reduce adverse drug interactions and allergic reactions
- Reduce hassle through online appointment scheduling and prescription refills
- Increase access to providers via e-visits
- Improve documentation of communication with patients

b) *Health Care Providers*

- Improve access to data from other providers and the patients themselves
- Increase knowledge of potential drug interactions and allergies
- Avoid duplicate tests
- Improve medication compliance
- Provide information to patients for both healthcare and patient services purposes
- Provide patients with convenient access to specific information or services (e.g., lab results, e-visits)
- Improve documentation of communication with patients

c) *Social/ Population Health Benefits*

- Strengthen health promotion and disease prevention
- Improve the health of populations
- Expand health education opportunities

To realize the potential benefits of PHR and to improve health and healthcare, significant steps are needed in the areas of privacy, security, and interoperability, in particular, as recommended. The key findings include the following:

i. It is important to clarify the respective rights, obligations, and potential liabilities of individuals, patients, providers, and other stakeholders in the PHR system.

ii. Individuals should have the right to make an informed choice concerning the uses of their personal information when signing up to use any personal health record products or services.

iii. Security is a critical component of a PHR system, especially if it is accessible via the Internet.

iv. The full potential of PHR system will not be realized until they are capable of widespread exchange of information with Electronic Health

Records (EHRs) and other sources of personal and other health data.

There is a scope for broad areas for research and evaluation for PHR system. They include individual, health services, and technical research and the development of metrics to assess the implementation and impact of PHR system on multiple dimensions of health and healthcare [1].

VI. Conclusion

This paper portrays the analysis, design and implementation of Personal Health Record (PHR) of an individual in Ethiopia and its recompense over the present PHR in Ethiopia. By means of this performance we can support wellness activities by facilitating better and timely treatment by doctors. It will help the country's economy to reach new heights. PHR provides timely access to health profile of an individual, engage patients, family members and more electronic synergies.

PHR can benefit individuals and their care givers, health care providers and societal/ population health benefits. In the proposed system all information related to the health profile of an individual is stored in database. So, implementing this will be really helpful to the people below poverty line. In future, data mining techniques can be adopted to forecast diseases and precautionary measures can be taken. Even it is possible to develop an expert system to diagnose the disease of the patient and given prescription accordingly.

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Emerging Virtualization Technology

By Richard Scroggins

Walden University

Abstract- Virtualization represents a class of technologies that covers a wide range of applications and implementations. Virtualization can be applied to hardware or software and the technologies within the umbrella of virtualization are growing. Some organizations are adopting virtualization technologies for the cost savings benefits, but they may not weigh the risks. Bizarro and Garcia(2013) write, "As the technology becomes more standardized, server virtualization has become more prevalent. Companies are realizing cost savings and greener computing. Virtualization may initially appear attractive because of additional capabilities and cost savings, but those benefits come with increased security risks." (p. 11). As the idea of virtualization grows, so does adoption, and new improvements and virtualization technologies are emerging. Every emerging virtualization technology or innovation, however, has pros and cons or benefits and risk. Many of the emerging virtualization technologies represent an implementation challenge for project managers and implementers. This research paper will be focused on emerging virtualization technologies, implementation success factors, and virtualization risks.

GJCST-H Classification: H.5.1

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I. Problem Statement

Trends in virtualization are always maturing and new technologies are rapidly available for implementation. (Bele & Desai, 2012) According to Hamersly and Land (2015), a significant problem exists because some IT professionals are unable to successfully adopt new virtualization technologies. The general IT problem is that many IT professionals are not able to successfully implement new virtualization technologies. The specific IT problem is that some IT project managers lack information of the relationship between organizational culture and the successful adoption of new virtualization technologies.

II. Virtualization

Violino (2009) writes, "Hordes of organizations have embraced server virtualization as they look to consolidate servers, reduce energy consumption in the data center, increase business agility and reduce costs. But there's life for virtualization beyond the server: The future of this technology likely will focus on client devices, and there's also great potential in areas such as business continuity, disaster recovery and capacity planning. The server virtualization market continues to grow, although it's maturing, according to industry experts." (p. 28). So, what is virtualization? Virtualization technologies represent a very broad category of tools and technology that present many advantages to an

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organization. Virtualization is the concept or process of separating the logical from the physical. Rouse and Madden (2013), define server and desktop virtualization as "the concept of isolating a logical operating system instance from the client that is used to access it." (p. 1) Virtualization technologies allow an organization to literally do more with less as more technologies can be deployed onto a smaller set of physical hardware. For example, a virtualization software platform or hypervisor, can host virtual computers, servers, or devices that all exist on the same hardware and share physical resources but run different operating systems and existing within different virtual networks.

Much of the focus on virtualization technology in the industry and in the literature is on server virtualization. Despite this, server virtualization is neither the origin of virtualization nor the area where most innovation is emerging. The concept of virtualization in computer technology originated in the 1960's. Both IBM and MIT started working on virtualization technologies in the 1960's. The initial reference to virtual machine technology is from a discourse by MIT's Melinda Varíanin the 1960's which introduced the compatible Time-Sharing System, or CTSS. (Ameen and Hamo, 2013)As stated, virtualization refers to a class of technologies rather than to one specific technology. The list below shows the major classifications of virtualization technology:

1) Mobile Virtualization
2) Data Virtualization
3) Memory Virtualization
4) Desktop Virtualization
5) Storage Virtualization
6) Network Virtualization
7) Application Virtualization
8) Grid Computing
9) Clustering
10) Server Virtualization

Ameen and Hamo, 2013

As stated, there is a focus in the industry on hardware or platform virtualization. This refers to creating a virtual machine, and is integral to the processes of server or desktop virtualization. This is the area of the technology where most administrator work with virtualization through hypervisor applications like VMWare or Microsoft's Hyper-V. This type of virtualization is popular, not only because of cost savings, but because it allows a server or computer running one operating system to also run a second operating system through virtualization. A common

example of this would be a Microsoft windows pc running Windows 10 to use the virtual application to install and run Linux. It is also very common to install a Linux based hypervisor like VMWare's ESX on a server and then install Microsoft Windows Servers implementations on the same hardware.

III. MOBILE VIRTUALIZATION

Mobile virtualization is a true representation of an emerging area of virtualization technology. Mobile virtualization technology is an embedded software technology for use in mobile phones. In Mobile virtualization, the hardware and the data and applications are separated through the use of a hypervisor. This separation allows the phone to run in an optimized way and consume less power and memory. This design is incorporated across multiple phone, notebook, and tablet platforms, including Windows CE 5.0 and 6.0, Linux 2.6.x, Symbian 9.x, eCos, pITRON NORTi and pC/OS-II. (Ameen and Hamo, 2013)The primary driver for Mobile virtualization cost reduction in the manufacture of mobile phones. Mobile virtualization is tied directly to creating lower cost phones and is part of the business strategy for Android. A good example of this is Android's decision to produce smartphones without a separate baseband processor. This is achieved by running the baseband processor code and the applications in separate virtual machines on one processor. (Hookway, 2010)

Every industry has a need to reduce costs, and the mobile phone industry is no exception. Virtualization technologies reduce costs whether on the small scale like with phones or on the larger scale of servers and data centers. The cost savings of virtualization technology is what draws many stakeholders to investigate virtualization in the first place. Pogarcic, Krnjak, and Ozanic (2012) write, "The calculation proved that the application of virtualization software can lead to significant positive economic effects. In the observed example, a saving of almost 57.63% has been achieved." (p. 6). In the end, the technologies that organizations implement have to align with the financial needs of the organization, which usually means saving money. Few organizations can evaluate new technologies and exclude the financial impact, whether it is positive or negative. Our goal in IT should be to align our technology goals with the business.

IV. DATA VIRTUALIZATION

Data virtualization is an emerging virtualization technology area that may be fruitful for new research, or for expanding existing research into. The research and discussion of virtualization technology is expanded into the overarching business intelligence models which includes software applications and analytical technologies that relate to the organizations data. Data virtualization, as a technology, abstracts data such that the source of individual aspects of the data whether databases, fields, etc. are presented on a common data access layer and the end client is blind to the source. This allows a single methodology for data access regardless of how or where the data is stored. (Ameen and Hamo, 2013)on the benefits of data virtualization technology, Bologa and Bologa (2011) write, "Providing a unified enterprise-wide data platform that feeds into consumer applications and meets the integration, analysis and reporting users' requirements is a wish that often involves significant time and resource consumption. As an alternative to developing a data warehouse for physical integration of enterprise data, the article presents data virtualization technology." (p. 110).

Another way to describe or think about data virtualization is that data virtualization is an approach to data management. As an approach to data management, data virtualization allows an application to retrieve and manipulate data without having any technical details about the data, including the format or physical location. This is very important for data integration or when data is presented from multiple sources. In stark contrast to the old methods of extracting, transferring, and importing data, data virtualization allows data access with no requirement for the data to move anywhere. In addition to saving costs, this reduces the risks associated with moving the data, like data corruption. Data virtualization does not impose any format on the data, so the reformatting is not needed, and can speed up implementations that access the data.

V. MEMORY VIRTUALIZATION

Memory virtualization is an important aspect of modern computing, whether applied to an individual computing device, or a clustered environment. Memory virtualization technologies include expanding usable memory by using disk space, sharing memory between clustered devices, or sharing physical memory in a hypervisor environment. As an example, a guest operating system in a hypervisor environment expects to get a zero based memory environment, because it expects real hardware. The hypervisor, for instance VMWare's ESX, provides the illusion of physical hardware by adding an additional layer of memory addressing. (Ameen and Hamo, 2013) Memory virtualization also allows for the decoupling of physical hardware so that is can be shared in clustered or pooled environments. In this scenario, RAM, or Random Access Memory, is allocated by the virtualization software and shared out to a pool. Once this is done, then the memory in the pool is available to any computer in the cluster.

The memory virtualization application that many administrators are most familiar with is Microsoft Windows' virtual memory feature. As with other operating systems, the virtual memory feature in Windows is facilitated by managing memory using both hardware and software. In the case of Windows, memory addresses are mapped to virtual address rather than physical addresses. Then the system can direct these virtual addresses to either physical memory or to disk storage. This allows for optimized operation when running multiple programs, as the data in memory can be moved to disk when programs are idle. Compatible CPU hardware is also capable of mapping virtual addresses directly through the use of an embedded MMU, or Memory Management Unit. There are several benefits of using virtual memory in this way including freeing application from the requirement to use a shared memory space, more security from memory isolation, and being able to use more memory than is physically present in the computer system, a technique called paging.

VI. Desktop/Application Virtualization

Desktop virtualization describes the ability to display a graphical desktop from one computer system on another computer system or smart display device. (Von Hagen, 2008) The simplest example of this is what people know as remote desktop. Desktop virtualization separates the desktop and application from the physical hardware. In this case the entire desktop can be virtualized or merely a single application, what is sometimes called application virtualization. Remote desktop in practice is a client/server configuration. Remote desktop is often used for remote support, high latency environments, or where secure or display only environments are desired. Remote desktop also allows the use of Microsoft Windows functionality on non-Windows devices like phones or tablets. Remote desktop can also be used as a cost saving measure by using inexpensive, low powered desktops that access virtual desktops on shared servers. This creates an environment that is centralized and easier to manage for administrators. The equivalent Linux application to Remote Desktop is X Windows. (Ameen and Hamo, 2013)

Desktop virtualization has many applications and benefits far beyond that of Remote Desktop alone. Gareiss(2008) writes, "An emerging technology destined to resolve many IT headaches without prescription medication is desktop virtualization. The technology helps IT staffs deliver functionality to remote workers faster and with more control than using traditional means. Desktop virtualization abstracts a desktop workload (operating system and applications) from desktop hardware." (p. 1). These features are facilitated by using a thin client on the client side. A thin client can be very simple in design, or offer all of the standard features of a desktop like sound and USB connection. While dedicated thin clients are available, some organizations use old desktops or inexpensive desktops in place of dedicated thin clients.

VII. Storage Virtualization

According to Ameen and Hamo(2013), Storage Virtualization is "the emerging technology that creates logical abstractions of physical storage systems. Storage Virtualization has tremendous potential for simplifying storage administration and reducing costs for managing diverse storage assets." (p. 65). A simple example of storage virtualization is a storage array, or disk array. A storage array uses virtualization, along with hardware and software to enable better functionality and provide additional features. This includes increased speed and reliability. Storage arrays, which are specially designed computers, implement virtualization in one of two ways, block virtualization or file virtualization. Block virtualization is the separation of logical storage from physical storage; this separation allows for greater flexibility in managing and allocation the storage. File virtualization eliminates the dependency the data access request and the physical location of the data.

Storage virtualization gives flexibility to administrators, reduces costs by sharing resources, and adds speed and security to data functions. Weil(2007) writes, "At its most basic, storage virtualization makes scores of separate hard drives look to be one big storage pool. IT staffers spend less time managing storage devices, since some chores can be centralized. Backup and mirroring are also much faster because only changed data needs to be copied; this eliminates the need for scheduled storage management downtime." (p. 20). In the recurring theme of the other virtualization technologies address, storage virtualization is primarily a cost saving measure, despite the other benefits. All of the benefits like reduced administration time and flexibility in the end result in lower cost for the organization, which helps to align IT with the financial goals of the organization. Storage virtualization requires complicated coordination of software and hardware configuration along with planning by implementers.

VIII. Network Virtualization

Network virtualization separates the network hardware from services that are delivered over the network. This is achieved by using both hardware and software together in a single administrative combination. This combination allows the separation of a network into virtual networks, called VLANs. This separation is very common in modern network environment and done for many reasons. On reason to use virtual networks is to separate users for security reasons. Another might be to

14

simplify administration by providing different services on different virtual networks. A real world example of this practice is using virtual networking to separate voice and data traffic on a local network. In this scenario, the windows server and IP phone server both have DHCP addressing enabled, such that any device plugged into the network can receive an IP address from either server. However, you only want the windows server to give addresses to windows machine, and you only want the phones to get IP addresses from the phone server. Virtual networking allows an administrator to separate one network into two, so that the windows data is on one virtual network and the phone traffic is on another virtual network.

Again, network virtualization comes down to cost savings and economics. Teeter (2011) writes, "Healthcare organizations must test their network infrastructures for disaster recovery and emergency mode operations, yet most can't afford to operate the complicated protocols needed for safe testing. The Rapid Adjustable Network architecture offers a solution." (p. 48). According to Teeter (2011), virtual networks also add high availability, security, and flexibility to networks. While flexibility is nice, availability and security are critical needs for any network. Even in environments that are not in the business of life or death data, like healthcare, availability and security are a must for the organization. Most modern organizations grind to a halt when the network goes down because most of the work is on the network. Organizational process, documents, and systems all need the network to function and transmit data.

IX. GRID COMPUTING

Grid computing is another way to abstract or separate multiple computers or servers from the application or services that they are providing. Unlike a cluster however, in grid computing, the server do not need to be identical or even located together. Computing grids provide more capability, but require more coordination. (Ameen and Hamo, 2013) Grid computing can be thought of as a collection of computer resources from multiple locations that are working together to create a common goal. These resources may not be permanent and computing devices might only be part of the grid for a short time. A good example of this idea is the SETI at home program produced and distributed by SETI, or the Search for Extra Terrestrial Intelligence program. SETI designed and distributed software that connected user's desktops to SETI servers. This software ran on the desktop as a screen saver and processed data for SETI remotely when the computer would have otherwise been idle. The desktop software was provided for free and the installation was voluntary. At the time, Reichhardt (1999) wrote, "Three months after it began, Seti@home, an

innovative scheme to enlist public help in the search for extraterrestrial intelligence (SETI), already has more than a million volunteers linking their PCs to the cause." (p.). Many other organizations have adopted this model, like the Human Genome Project. Grid computing clusters are sometime called super virtual computers.

The most important thing to understand about grid computing is that computers are brought together to achieve a common task, and which point the grid is dissolved. This grid typically using existing networks, much of which are public and often unsecured. Grid devices may enter or leave the grid suddenly, so contingencies must be programmed in to account for any unprocessed data. Computing grids are best suited for data that can be broken up and processed in different amounts, according to the ability of each device on the grid.

X. CLUSTERING

Clustering is "a form of virtualization that makes several locally-attached physical systems appear to the application and end users as a single processing resource. This differs significantly from other virtualization technologies, which normally do the opposite, i.e. making a single physical system appear as multiple independent operating environments." (Ameen and Hamo, 2013, p. 65) Unlike a computing grid, clusters are built to be permanent, at least for the life of the application, which may mean years or decades. The hardware in clustered environments must have physical interconnectivity and the server hardware must be nearly identical. In a clustered environment, one system does the processing or work and the other system or systems are idle, at least in terms of that function. Only when needed, like in a disaster, does another computer take over control of that process. In a cluster, the individual computers are called nodes. In the typical design, each node in the clusters will be the primary node for one function. Cluster nodes are also connected to the same storage device, usually a storage array.

A simple example of a cluster might be two servers running Microsoft Windows Cluster Services. In the scenario, there is a file share and several printers being shared. On each server, the file share and the printers would be configured identically. Each server would have access to the cluster configuration utility where the file share service and printer share service could be monitored and changed. In an active-active configuration, one server would handle the file share and have the service assigned to it by the cluster management tool. The other server would have the printer service assigned to it. This configuration makes use of the computing power of each server to do something rather than sit idle. If there is a failure, one service would fail over to the server that was still up and

functioning. In an active-passive configuration, one server would run both the file share and printer share services and the other server would stay idle until needed.

XI. SERVER VIRTUALIZATION

This paper has thus far included research and commentary on many forms of virtualization technology. However, server virtualization, in common parlance is the "big enchilada." Server virtualization technologies drive the industry and provide the computing backbones for organizations. Cloud computing, remote hosting, and virtual private servers all rely on server virtualization technology. HP (2009) defines server virtualization as referring to "abstracting, or masking, a physical server resource to make it appear different logically to what it is physically. In addition, server virtualization includes the ability for an administrator to relocate and adjust the machine workload." In other words server virtualization takes the resources of one computer or server and divides them up among guest operating systems that are unaware, for lack of a better term, of the host hardware or even that they themselves are virtual. This is facilitated by a type of software called a hypervisor. There are many hypervisors available, but one that has a very large footprint is VMWare's ESX platform. Hypervisors are able to facilitate not only the running of multiple virtualized systems, but also systems that vary in their operating system. Hypervisors are even able to host systems that would not be able to run on the host hardware through a process called emulation.

There are many advantages of server virtualization including cost savings, flexibility, performance advantages, and the optimization of resources. Server vitualization is a streamlining and optimizing technology that can have a significant impact on an organization. Bridges (2013) writes, "Visualization is an enabling technology that allows multiple operating system environments to be consolidated onto a single server, which reduces the amount of hardware that is required to run the entire bank's infrastructure. Adding virtualization technologies changes the shape of the existing IT infrastructure. A bank can also choose to outsource some IT workloads to cloud providers. In that case, it is the cloud service providers that use virtualization technologies to enhance their ability to manage their hosting infrastructures." (p. 14).

XII. SUMMARY

As shown, there are many different types of virtualization technology, each with unique benefits and risks. One thing that these virtualization categories have in common, however, is that they are changing as new virtualization technologies emerge, and the label of virtualization is applied to more areas of IT. Some of the common themes across all of these technologies are cost savings, flexibility, scalability, and simplified administration. Virtualization encompasses many technologies and types of technologies, but the family of virtualization technologies is growing as new things emerge, and as new uses are discovered for existing virtualization technologies.

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Inverse Linear Regression in Machine Learning

By Subhradeep Biswas & Sudipa Biswas

Abstract- A linear regression machine learning model derives the linear relationship between single or multiple features (put in the x-axis of a co-ordinate plane) and a single response (put in the y-axis of the co-ordinate plane) for a given set of observations. The model then learns to predict the response for a set of new feature values using the derived relationship. However, the linear regression model does not have the flexibility to predict the feature values for a target response. The solution proposed in this paper can leverage the relationship derived by the linear regression model between multiple features and single response. Using the relationship, it can predict the feature values for a target response value. In the proposed solution, the model accepts the training data in two separate input datasets – one contains the features in observations and the other contains the responses. After making the prediction on feature values for a queried response value, the model returns a two dimensional array of numbers.

Keywords: inverse linear regression, reversed regression, machine learning.

GJCST-H Classification: H.1.2, I.2.7

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Inverse Linear Regression in Machine Learning

Subhradeep Biswas [α] & Sudipa Biswas [σ]

Abstract- A linear regression machine learning model derives the linear relationship between single or multiple features (put in the x-axis of a co-ordinate plane) and a single response (put in the y-axis of the co-ordinate plane) for a given set of observations. The model then learns to predict the response for a set of new feature values using the derived relationship. However, the linear regression model does not have the flexibility to predict the feature values for a target response. The solution proposed in this paper can leverage the relationship derived by the linear regression model between multiple features and single response. Using the relationship, it can predict the feature values for a target response value. In the proposed solution, the model accepts the training data in two separate input datasets – one contains the features in observations and the other contains the responses. After making the prediction on feature values for a queried response value, the model returns a two dimensional array of numbers. Each column of the output array contains the predicted values for a specific feature. Each row of the array contains different valid sets of feature values. Each set of feature values results the queried response value according to their linear relationship.

Keywords: inverse linear regression, reversed regression, machine learning.

I. Introduction

To explain the problem and the proposed solution in detail, a scenario from the book named "Introduction to Statistical Learning" is given below.

Advertisement expense – Sales dataset:

Row#	TV	Radio	Newspaper	Sales
1	230.1	37.8	69.2	22.1
2	44.5	39.3	45.1	10.4
3	17.2	45.9	69.3	9.3
4	151.5	41.3	58.5	18.5
5	180.8	10.8	58.4	12.9

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.199	283.6	42	66.2	25.5
200	232.1	8.6	8.7	13.4

The first column "TV" shows the amount of money in thousands of dollars spent on TV ads to advertise a single product. For example, in observation 200 (row number), $232,100 was spent on TV ads. Similarly, $8600 was spent on radio ads in the same observation. The "Sales" column represent the sales of the product being advertised in that observation in thousands of items. So, in observation 200, a quantity of 13,400 was sold. In this case, linear regression model can be useful to predict the sales based on amount of dollars spent on advertisement on different channel. The model uses "TV", "Radio" and "Newspaper" as the features and it predicts the sales as response. The model learns the linear relationship between the features and response in order to make the predictions. However, this model does not predict the advertisement expenses required to be put in different channels in order to reach a specific sales target.

The Inverse Linear Regression algorithm can fulfil such requirements by leveraging the relationship learnt by the linear regression model. The outcome of the model also suggests the relative weight of each feature and how well each feature contributes in order to reach the target response.

II. Proposed Algorithm

a) Deriving Relationship

The relationship between features and response is learnt with the help of linear regression model. The linear regression model derives the weights of each feature (I.e. "TV", "Radio" and "newspaper") to calculate the response (I.e. "sales"). The formula representation of the relationship is given below:

$$y \text{ (sales)} = w_0 + w_1.x_1 \text{ (TV ads)} + w_2.x_2 \text{ (Radio ads)} + w_3.x_3 \text{ (Newspaper ads)}$$

Once the linear regression model is trained with the features and response data, the model returns the intercept (w_0) and the coefficients (w_1, w_2 and w_3).

b) Locating Nearest Features

The proposed solution locates the nearest observation that has the response value less than the queried response for which the feature values are to be predicted. For each queried response, the immediate lower 'value in response' (r) that was used while training the linear regression model is located. Using the index of the located training response(r), the corresponding feature values are obtained from the observations.

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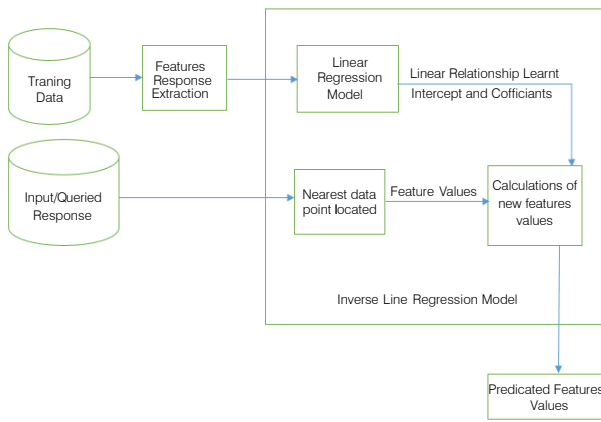
Fig. 1: Reverse Linear Regression Block Diagram

c) *Calculating New Feature Values*
　　The new sets of feature values are calculated as below:

Calculating 1st set of features: The proposed solution calculates x_1 (TV ads) for y(sales) = queried response value, x_2(radio ads) = radio ads expense from nearest observation obtained above and
X_3 = Newspaper ads expense from nearest observation obtained above.
Thus, Predicted_x_1 = [y − {w_0 + w_2.x_2 (Radio ads) + w_3.x_3 (Newspaper ads)}]/w_1
The 1st set of predicted feature values [Predicted_x_1, x_2, x_3]

Calculating 2nd set of features: The algorithm repeats the steps described above to calculates x_2 (radio ads) for x_1 and x_2 from nearest observation and y = queried sales value.
The 2nd set of predicted feature values [x_1, Predicted_x_2, x_3].

Calculating 3rd set of features: The same steps are repeated to predict x_3.
The 3rd set of predicted feature values [x_1, x_2, Predicted_x_3].

d) *Output*
　　The solution returns a two dimensional array. Columns of the array represent features. Each row of the array is a set of predicted feature values.
The no. of columns in array= the no. of rows in array= the no. of features in the observation.

III. Conclusion

　　The prediction accuracy by the proposed algorithm is as good as the accuracy of the linear regression model as the relationship determined by the linear regression model is leveraged by the new solution. Different sets of feature values provide the information about the effectiveness of each feature i.e. if the coefficient of a feature is relatively small, a larger amount is to be spent on that channel in order to get the target response. Thus, it provides the flexibility to the stakeholders to choose the appropriate mechanism to achieve the target.

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Ambient Intelligence in Healthcare: A State-of-the-Art

By Nilanjan Dey & Amira S. Ashour

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Abstract- Information technology advancement leads to an innovative paradigm called Ambient Intelligence (AmI). A digital environment is employed along with AmI to enable individuals to be aware to their behaviors, needs, emotions and gestures. Several applications of the AmI systems in healthcare environment attract several researchers. AmI is considered one of the recent technologies that support hospitals, patients, and specialists for personal healthcare with the aid of artificial intelligence techniques and wireless sensor networks. The improvement in the wearable devices, mobile devices, embedded software and wireless technologies open the doors to advanced applications in the AmI paradigm. The WSN and the BAN collect medical data to be used for the progress of the intelligent systems adapted inevitably. The current study outlines the AmI role in healthcare concerning with its relational and technological nature.

Keywords: ambient intelligence, wearable devices, wireless sensor networks, wireless body area networks, wearable sensors, monitoring systems, computational intelligence.

GJCST-H Classification: J.3, K.4.1

Ambient Intelligence in Healthcare: A State-of-the-Art

Nilanjan Dey [α] & Amira S. Ashour [σ]

Abstract- Information technology advancement leads to an innovative paradigm called Ambient Intelligence (AmI). A digital environment is employed along with AmI to enable individuals to be aware to their behaviors, needs, emotions and gestures. Several applications of the AmI systems in healthcare environment attract several researchers. AmI is considered one of the recent technologies that support hospitals, patients, and specialists for personal healthcare with the aid of artificial intelligence techniques and wireless sensor networks. The improvement in the wearable devices, mobile devices, embedded software and wireless technologies open the doors to advanced applications in the AmI paradigm. The WSN and the BAN collect medical data to be used for the progress of the intelligent systems adapted inevitably. The current study outlines the AmI role in healthcare concerning with its relational and technological nature. Health monitoring and electronic patients' planning assistance applications are reported in the present work. Lastly, the challenges tackled in the AmI technology adaptation in the real world healthcare applications are highlighted.

Keywords: ambient intelligence, wearable devices, wireless sensor networks, wireless body area networks, wearable sensors, monitoring systems, computational intelligence.

I. Introduction

Ambient intelligence is associated with the atmosphere at which emotional and rational intelligence is ubiquitous. In the AmI environment, individuals are bounded by embedded intelligent devices' networks to collect information nearby their physical places in order to provide services, and ubiquitous information. Intelligent devices are accessible whenever required through interactions and acting independently to allow high quality information to any user, at any time, on any device, and anywhere.

In healthcare environments, these devices are related to medical informatics, decision support, gathered electronic health records, knowledge reasoning and representation, and telemedicine. Patients' medical reports, radiological films, personal and medical information can be observed in remote places. Furthermore, remote robotics can be used in telemedicine and surgery. Nevertheless, these healthcare applications are used for specific clinical situations in certain services with explicit patient.

Distributed environment are used mainly with applications that are undeveloped to share actions and knowledge. Recently, AmI is related to the exponential evolution of Internet. For user-friendly applications, web browsers can support several features to allow users to use remote applications.

Recently, technology is moving towards Ambient Intelligence (AmI) environments to support inhabitants the daily life [1- 21]. In physical world environments, AmI allows the human to interact in an inconspicuous and intelligent way using computing devices with complete awareness of the people requirements and forecasting behaviors. AmI environments are essentially local including hospitals, offices, homes, transports, and control centers. Recently researchers are interested to comprise extra intelligence in the AmI environments for superior access to the indispensable knowledge and decision making that support individuals. Typically, AmI is related to several concepts, such as context awareness, embedded systems, and artificial intelligence to incorporate with other techniques including computer graphics, automation and communications. Several challenges faces the AmI requiring advanced techniques such as the artificial intelligence (AI), machine learning, computational intelligence, computer vision, and intelligent robotics that have been used in several applications [22- 31].

AmI technologies have several features including transparent, adaptive, sensitive, intelligent and ubiquitous. Researchers reported different AmI definitions, namely i) AmI is an emergent multi-disciplinary domain founded on ubiquitous computing that influences the protocols design, devices, systems, and communications [32], ii) AmI offers new interaction ways between people and technology to serve the environment and individuals' needs [33], and iii) AmI is a new research domain for non-intrusive, distributed, and intelligent software systems [34]. AmI is involved in several applications especially in the medical sector to improve the healthcare by developing for example an inclusive structured approach to electronic medical record (EMR) toward intelligent healthcare units [35]. Furthermore, it can be employed to augment smart hospital rooms that support both the medical staff and patients [36]. In order to achieve these features, wired/wireless sensor technologies are assimilated, tolerating the patient to interact and to control the

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hospital services. In addition, the clinical oriented interface can allow vital sign monitoring. Such wireless technologies include the use of Bluetooth, Zigbee, WiFi, and RF (radio frequency along with intelligent sensors. This AmI environment integrates several software and hardware technologies for manually or automatically controls electronic and electrical devices.

Smart environments and wireless technologies have an ultimate role to provide user-friendly tools to cope with the surrounding environment. Mahoney [37] established that smart environment can be considered ease the hospitals staff workload when supporting the AmI. These technologies endorse the clinical care quality with patient's independency, superior life quality and improving the health care quality. Several applications that support miscellaneous clinical requirements include condition unambiguous treatment and diagnosis, patient's remote monitoring and softcopy radiological film review. Moreover, assistive environments, such as RFID based smart hospitals, environmental sensors and monitoring cameras can be included to support healthcare. Such environments require integrated interconnect services in the automation systems, e-health systems and sensors through binding architecture [38].

The structure of the remaining sections is as follows. Section 2 introduces the wireless sensor networks role in the AmI systems. Section 3 reports several studies that have employed the artificial intelligence to develop advanced AmI systems. Conducting decision making, healthcare interactions and monitoring in AmI environments are addressed in section 4. The challenges face the AmI technology in healthcare are highlighted in section 5. Finally, the conclusion is considered in section 6.

II. WIRELESS SENSOR NETWORKS IN AMI SYSTEMS

The Wireless Sensor Networks (WSN) is a compulsory technology for developing the AmI environment via providing the users by services based on their context. These networks offer flexible and dynamic structure for the acquired data transmission from the environment through sensors. The transmitted data is considered the base for developing the AmI services adjusted with the acquired information from the sensors system in charge of handling this information. The WSN allow information gathering about the environment and the user.

The foremost characteristic of the WSN is to transmit wirelessly the acquired data by sensors in diverse environments to other nodes for processing this data. Since the WSN consists of massive number of nodes, these nodes require special design characteristics, namely low power consumption, small size, low cost, and low complexity. Furthermore, network

topology and protocol are considered during the WSN design to simplify the nodes functionality with less time consuming to reduce the power consumption. In the Wireless Body Area Networks (WBAN) for healthcare applications, the star topology is used mainly, where a central node coordinates the communication with outside the Body Area Networks (BAN) and the medical sensors [39]. Generally, the BAN has compact units responsible about transferring the vital signs from the patient's body and the physician or hospital. Several applications employed the BAN to monitor the patient's state, such as i) MobiHealth monitoring system for vital signs based on a BAN [40] and an m-health service stage using communication via Bluetooth between the central device and the intra-BAN, ii) WBAN VitaSens system including ECG, blood pressure, respiratory, and temperature sensors [41], and iii) Ubimon ubiquitous monitoring system for implantable and wearable sensors including accelerometer, ECG, humidity and temperature sensors [42].

Through the AmI paradigm, the way to offer the information to the society services and users is developed by including the Internet services. Services can be accessible by the user as well as by the system intelligence tolerate automatic delivery of the services. The user interaction with the services will be over interfaces. Consequently, in order to realize services based on this paradigm, the user context should be known requiring sensors in the patient's body and in the environment. Such facility can be acquired using AmI services to compromise the adopted service via the natural interfaces. Likewise, the interoperability and integration of these networks with Local, Personal, and other networks configurations become essential.

Hospitals and medical centers offer traditional healthcare services. For the scientific community, finding active methods to improve healthcare become challenging issue. Post-surgery monitoring is considered one of the vital needs. Furthermore, patients need to contact their doctors easily. Nevertheless, traditional solutions for these aspects are inconvenient, costly, and inefficient for the patients for routine checks. Thus, E-health aims mainly to improve the health care quality, and to enhance the health care effectiveness. In order to direct the healthcare services from the hospital environment to the home, AmI environment become essential for personalized healthcare and for healthcare monitoring. AmI has been involved in several healthcare applications, such as computer-assisted surgery systems to remote surgical conduction with reduced risk [43], virtual reality systems to treat the anxiety disorders [44].

AmI allows a physical connection between the patient's daily practices and the e-health systems using wearable medical devices, smart environments software techniques. The context embraces the environment and the users' information, which contain different

parameters, such as temperature, light, blood pressure, and heart rhythm. Different WSNs technologies, such as ZigBee; Bluetooth or Radio Frequency Identification (RFID), are employed to gather the AmI required information. Development of AmI systems requires also dynamic methods and mechanisms based on artificial intelligence (AI).

III. Artificial Intelligence in AMI Systems

Typically, AmI environment is profound to the living creatures' existence in it, ropes their activities and anticipates/remembers their actions [45]. Consequently, for health claims in AmI, data collected from vital-sign sensors plays a significant role. Several computational methods based AmI in vital sign sensors are developed. Sensor data analysis requires distributed/centralized models with the AmI systems [46]. Each sensor has committed processing abilities to perform local computation before transferring the data to other nodes in the WSN.

Numerous data mining and artificial intelligence (AI) techniques are used to analyze the sensors data in the AmI systems, including fuzzy logic rules, neural networks, machine learning and decision making. Such techniques assist AmI in healthcare monitoring. Several studies for developing AmI systems in healthcare have been carried out. Activity recognition system based on artificial neural network (ANN) has been conducted to regulate the falls occurrence using single sensor positioned on the individual's chest [47]. The results established that the ANN entails more tuning factors compare to the support vector machines (SVM).

A GerAmI system has been settled with the Alzheimer Santísima Trinidad Residence of Salamanca that used sensors to record the patients'/users' data, where the user wore an armlet holding a RFID chip for tracking individuals [48]. In the case of required assistance, a message containing the patient's name, the occurred problem and information about the paramount way to handle this situation is directed to the staff members PDA. In patients with Parkinson's disease, in order to predict clinical scores of data severity obtained from wearable sensors, a SVM has been implemented [49]. On a single environment, an AmI application has been outfitted with sensors and deliberated to improve the resident experience in the environment [50]. A Hierarchical Task Network (HTN) planner has been employed to produce actions sequences and eventuality plans to realize the aim goal of the AmI system [51]. The AmI system may react to a sensed health necessity by calling the medical professional and transferring health vitals through any communication device/tool such as email, or cell phone.

In smart health environments, a study has been carried out to proof the architecture concept for emotion regulation and detection of the patients through the analysis of their facial expressions, behavior and vital signals [52]. Another study has been applied using the insulin dosing, glucose levels, sleep state, and physical activity data gathered from body-wearable sensors to detect type 1 diabetes [53]. An open research domain is directed toward the techniques used in order to acquire self-reported data and to integrate sensor-provided information from the sensor networks in the AmI system. Subsequently, a platform for collecting and integrating data from service providers and sensors into one cohesive format for further use in the experience sampling methods (ESM) has been implemented [54].

For cognitive-related pathologies, a game has been designed for the analysis and evaluation of the frontal brain activity via the videogame mechanics identification that include EEG brain activities associated to some cognitive skills [55]. Furthermore, another study, on the brain signals to recognize emotions, has been proposed using the neural network [47]. Several machine learning methods have been used to evaluate a predictive system performance that deals with the in-hospital patients' mortality. These patients undergo overhaul of an abdominal aortic aneurysm.

IV. Decision Making, Healthcare Interactions and Monitoring in AMI

In order to conduct fully automated AmI applications, decision-making techniques are employed. Several studies have been carried out to implement decision making based AmI systems. Temporal reasoning has been used with a rule-based system in order to recognize hazardous states with decision making that resolve this situation and return the environment to a nonviolent status while communicating the place's residents [56]. Added, deleted, and modified fuzzy rules have been learned via observing the resident behavior in the iDorm application to adapt the environment according to the changing behavior.

Another AmI system based on decision making has been conducted to design a planning system supported by artificial intelligence to remind entities by their next daily activities as well as the incomplete tasks [57]. A hierarchical task network planner based AmI system has been proposed to produce plans of actions' sequences for responding to sensed health requirements by contacting medical professional and sending health vitals through email, cell phone, or fax [51]. Patients suffer from Alzheimer's disease and other disorders are also supported by developing an AmI system that help individuals to perform their regular errands through sensing their location/environment and offer decision making to forewarning caregivers in the critical situations [58]. In medicine, to in order to regulate optimal decisions sequences, Markov-based

method has been used to describe the dynamic sequential decision making process [59].

Based on communication technologies and information, ambient systems can assist and enhance the life quality of individuals at home and anywhere. This promotes the services/infrastructures development toward autonomous life through the incorporation of the communication technologies and information through ambient intelligence in healthcare applications. In such domain, ubiquitous systems, wearable sensors and secure mobile can be engaged to improve the life health quality. Automated AmI systems require universe technologies to achieve the interaction between the patients and the physicians.

A theoretical framework has been proposed to support this interaction process [60]. In the AmI design, different measuring tools for the patient's rendezvous in technology progress and for testing the effectiveness of AmI prototypes have been used. Other interactive environment has been proposed for people rehabilitation with physical disabilities [61]. Due to the intuitive interaction of users, direct, and natural features of the AmI systems, it can be employed to recognize and predict the individuals' activities and can be involved with services and applications embedded in the surrounding environment. Based on inertial wearable sensors, a collective dataset for human gait has been gathered of further analysis [62]. A passive vision-based system to estimate the measurements of gait using light sensor along with 3D point-cloud has been proposed in order to explore the gait analysis of the wearable system that has 2 wireless sensors for acceleration fixed on the ankles [63].

AmI systems have been also supported the daily life healthcare through homecare assistance. A computational detection technique to quantify the changes in physical activity patterns using wearable sensor data has been proposed [64]. This technique can be applied to detect inadvertent changes in the individuals' patterns performance to validate the effect of any new healthy behavior on the individual's lifestyle. Another ambient system has been framed to promote social commitments and activities of the elderly individuals using in-home sensors by linking the information inferred with the social network [65]. This provides the old individuals with the chances to make new social networks. In the daily life environment, another AmI system application to support old people has been proposed to assess the fall risk assessment with preventing its occurrence using wearable sensors [66].

V. Wearable Sensors Devices in AMI Systems

AmI is an evolving restraint that passes intelligence to the individuals' daily life environments and creates sensitive environments to the human needs. Its main idea depends on enriching the surroundings with technology, namely interconnected devices to a network and sensors leading to a system that can take useful decisions to the users. Such decisions depend on the gathered real-time historical information and accumulated data. Based on the development in several technologies and areas, including networks, sensors, artificial intelligence, human computer interfaces and ubiquitous computing, AmI environment grows quickly.

AmI has several applications in the healthcare domain, including: I) Human fall detection by evaluating the wearable sensors data such as that obtained from the accelerometers. In this application, numerous algorithms and sensor's data transmission and localization are developed. In addition, an automated call to the person's relatives can be started with the fall situation detection. II) Human activity recognition that identifies the user's activities if he/she wears accelerometer(s). Such system requires machine learning procedures for analyzing the data received from the sensors. Numerous procedures for studying the sensor body locations in different positions, such as the ankles, chest, wrists, and thighs can be involved. III) Human stress detection, which detects the users' stress level using also machine learning procedures for data analysis data is considered one of the important AmI applications. IV) Automated human energy expenditure estimation can be carried out by analyzing the data from different wearable sensors, including the galvanic skin response, heart rate, and accelerometer. This system is also requires machine learning methods to estimate the energy expenditure.

From the preceding addressed applications of the AmI systems in the healthcare domain, it is obvious that the wearable sensors have the main impact in all systems. Wearable sensors have monitoring as well as diagnostic applications using their biochemical/physiological capabilities. Physiological monitoring can be involved in diagnosis and enduring treatment of a massive number of patients, who suffer from cardiovascular, neurological, and pulmonary diseases including hypertension, seizures, asthma, and dysrthymias. Sensors are positioned and arranged in consistent with the clinical application under concern. For example, sensors for monitoring vital signs, such as the respiratory rate and the heart rate, can be arrayed when the monitored patients with chronic disease or congestive heart failure suffering clinical intrusion [67]. Sensors for capturing movement data can be used in monitoring applications effectively, such as in the home-based therapy interventions in stroked patients or to detect the elderly people mobility. Figure 1 demonstrated the monitoring system structure based on wearable sensors that attached to the users' body.
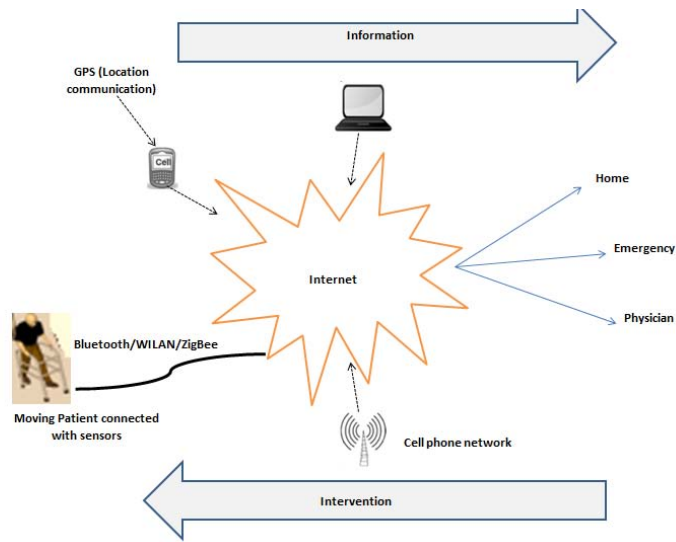
Figure1: Wearable sensors based remote health monitoring structure

In order to transmit the collected sensors data, wireless communication is trusted to convey the patient's data to any access point or mobile phone and communicate the information to an inaccessible center through the Internet. Detecting emergency situations using data processing systems are implemented to send an alarm message to the emergency service center for instantaneous assistance to the patients. Consequently, the wearable system consists of main parts, namely i) data sensing and collecting hardware sensor device, communication system of software/hardware to transmit the sensed data to a remote center, and finally the data analysis and processing technique based on machine learning in order to extract the significant and clinical information. Subsequently, development in the telecommunication, electronic circuits, sensors technology, microelectronics, and data processing and analysis methods is directly reflected to an improvement in the wearable systems for several healthcare applications.

The prominence of incorporating large scale wireless tele-communication tools, including the WiMAX, Wi-Fi Mesh, and 3G with tele-medicine attracts several researchers. Such technologies integration can be employed for endless people's monitoring who suffer from cognitive disorders, such as Parkinson's, and Alzheimer's. Furthermore, there is an important research studies that focused on the tiny wireless sensor devices development that integrated into wearable materials, fabrics or can be entrenched in the human body. Currently, the range of implantable and wearable biomedical devices increases due to the developments in the digital electronics, wireless communications, and micro-electro-mechanical systems (MEMS) technology. This provided multi-functional, low power and low-cost sensor nodes having small size and can interconnect through short distances. In addition, tiny sensor nodes will be applicable that have the advantage of the sensor networks depending on cooperative strength of a large nodes' number.

VI. AMBIENT INTELLIGENCE CHALLENGES IN HEALTH CARE

Ambient intelligence based on wireless communication and wearable devices has a significant role in several applications [68-71]. The ability to resolve to individuals requirements along with bridging the gap between devices, environment and individuals with widespread practice in changes management, innovation and knowledge sharing, lead to the presence of several challenges in the AmI environment. More challenges and limitations are raised in the healthcare area. Since AmI is considered a conception at which the environment ropes the individuals using embedded sensors and processors.

Wearable devices and handheld devices considered as interface between the system and user that allow the system to adapt based on the user's behavior. In order to realize higher quality health care environment including hospitals, homes, and medical centers, more effective healthcare systems based on the AmI technology become compulsory to handle in-bed/wheel chair patients and many other critical cases. Massive progress in medicine and living circumstances increased the life expectations.

Intensifying healthcare cost and lack of healthcare experts poses a difficulty in today's society. Sensor equipment and communication equipment are engaged mainly to handle the challenges in the healthcare environment. In addition, artificial intelligent can produce a self-satisfying life style. In AmI systems,

communication/embedded sensors technologies allow the detection the life threatening situations and rapid the time response in emergency cases. The information technology progress supports healthcare institutions including healthcare centers and hospitals to operate competently with saving cost.

Identifying the shortage in healthcare information management is considered one of the critical issues to develop AmI systems for based on advanced AI techniques. Furthermore, proposing active communication system to handle time-critical situations is considered one of the challenging problems in the Ami environment to improve healthcare delivery using distributed intelligence systems. Designing wearable electronic devices to assist chronic disease patients to know the correct medication, to give reminder, and to contact relatives in the critical situations as well as to suggest the appropriate diet in order to manage their heath conditions become one of the new research challenges.

Transcription problem of can be considered as a problematic of transforming one information form to an alternative or from one storing system to another. Thus, human resources must be allotted to copy the record from one format to an alternative, which is time consuming, error prone, costly and challenging for the real world AmI in healthcare. Another challenging aspect is the end user acceptance and usability of the complicated designed user interface. For potential assistance for the healthcare provision, AmI systems have been identified for all individuals' categories, however old peoples have limited experience to adopting technologies. Thus, in advance of organizing developed technologies, it is important to assess their acceptance. Moreover, the intensive care unit can be considered a complex system that includes massive health information and severe healthcare system components, including environments, patients, and tasks. Thus, in order to improve the patient outcomes and to enhance the health information technology, critical care delivery competence and the patients' safety, superior interaction in the intensive care units systems with the different healthcare information technology components become significant.

The AmI healthcare applications can be categorized into personal healthcare/wrist-worn monitoring devices, and institutional healthcare providers' aspects, including hospital environment sensor localization. In environmental intelligence, although in healthcare applications, research is going ahead, it does not grasped yet the maturity level due to the challenges in healthcare domain raised by the computer scientists as well as the difficulty to handle the critical situations at which errors are intolerable. Several research openings can be directed to explore the role of the AmI systems in several applications to support healthcare, including:

- Data analysis for health AmI environments
- Behavior analysis in AmI to assist living environments
- Mobile devices and wearable systems developments in activity recognition systems
- Ubiquitous healthcare applications
- Machine learning techniques supporting handicapped people in AmI systems
- Monitoring of chronic diseases in AmI environments
- Physiological data acquisition system in AmI environments
- Privacy and security in AmI systems
- Big data, data management and sensing in AmI environment
- Smart homes based on AmI systems
- AmI in intensive care units

Furthermore, one of the main hurdles to the sensing technology implementation, expressly for the wearable applications, is the sensors' size and the front-end electronics, which used to collect the movement and physiological data in the applications of long-term monitoring. Modern progresses in the microelectronics domain, allowed the engineering and researchers to improve minute circuits with front-end amplification, sensing ability, radio transmission, and microcontroller purposes. Improvements in the manufacture technology of the micro-electromechanical systems (MEMS), enables the miniaturized inertial sensors progress, which can be involved in the detection of the motor activities as well as other health cases monitoring systems. In addition, batch fabrication methods are challenging and have substantial reduction in the sensors' cost and size and cost. Moreover, microelectronics is recently depending on the integration of several components, including the radio communication circuits and the microprocessors, into a single unified circuit leading to the implementations of System-on-Chip [72].

VII. CONCLUSIONS

The AmI technology is considered a new paradigm for upcoming applications in the information society proposing intelligent services based on the user context through interactive interfaces. Ambient intelligence has an emerging role in healthcare. The paper presented a snapshot of the AmI system related technologies as well as some empirical studies in healthcare. Robust foundation for the integrated AmI systems implementation is clearly reported based on the wearable sensors, information and communication technologies advancement to support healthcare. Several challenges are highlighted to inspire the researchers toward the AmI technology as a starting point for progress to provide effective AmI systems in healthcare. Such challenges include elder users' acceptance to this new technology, intelligence

wearable sensors design, and developing advanced machine learning techniques to support the AmI technology. An important attention to technology, organizational structure, and human factors in the relevant healthcare services should be considered by the healthcare providers to exploit the AmI potential.

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27

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Thai to Khmer Rule-Based Machine Translation using Reordering Word to Phrase

By Sukchatri Prasomsuk & Puthy Mol

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Abstract- In this paper, an effective machine translation system from Thai to Khmer language on a website is proposed. To create a web application for a high performance Thai-Khmer machine translation (ThKh-MT), the principles and methods of translation involve with lexical base. Word reordering is applied by considering the previous word, the next word and subject-verb agreement. The word adjustment is also required to attain acceptable outputs. Additional steps related to structure patterns are added in a combination with the classical methods to deal with translation issues. PHP is implemented to build the application with MySQL as a tool to create lexical databases. For testing, 5,100 phrases and sentences are selected to evaluate the system. The result shows 89.25 percent of accuracy and 0.84 for F-Measure which infers to a higher efficiency than that of Google and other systems.

Keywords: thai khmer translation, machine translation (MT), rule based, pattern-based.

GJCST-H Classification: H.1.2, I.2.7

THAITOKHMERRULEBASED MACHINETRANSLATIONUSINGREORDERING WORDTOPHRASE

Strictly as per the compliance and regulations of:

Thai to Khmer Rule-Based Machine Translation using Reordering Word to Phrase

Sukchatri Prasomsuk [α] & Puthy Mol [σ]

Abstract- In this paper, an effective machine translation system from Thai to Khmer language on a website is proposed. To create a web application for a high performance Thai-Khmer machine translation (ThKh-MT), the principles and methods of translation involve with lexical base. Word reordering is applied by considering the previous word, the next word and subject-verb agreement. The word adjustment is also required to attain acceptable outputs. Additional steps related to structure patterns are added in a combination with the classical methods to deal with translation issues. PHP is implemented to build the application with MySQL as a tool to create lexical databases. For testing, 5,100 phrases and sentences are selected to evaluate the system. The result shows 89.25 percent of accuracy and 0.84 for F-Measure which infers to a higher efficiency than that of Google and other systems.

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I. Introduction

Association of Southeast Asian Nations (ASEAN) consists of ten countries with various cultures and languages. Thailand and Cambodia are included in ASEAN, and the eastern border of Thailand is adjacent to Cambodia. Therefore, efficient communication is significant for international relations between these two countries. Cambodian natives have Khmer as a national language while formal language in Thailand is Thai. The linguistic differences of Thai and Khmer in both writing and speaking contribute to a translation barrier. For instance, since Thai language has been adapted partly from Pali, Sanskrit and Old Khmer, Thai vocabulary is relatively diverse. Thai language also contains complex orthography and relational markers. Furthermore, standard written Thai is complicated due to various combinations of syllabic alphabets, which consists of 44 basic consonants, 21 vowel symbols and 4 tone diacritics, applied under the rule that all diacritics appear in front of, above or below the consonants. Furthermore, Thai syntax has a noun classifier system as well as conforms to a basic sentence structure called subject–verb–object (SVO) with a horizontal and vertical writing direction from left to right and from top to bottom, respectively. Similarly, Khmer contains 33 consonants, 23 dependent vowels and 15 independent vowels; however, no tone is presented. Due to the linguistic differences, current Thai-Khmer translation systems have scarcely achieved complete and accurate outputs. Moreover, the existent systems have rarely been created and developed. There is also a shortage of intellectuals who are competent in both languages and able to convey knowledge for creating a system of translation. As a result, the improvement of the Thai-Khmer translation system has been disrupted. Document translation between Thai and Khmer which requires high accuracy has consequently encountered difficulties. To solve the issues, machine translation (MT) from Thai to Khmer language requires development.

The proposed system in this paper implements translation techniques including rule-based algorithm with verification of sentence patterns to improve translation quality. The overview operation of the translation system is to input a Thai language text in a web application and then convert it into a desired output in Khmer. A lexical analyzer is first applied in the process to divide Thai sentences or phrases into individual syllabic words so that the separated words are analyzed and processed in the following steps resulting in Khmer sentences.

II. Related and Previous Works

There have been many attempts to research on machine translation between Thai and other languages. English-Thai machine translation was developed in 1998 with regard to the sentence-based technique which combines the rule-based and the example-based method to establish a system for English to Thai sentence translation [1]. However, the research result of performance evaluation and comparison was not indicated. In 2012, a technique called generalized patterns is presented to improve machine translation from Japanese to Thai language [2]. The method was compared to the others implemented in Google and Bing translators by executing 3,107 Japanese sentences in testing. F-Measure score was applied to assess performance of the translator.

Machine translation between Khmer and other language has also been researched. One of the studies selected Moses DoMY CE, which is statistical machine translation (SMT), as a tool to create an online system for English - Khmer translation based on Python, XML

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and HTML language in 2013 [3]. There is also research in 2014 on developing a French-Khmer dictionary called 'MotàMot' [4]. In 2015, an automatic machine translation was created to provide translation between Khmer and other 20 languages by using three statistical methods: the phrase-based approach, the hierarchical phrase-based approach and the operation sequence model (OSM) as well as selecting BLEU and RIBES to evaluate translation quality [5].

There is, furthermore, research specifically on Thai-Khmer machine translation. For example, Thai - Khmer machine translation on a website has been developed based on Java (JSP) and SQL (Appserv) with 4,000 words from a Thai - Khmer dictionary as a database [6]. In testing, 212 sample sentences have been processed, and the result has shown 72.16% of accuracy which is higher than that of Google translator. In 2014, the rule-based machine translation (RBMT) combined with statistical methods was recognized to be widely applied in automated translation [7]. The technique has shown the potential to improve translation between Thai and Khmer. Even though such classical technique is applied, the research has rarely a result with high performance.

III. Background of thai to Khmer Translation

Sentences in Thai and Khmer language are similarly formed; on the other hand, ordering and semantic structure are different. With regard to the existent methods, the newly presented one for the proposed system is expected to balance between advantages and disadvantages of the classical techniques and be straightforward for implementation. In

this paper, a process to translate Thai to Khmer language is composed of six main steps including

1) Input process: reading Thai text into the system from a website screen,
2) Word segmentation: applying Lex To and the longest matching approach to divide Thai sentences into words,
3) Word search: retrieving data from the database of Thai-Khmer dictionary to find a matched-meaning word in Khmer for each Thai word,
4) Boundary check: considering a boundary of each Thai word such as conjunction, verb, adjective and surrounding nouns to inspect parts of speech,
5) Pattern verification: examining Thai sentence patterns by using the rule-based algorithm, and
6) Khmer word rearrangement: reordering Khmer words in phrases or sentences.

To build a Thai-Khmer dictionary for testing in this paper, approximately 37,052 Thai words from the Royal Institute Dictionary (RID, 1999) are translated according to the existent Thai-Khmer dictionary [8]. In the process of examining word boundaries, patterns and various conditions of grammar rules are taken into account to solve translation mistakes.

The classification of machine translation architecture which is regularly implemented on client-web server for online translation is the direct model shown in Figure 1. The direct machine translation architecture transforms a source language sentence (Thai) into a target language sentence (Khmer). Besides, the proposed system applies the indirect architecture which is demonstrated as a diagram in Figure 2. A sample screen of the program is also provided Figures 3.
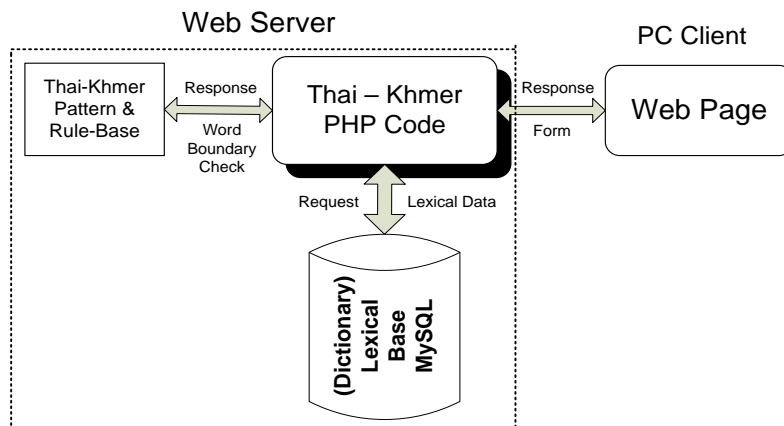

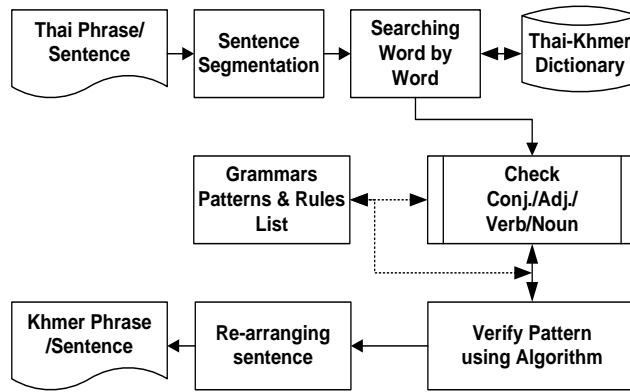*Fig. 1:* Architecture of Thai-Khmer Translation on Web

Fig. 2: Proposed System

Fig. 3: Screen of Application

(Available on http://www.ict.up.ac.th/skchatri/translate.thai khmer/)

IV. Methodology and Proposed Algorithm of Reordering

In general, Thai and Khmer sentences are sorted verbatim. Regarding to the verbatim characteristics of these two languages, the classical algorithm of word reordering could appear to be a proper tool to cope with phrase and sentence arrangement. On the other hand, the reordering method is unable to suit all cases of input phrases and sentences since the reordering could cause translation mistakes. The analysis to deal with the issue has consequently become essential. The verification process is included in the proposed system to investigate errors; in addition, simple approaches to examine the previous word, the next word, and noun and verb positions are used to attain accurate outputs. Implementing pattern-based machine translation also alleviates the translation issue although the method is not novel. The technique based on patterns is also applied to assist translation due to its reputation of promoting translation performance. In this paper, patterns for the method are designed according to Thai and Khmer grammatical structures. The process to deal with the translation issue is arranged into four steps as follows.

1. Morphological analysis
2. Concept of pattern matching
3. Search for proposed patterns
4. Word rearrangement and translation

In the first step, LexTo software is applied to separate each word in a sentence from the others so that the morphology of an input sentence is analyzed. Next, positions of noun (n.), verb (v.), adverb (adv.), adjective (adj.), conjunction (con.) and interjection (int) are considered to acquire a concept of pattern matching with regard to SVO sentence structure. Sample sentences are demonstrated as follows.

A simple sentence:

Example: I eat rice.

Thai sentence	Khmer sentence
S + V + O	S + V + O
ฉัน + กิน + ข้าว	= ខ្ញុំ + ញ៉ាំ + បាយ
cʰǎn + kin + kʰâaw	kɲom + ɲam + bay

A sample sentence with color term or color perception [9]:

Example: This car is red.

Thai sentence	Khmer sentence

S   + (V) + O   S   + (V) + O

รถยนต์ + คันนี้ + สีแดง = រថយន្ត + នេះ + ពណ៌ក្រហម

rót 'yon + kʰan-níi + sǐi 'dɛɛŋ   rʋət yʋən + nih + poa krahaam

A sample sentence: The counter unit without subject (S):

Example: There are five eggs.

Thai sentence	Khmer sentence

S + V + O + unit(s)   S + V + O + unit(s)

+ มี + ไข่ + 5 + ฟอง = +មាន+ស៊ុត+ប្រាំ+គ្រាប់

+ mii + kʰay + hâa + fɔɔŋ   + mien+sut+pram+kroap

In the third step is to search for the proposed patterns in the input Thai sentence so that the output words are appropriately used in the Khmer sentence. Mapping between grammatical structures of Thai and Khmer language is undertaken. Khmer sentence patterns are then converted into proper forms through mapping algorithms.

To explain the mapping process, let Thwd{x} be a Thai word and Khwd{x} be a Khmer word where x is an index of a word in the sentence. Then the pattern mapping is defined as follows.

Thai Sentence Pattern X: [ThPatternx]

Thwd{1} + Thwd{2} + Thwd{3} + … + Thwd{ xn }

is mapped to
Khmer Sentence Pattern X: [KhPatternx]

Khwd{1} + Khwd{2} + Khwd{3} + … + Khwd{ xn }

It has been found that one Thai sentence pattern is possibly mapped to more than one Khmer sentence patterns as shown below.
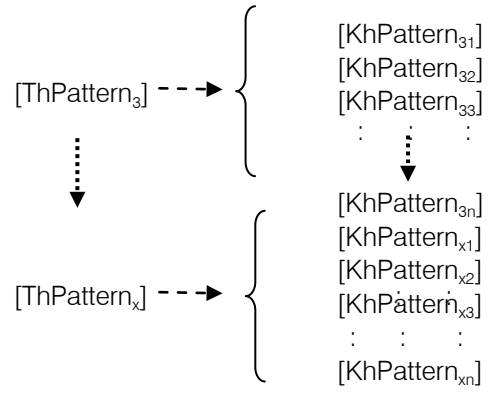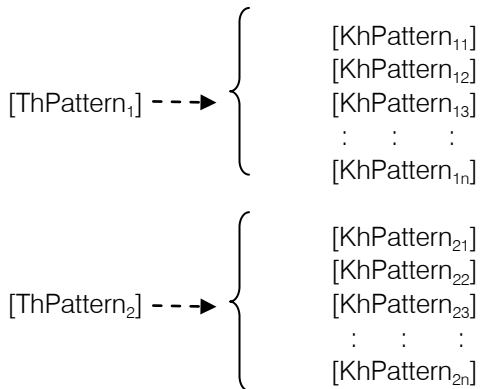
After mapping sentence patterns, all proposed patterns are retrieved from the corpus. For testing in this paper, only frequently used patterns are considered. The proposed patterns are searched, and the search consequently causes changes in the output construction. Sample patterns and the related algorithms are exemplified as follows.

Note: ✘ = incorrect ordering words, ✔ = Correct

A. *Sample 1:* [ThPattern₁] ---▶ [KhPattern₁₁]

Thwd{1} + Thwd{2} + Thwd{3} + … + Thwd{ xₙ }

Khwd{1}+Khwd{2}+(non, Khwd{3-1} or Khwd{3-2}) + … + Khwd{ xₙ }   [KhPattern₁₁]
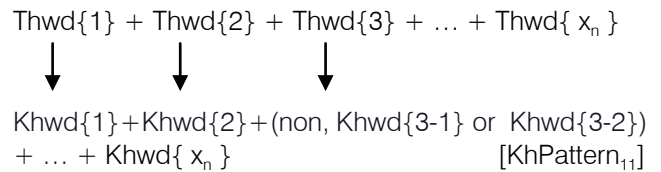
Algorithm1.1:

IF((Thwd{2}="number || noun || date || adv || verb || adj") || (Thwd{4}="number || noun || adj || verb || date") ||
(Thwd{2}="noun || adj" && Thwd1!="verb")) THEN Thwd{3} is replaced by Khwd{3-2}
ELSE Thwd{3} is translated as Khwd{3-1}

The algorithm is applied if a Thai phrase contains words (Thwd{3}) such as คน, หน้า, ด้วย, กัน, นั่ง, ให้หน้า, ทาง, ได้เปรียบ, จะ, แค่, ดู, ใหม่, เหมือน, ถึง, ต่อ, แก, ใน, หยุด, ก้าว, มากกว่า, เมื่อ, ตอน, มาก, กับ, etc.

Example1.1.1: To verify a Thai word "คน" (kʰon) = person, people, human, man

If the word "คน" (kʰon) is in a position following any other words in the sentence, the Khmer word "មនុស្ស" (mɔnuh) is replaced by "នាក់" (neak). The example sentences are provided below.

32

Thai: "ผมมีพี่น้องสามคน" (I have three brothers.)
        (pʰǒm-mii-pʰǐi-nɔ́ɔŋ-sǎam-kʰon), and

Khmer: ខ្ញុំមានបងប្អូនបីមនុស្ស   ✗
        (kɲom - mien -baaŋ- pʔoon - bəy -mɔnuh)
        ខ្ញុំមានបងប្អូនបីនាក់   ✓
        (kɲom - mien -baaŋ- pʔoon - bəy - neak)

Example1.1.2: To verify a Thai word "นั่ง" (nâŋ) = sit

      If the word "นั่ง" (nâŋ) is in a position before a noun (n.), the Khmer word "អង្គុយ" (ʔaŋkuy) is replaced by "ជិះ" (cih). The example sentences are demonstrated as follows.

Thai: "เขาจะนั่งรถไฟไปทำงาน" (He will go to work by train.)

        (kʰǎw - jà - nâŋ - rót ˈfay - pay - tʰam ˈŋaan), and

Khmer: គាត់នឹងអង្គុយរថភ្លើងទៅធ្វើការ   ✗
        (koat - niŋ - ʔaŋkuy - rʊət pləəŋ - tiv - tvəə-
        គាត់នឹងជិះរថភ្លើងទៅធ្វើការ   ✓
        (koat - niŋ - cih - rʊət pləəŋ - tiv - tvəə-kaa)

Algorithm1.2:
IF((Thwd{1}="ยัง || หา || ค้นหา || ไม่ || หัวใจ || โมง") || (Thwd{2}="ยัง || หา || ค้นหา || ไม่ || หัวใจ || โมง") || ((Thwd{1}="กำลัง" || Thwd{2} ="กำลัง") && Thwd{4}!="noun")) THEN Thwd{3} is translated as Khwd{3-2} ELSE Thwd3 is translated as Khwd{3-1}

      The algorithm is used in a case that a Thai phrase contains words (Thwd{3}) such as **อยู่**, **ไม่**, **เจอ**, **สบาย**, **เต้น**, **เย็น**, etc.

Example1.2.1: To verify a Thai word "**อยู่**" (yùu) = is, am, are, was, were, be

   If the word "**อยู่**" (yùu) follows another Thai word "**กำลัง**" (kamˈlaŋ) = …ing , the Khmer word "នៅ" (nɨv) is removed from the sentence. The example sentences are shown below.

Thai: "กำลัง เขียนจดหมายอยู่ครับ" (writing a letter sir.)
        (kamˈlaŋ-kʰǐan-jòt ˈmǎay-yùu-kʰráp)

Khmer: កំពុងសរសេរសំបុត្រនៅបាទ   ✗
        (kampuŋ-saa seɛ-sambot-nɨv-baat)
        កំពុងសរសេរសំបុត្របាទ   ✓
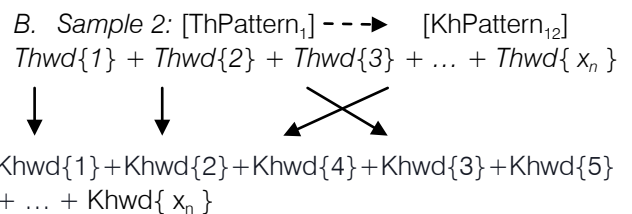   (kampuŋ-saa seɛ-sambot-baat)

Algorithm1.3:
IF(((Thwd{1}="verb") || (Thwd{2}="verb")) || ((Thwd{1}="verb || noun || adv") || (Thwd{2}="verb || noun || adv") && Thwd{4} !="noun || verb")) THEN Thwd{3} is translated as Khwd{3-2} ELSE Thwd{3} is translated as Khwd{3-1}

      The algorithm is implemented when a Thai phrase contains words (Thwd{3}) such as **ทำไม**, **ถูก**, **จน**, **เอง**, etc.

Example1.3.1: To verify a Thai word "**ทำไม**" (tham ˈmay) = why, for what

   If Thwd{3} = "**ทำไม**" (tham ˈmay) is in a position after a verb (v.), Khwd{3-1} = "ហេតុអ្វី" (haet ʔvəy) is replaced by Khwd{3-2} = "ធ្វើអ្វី" (tvəə ʔvəy). The example sentences are explained as follows.

Thai: "คุณมาที่นี่ทำไม" (Why did you come here?)
        (kʰun-maa-tʰǐi ˈnǐi-tha-- ˈˈmay)

Khmer: អ្នកមកទីនេះហេតុអ្វី   ✗
        (neak-mɔɔk-tii nih-haet ʔvəy)
        អ្នកមកទីនេះធ្វើអ្វី   ✓
        (neak-mɔɔk-tii nih-tvəə ʔvəy)

B. Sample 2: [ThPattern$_1$] - - - ➤ [KhPattern$_{12}$]
Thwd{1} + Thwd{2} + Thwd{3} + … + Thwd{ x_n }

⬇   ⬇   ✕

Khwd{1}+Khwd{2}+Khwd{4}+Khwd{3}+Khwd{5} + … + Khwd{ x_n }

Algorithm2.1:

IF(Thwd{3}=="number || noun") THEN Khwd{3} and Khwd{4} is swapped position

ELSE Khwd{3} and Khwd{4} is not swapped
      The algorithm is for the case that a Thai phrase contains words (Thwd{4}) such as **โมง** and **ละ**.

Example2.1: To verify a Thai word "**โมง**" (mooŋ) = o'clock

   If the word "**โมง**" (mooŋ) follows a number (of time indications), the Khmer word "ព្រាំបួនម៉ោង" (pram buən-maoŋ) is replaced by drow eht "ម៉ោងព្រាំបួន" or swap the position with that of the word "ម៉ោង-ព្រាំបូ ន". In this case, the example sentences are provided below.

Thai: "พรุ่งนี้ เริ่มต้น เก้าโมง เช้า" (Tomorrow, start at nine o'clock.) (pʰruŋ ˈnɨi-rɯ̂əm ˈtɤ̂n-kâaw- mooŋ -cʰáaw)

Khmer: ថ្ងៃស្អែកចាប់ផ្ដើមព្រាំបួនម៉ោងព្រឹក   ✗
        (tŋay sʔaek-cap pdaəm-pram buən-maoŋ-prɨk
        ថ្ងៃស្អែកចាប់ផ្ដើមម៉ោងព្រាំបួនព្រឹក   ✓
        (tŋay sʔaek-cap pdaəm-maoŋ-pram buən-prɨk)

C. Sample 3: [ThPattern$_1$] - - ➤ [KhPattern$_{13}$]

Thwd{1} + Thwd{2} + Thwd{3} + … + Thwd{ x_n }

⬇   ✕

Khwd{1}+Khwd{3}+Khwd{4}+Khwd{2}+Khwd{5} + … + Khwd{ x_n }   [KhPattern$_{13}$]
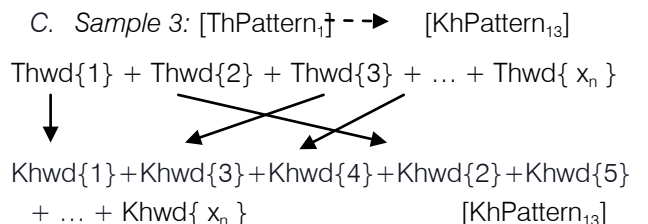
Algorithm3.1:

IF(Thwd{3}==″num″) THEN Khwd{2}, Khwd{3} and Khwd{4} should be reorder as Khwd{3}+Khwd{4} +Khwd{2} ELSE do not reorder phrase

The algorithm is applied for a Thai phrase consisting of a word (Thwd{2}) **อีก**.

Example3.1: To verify a Thai word "**อีก**" (ìik) = more
If the Thai word Thwd{2} = "**อีก**" (ìik) is in front of any other words in the sentence, the Khmer phrase is required to be reordered. The example sentences are shown below.

Thai: "อีกสอง เดือนฉันจะไปกัมพูชา"

    (ìik -sɔ̌ɔŋ-dɯan-cʰǎn-jàʔ-pay-kam.pʰuuˈcʰaa)
    (Next two month I will go to Cambodia.)

Khmer: ទៀតពីរខែខ្ញុំនឹងទៅកម្ពុជា ✗

    (tìət-pii-kʰae-kɲom-niŋ-tɨv-kampuʔcie)

    ពីរខែទៀតខ្ញុំនឹងទៅកម្ពុជា ✓

    (pii-kʰae-tìət-kɲom-niŋ-tɨv-kampuʔcie)

Reordering words and translating are in the final step to diminish the translation issue. After the pattern mapping is completed, around 37,000 words from Thai – Khmer dictionary database are retrieved to match each word which is then rearranged to be in a proper position. As a result, a Khmer sentence is attained as the output.

V. Performance Evaluation

The proposed system is assessed for translation performance from Thai to Khmer by sentences from various sample documents as the input. In the testing process, the total phrases and sentences of 5,100 were employed: 212 sentences from Learning of Thai – Cambodian Language (Chan Rithy (ច័ន្ទ្រ ឫទ្ធិ, 2001), 170 sentences from Conversational Thai - Khmer (Seiw Som Aeoun (សិវ សំអឿន)), 150 sentences from Teaching of Conversational Thai - Cambodian (Lirm Peng (លឹម ជ័ង), 2003), 189 sentences from Dictionary of Idioms and Phrases for Professional Sentence Writing (Sean Cemeron Beatt (ប្រេមចិត បីទ), 2012) and the others from a handbook, Fundamental Khmer 2 [10] and websites. Sample phrases and sentences are shown in Table I.

Table I: Sample of Phrase/Sentences for testing

English/ Thai/ Khmer
Are you married?
คุณแต่งงานหรือยัง kʰun-tɛ̀ŋ ˈŋaan-rɯ̌ɯ-yaŋ
អ្នករៀបអាពាហ៍ពិពាហ៍ឬនៅ neak-rìəp-ʔaapie- piʔpie-rɨɨ nɨv
What newspaper do you read?
คุณอ่านหนังสือพิมพ์อะไร kʰun-àan-naŋ.sɯ̌ɯ ˈpʰim- aˈray
អ្នកអានកាសែតអ្វី neak-ʔaan- kaasaet-ʔvəy
I'm sorry to let you waiting.
ผมขอโทษที่ต้องให้คุณรอ pʰǒm-kʰɔ̌ɔ ˈtʰôot-tʰ́i-hây- kʰun-rɔɔ
ខ្ញុំសុំទោសដែលត្រូវឲ្យអ្នករងចាំ kɲom-som tooh-dael-trəv-ʔaoy-neak-rɔɔŋ cam
I will go to a party.
ผมจะไปงานเลี้ยง pʰǒm -ja-pay-ŋaan-lía̋ŋ
ខ្ញុំនឹងទៅពិធីជប់លៀង kɲom-niŋ-tɨv-piʔtʰii- cup lìəŋ

Three translation systems including Google translator [11], Chhun's translation system and the proposed system in this paper are assessed through translating the sample phrases and sentences. The translated outputs of each translation system are categorized into three groups consisting of accuracy (correct), acceptance (acceptable) and mistake (wrong). According to 5,100 Thai sentences selected for testing, the proposed system is able to translate 4,083 words correctly (80.06%), reach the acceptable level of translation for 469 sentences (9.189%) and produce errors only in 548 sentences (10.75%). The total translation accuracy of the proposed system becomes 89.25 % which is a sum of its accuracy and acceptance value. On the other hand, Chhun's translation contributes to 3,590 correct sentences (70.38%) which is less than those of the proposed system, 658 acceptable sentences (12.9%) and 857 mistakes (16.81%). Google translation also achieve less accuracy compared to the proposed system: 1,067 correct sentences (20.9%). whereas it acquires 798 acceptable sentences (15.64%) and 3,230 mistakes (63.34%), respectively, higher than those of the proposed one.

Moreover, performances of all systems are compared with regard to system precision, recall and efficiency by implementing F-measure as shown in Table 2.

Table II: F-Measure Results for Thai into Khmer

Translation Methods	Precision	Recall	F-Measure
Google	0.57	0.21	0.31
Chhun	0.84	0.70	0.76
Proposed System	0.89	0.80	0.84

The result in Tables 2 reveals that the proposed system attains the highest score in all evaluations: the precision is 0.89, the recall is 0.80 and the efficiency (F-Measure) is 0.84.

VI. Conclusion

The methodology in this paper is presented for creating Thai to Khmer machine translation system by using syntactic and semantic analysis to transform and structure patterns as well as implementing the rule-based translation. The presented processes can also simplify compound sentences into simple ones based on predefined sentence structures. The previous word, the next word and the subject-verb agreement are also considered. In addition, switching with more suitable words, reordering words and adjusting output sentences are also performed with regard to Thai and Khmer grammar. As a result, the proposed system is apparently able to improve the quality of source texts and translated outputs as well as assist Thai-Khmer language learners. Nevertheless, a larger amount of sample sentences in the corpus than that which is currently applied in the proposed system is necessary to achieve higher performance in Thai-Khmer translation. Furthermore, the larger dictionary database as well as the higher diversity of sample sources would be added to the process. Other methods or tools would also be considered to develop Thai-Khmer translation in future research.

VII. Acknowledgment

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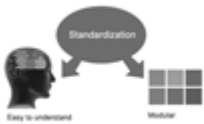
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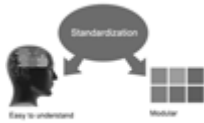
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Metric SI units are supposed to generally be used excluding where they conflict with current practice or are confusing. For illustration, 1.4 l rather than $1.4 \times 10\text{-}3$ m3, or 4 mm somewhat than $4 \times 10\text{-}3$ m. Chemical formula and solutions must identify the form used, e.g. anhydrous or hydrated, and the concentration must be in clearly defined units. Common species names should be followed by underlines at the first mention. For following use the generic name should be constricted to a single letter, if it is clear.

Structure

All manuscripts submitted to Global Journals Inc. (US), ought to include:

Title: The title page must carry an instructive 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) wherever the work was carried out. The full postal address in addition with the e-mail address of related author must be given. Up to eleven keywords or very brief phrases have to be given to help data retrieval, mining and indexing.

Abstract, used in Original Papers and Reviews:

Optimizing Abstract for Search Engines

Many researchers searching for information online will use search engines such as Google, Yahoo or similar. By optimizing your paper for search engines, you will amplify the chance of someone finding it. This in turn will make it more likely to be viewed and/or cited in a further work. Global Journals Inc. (US) have compiled these guidelines to facilitate you to maximize the web-friendliness of the most public part of your paper.

Key Words

A major linchpin in research work for the writing research paper is the keyword search, which one will employ to find both library and Internet resources.

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

Search engines for most searches, use Boolean searching, which is somewhat different from Internet searches. The Boolean search uses "operators," words (and, or, not, and near) that enable you to expand or narrow your affords. Tips for research paper while preparing research paper are very helpful guideline of research paper.

Choice of key words is first tool of tips to write research paper. Research paper writing is an art.A few tips for deciding as strategically as possible about keyword search:

- One should start brainstorming lists of possible keywords before even begin 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 research paper?" Then consider synonyms for the important words.
- It may take the discovery of only one relevant paper to let steer in the right keyword direction because in most databases, the keywords under which a research paper is abstracted are listed with the paper.
- One should avoid outdated words.

Keywords are the key that opens a door to research work sources. Keyword searching is an art in which researcher's skills are bound to improve with experience and time.

Numerical Methods: Numerical methods used should be clear and, where appropriate, supported by references.

Acknowledgements: Please make these as concise as possible.

References

References follow the Harvard scheme of referencing. References in the text should cite the authors' names followed by the time of their publication, unless there are three or more authors when simply the first author's name is quoted followed by et al. unpublished work has to only be cited where necessary, and only in the text. Copies of references in press in other journals have to be supplied with submitted typescripts. It is necessary that all citations and references be carefully checked before submission, as mistakes or omissions will cause delays.

References to information on the World Wide Web can be given, but only if the information is available without charge to readers on an official site. Wikipedia and Similar websites are not allowed where anyone can change the information. Authors will be asked to make available electronic copies of the cited information for inclusion on the Global Journals Inc. (US) homepage at the judgment of the Editorial Board.

The Editorial Board and Global Journals Inc. (US) recommend that, citation of online-published papers and other material should be done via a DOI (digital object identifier). If an author cites anything, which does not have a DOI, they run the risk of the cited material not being noticeable.

The Editorial Board and Global Journals Inc. (US) recommend the use of a tool such as Reference Manager for reference management and formatting.

Tables, Figures and Figure Legends

Tables: Tables should be few in number, 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. Vertical lines should not be used.

Figures: Figures are supposed to be submitted as separate files. Always take in a citation in the text for each figure using Arabic numbers, e.g. Fig. 4. Artwork must be submitted online in electronic form by e-mailing them.

Preparation of Electronic Figures for Publication

Even though low quality images are sufficient for review purposes, print publication requires high quality images to prevent the final product being blurred or fuzzy. Submit (or e-mail) EPS (line art) or TIFF (halftone/photographs) files only. MS PowerPoint and Word Graphics are unsuitable for printed pictures. Do not use pixel-oriented software. Scans (TIFF only) should have a resolution of at least 350 dpi (halftone) or 700 to 1100 dpi (line drawings) in relation to the imitation size. 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).

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TECHNIQUES FOR WRITING A GOOD QUALITY RESEARCH PAPER:

1. Choosing the topic: In most cases, the topic is searched by the interest of author but it can be also suggested by the guides. You can have several topics and then you can judge that in which topic or subject you are finding yourself most comfortable. This can be done by asking several questions to yourself, like Will I be able to carry our search in this area? Will I find all necessary recourses to accomplish the search? Will I be able to find all information in this field area? If the answer of these types of questions will be "Yes" then you can choose that topic. In most of the cases, you may have to conduct the surveys and have to visit several places because this field is related to Computer Science and Information Technology. Also, you may have to do a lot of work to find all rise and falls regarding the various data of that subject. Sometimes, detailed information plays a vital role, instead of short information.

2. Evaluators are human: First thing to remember that evaluators are also human being. They are not only meant for rejecting a paper. They are here to evaluate your paper. So, present your Best.

3. Think Like Evaluators: If you are in a confusion or getting demotivated that your paper will be accepted by evaluators or not, then think and try to evaluate your paper like an Evaluator. Try to understand that what an evaluator wants in your research paper and automatically you will have your answer.

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

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7. Use right software: Always use good quality software packages. If you are not capable to judge good software then you can lose quality of your paper unknowingly. There are various software programs available to help you, which you can get through Internet.

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

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

12. Make all efforts: Make all efforts to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in introduction, that what is the need of a particular research paper. Polish your work by good skill of writing and always give an evaluator, what he wants.

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16. Use proper verb tense: Use proper verb tenses in your paper. Use past tense, to present those events that happened. Use present tense to indicate events that are going on. Use future tense to indicate future happening events. Use of improper and wrong tenses will confuse the evaluator. Avoid the sentences that are incomplete.

17. Never use online paper: If you are getting any paper on Internet, then never use it as your research paper because it might be possible that evaluator has already seen it or maybe it is outdated version.

18. Pick a good study spot: To do your research studies always try to pick a spot, which is quiet. Every spot is not for studies. Spot that suits you choose it and proceed further.

19. Know what you know: Always try to know, what you know by making objectives. Else, you will be confused and cannot achieve your target.

20. Use good quality grammar: Always use a good quality grammar and use words that will throw positive impact on evaluator. Use of good quality grammar does not mean to use tough words, that for each word the evaluator has to go through dictionary. Do not start sentence with a conjunction. Do not fragment sentences. Eliminate one-word sentences. Ignore passive voice. Do not ever use a big word when a diminutive one would suffice. Verbs have to be in agreement with their subjects. Prepositions are not expressions to finish sentences with. It is incorrect to ever divide an infinitive. Avoid clichés like the disease. Also, always shun irritating alliteration. Use language that is simple and straight forward. put together a neat summary.

21. 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 to your topic. You may also maintain your arguments with records.

22. Never start in last minute: Always start at right time and give enough time to research work. Leaving everything to the last minute will degrade your paper and spoil your work.

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

24. Never copy others' work: Never copy others' work and give it your name because if evaluator has seen it anywhere you will be in trouble.

25. Take proper rest and food: No matter how many hours you spend for your research activity, if you are not taking care of your health then all your efforts will be in vain. For a quality research, study is must, and this can be done by taking proper rest and food.

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

27. Refresh your mind after intervals: Try to give rest to your mind by listening to soft music or by sleeping in intervals. This will also improve your memory.

28. Make colleagues: Always try to make colleagues. No matter how sharper or intelligent you are, if you make colleagues you can have several ideas, which will be helpful for your research.

29. Think technically: Always think technically. If anything happens, then search its reasons, its benefits, and demerits.

30. Think and then print: When you will go to print your paper, notice that tables are not be split, headings are not detached from their descriptions, and page sequence is maintained.

31. Adding unnecessary information: Do not add unnecessary information, like, I have used MS Excel to draw graph. Do not add irrelevant and inappropriate material. These all will create superfluous. Foreign terminology and phrases are not apropos. One should NEVER take a broad view. Analogy in script is like feathers on a snake. Not at all use a large word when a very small one would be sufficient. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Amplification is a billion times of inferior quality than sarcasm.

32. Never oversimplify everything: To add material in your research paper, never go for oversimplification. This will definitely irritate the evaluator. Be more or less specific. Also too, by no means, ever use rhythmic redundancies. Contractions aren't essential and shouldn't be there used. Comparisons are as terrible as clichés. Give up ampersands and abbreviations, and so on. Remove commas, that are, not necessary. Parenthetical words however should be together with this in commas. Understatement is all the time the complete best way to put onward earth-shaking thoughts. Give a detailed literary review.

33. Report concluded results: Use concluded results. From raw data, filter the results and then conclude your studies based on measurements and observations taken. Significant figures and appropriate number of decimal places should be used. Parenthetical remarks are prohibitive. Proofread carefully at final stage. In the end give outline to your arguments. Spot out perspectives of further study of this subject. Justify your conclusion by at the bottom of them with sufficient justifications and examples.

34. After 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 to 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 in 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 criterion for grading the final paper by peer-reviewers.

Final Points:

A purpose of organizing a research paper is to let people to interpret your effort selectively. The journal requires the following sections, submitted in the order listed, each section to start on a new page.

The introduction will be compiled from reference matter and will reflect the design processes or outline of basis that direct you to make study. As you will carry out the process of study, the method and process section will be constructed as like that. The result segment will show related statistics in nearly sequential order and will direct the reviewers next to the similar intellectual paths throughout the data that you took to carry out your study. The discussion section will provide understanding of the data and projections as to the implication of the results. The use of good quality references all through the paper will give the effort trustworthiness by representing an alertness of 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 the 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 evade

- Insertion a title at the foot of a page with the subsequent text on the next page
- Separating a table/chart or figure - impound each figure/table to a single page
- Submitting a manuscript with pages out of sequence

In every sections of your document

· Use standard writing style including articles ("a", "the," etc.)

· Keep on paying attention on the research topic of the paper

· Use paragraphs to split each significant point (excluding for the abstract)

· Align the primary line of each section

· Present your points in sound order

· Use present tense to report well accepted

· Use past tense to describe specific results

· Shun familiar wording, don't address the reviewer directly, and don't use slang, slang language, or superlatives

· Shun use of extra pictures - include only those figures essential to presenting results

Title Page:

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

Abstract:

The summary should be two hundred words or less. It should briefly and clearly explain the key findings reported in the manuscript--must have precise statistics. It should not have abnormal acronyms or abbreviations. It should be logical in itself. Shun citing 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 approach 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. Yet, use comprehensive sentences and do not let go readability for briefness. You can maintain it succinct by phrasing sentences so that they provide more than 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 maintain the initial two items to no more than one ruling each.

- Reason of the study - theory, overall issue, purpose
- Fundamental goal
- To the point depiction of the research
- Consequences, including <u>definite statistics</u> - if the consequences are quantitative in nature, account quantitative data; results of any numerical analysis should be reported
- Significant conclusions or questions that track from the research(es)

Approach:

- Single section, and succinct
- As a outline of job done, it is always written in past tense
- A conceptual should situate on its own, and not submit to any other part of the paper such as a form or table
- Center on shortening results - bound background information to a verdict or two, if completely necessary
- What you account in an conceptual must be regular with what you reported in the manuscript
- Exact spelling, clearness 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

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The **Introduction** should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable to comprehend and calculate the purpose of your study without having to submit to other works. The basis for the study should be offered. Give most important references but shun difficult to make a comprehensive appraisal of the topic. In the introduction, describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will have no attention in your result. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here. Following approach can create a valuable beginning:

- Explain the value (significance) of the study
- Shield the model - why did you employ this particular system or method? What is its compensation? You strength remark on its appropriateness from a abstract point of vision as well as point out sensible reasons for using it.
- Present a justification. Status your particular theory (es) or aim(s), and describe the logic that led you to choose them.
- Very for a short time explain the tentative propose and how it skilled 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 with every section. If you make the four points listed above, you will need a least of four paragraphs.

- Present surroundings information only as desirable in order hold up a situation. The reviewer does not desire to read the whole thing you know about a topic.
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- As always, give awareness to spelling, simplicity and correctness of sentences and phrases.

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This part is supposed to be the easiest to carve if you have good skills. A sound written Procedures segment allows a capable scientist to replacement 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 for the least amount of information that would permit another capable scientist to spare 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 object, mention the specific item describing a way but draw the basic principle while stating the situation. The purpose is to text 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:

- Explain materials individually only if the study is so complex that it saves liberty this way.
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- Do not take in frequently found.
- If use of a definite type of tools.
- Materials may be reported in a part section or else they may be recognized along with your measures.

Methods:

- Report the method (not 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 - details how procedures were completed not how they were exclusively performed on a particular day.
- If well known procedures were used, account the procedure by name, possibly with reference, and that's all.

Approach:

- It is embarrassed or not possible to use vigorous voice when documenting methods with no using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result when script up the methods most authors use third person passive voice.
- Use standard style in this and in 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 a 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. Carry on to be to the point, by means of statistics and tables, if suitable, to present consequences most efficiently.You must obviously differentiate material that would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matter should not be submitted at all except requested by the instructor.

Content

- Sum up your conclusion in text and demonstrate them, if suitable, with figures and tables.
- In manuscript, explain each of your consequences, point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation an exacting study.
- Explain results of control experiments and comprise 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 in manuscript form.

What to stay away from

- Do not discuss or infer your outcome, report surroundings information, or try to explain anything.
- Not at all, take in raw data or intermediate calculations in a research manuscript.

- Do not present the similar data more than once.
- Manuscript should complement any figures or tables, not duplicate the identical information.
- Never confuse figures with tables - there is a difference.

Approach

- As forever, use past tense when you submit to 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 part.

Figures and tables

- If you put figures and tables at the end of the details, make certain that they are visibly distinguished from any attach appendix materials, such as raw facts
- Despite of position, each figure must be numbered one after the other and complete with subtitle
- In spite of position, each table must be titled, numbered one after the other and complete with heading
- All figure and table must be adequately complete that it could situate on its own, divide from text

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The Discussion is expected the trickiest segment to write and describe. A lot of papers submitted for journal are discarded based on problems with the Discussion. There is no head of state for how long a 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 implication of the study. The purpose here is to offer an understanding of your results and hold up for all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of result should be visibly 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 with prospect, and let it drop at that.

- Make a decision if each premise is supported, discarded, or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."
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- Give details all of your remarks as much as possible, focus on mechanisms.
- Make a decision if the tentative design sufficiently addressed the theory, and whether or not it was correctly restricted.
- Try to present substitute explanations if sensible alternatives be present.
- One 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 available information
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Topics	Grades		
	A-B	**C-D**	**E-F**
Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
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

Index

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