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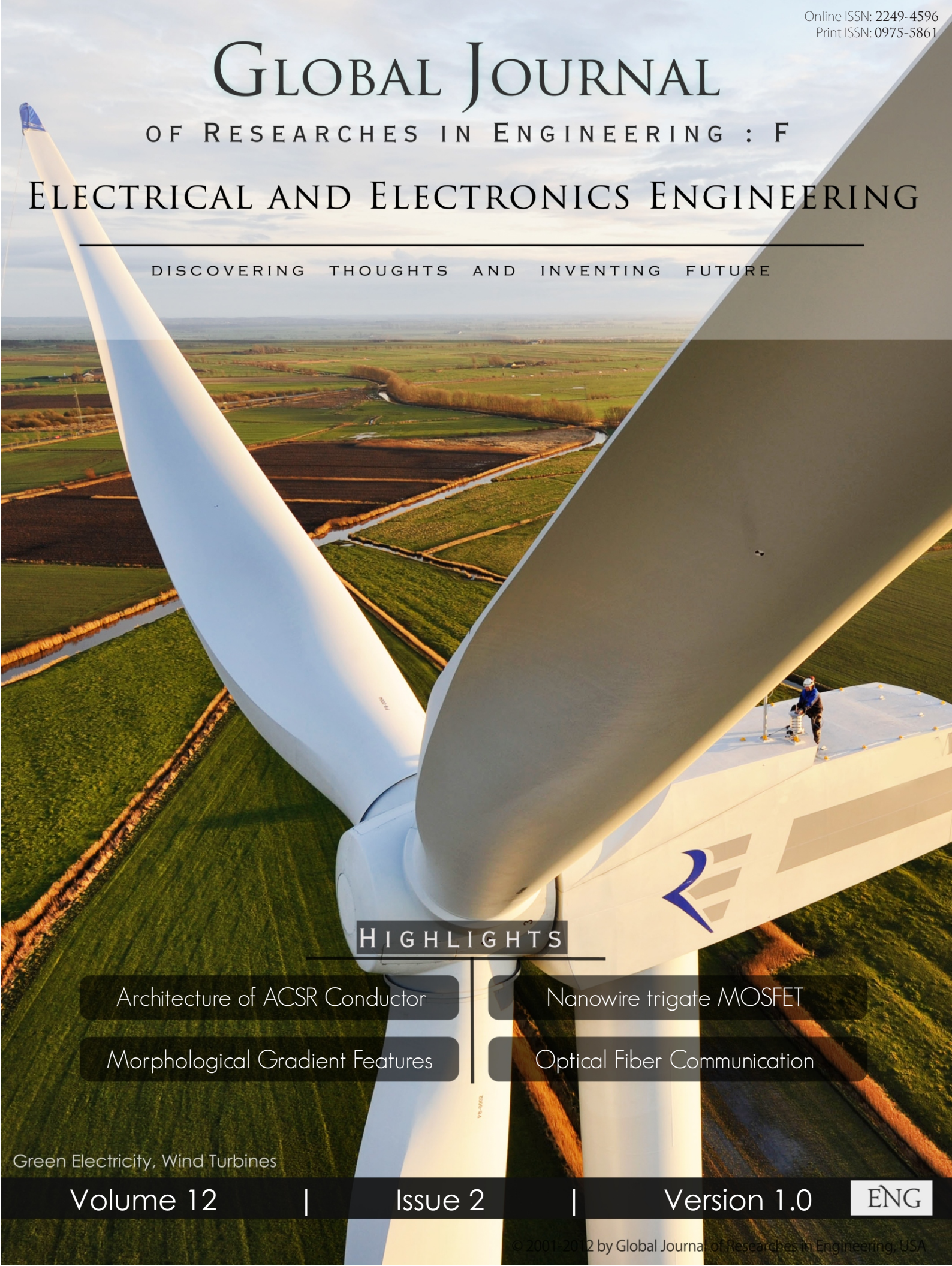

HIGHLIGHTS

- Architecture of ACSR Conductor
- Nanowire trigate MOSFET
- Morphological Gradient Features
- Optical Fiber Communication

Green Electricity, Wind Turbines

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Application Based Analysis and Design Using Microcontroller

By Ashutosh Tripathi
Amity University Rajasthan, Jaipur

Abstract - Now day's automation systems are very common to each and every field of human life. Humans want to lead a leisure full life. The theme work of this paper is also based on this idea. The idea is to automate the appliances using a normal mobile phone system. These paper fistly commands a system which governs a system which gives the command to appliances to either switch on or off. The system works on some common day's technologies which are mobile networking using GSM or CDMA, Duel Tone Multiple Frequency and basic encoding and decoding techniques. In this project we try to give the same prototype for this type of trains. We are using microcontroller 89c51 as CPU. And secondly the motion of the train is controlled by the stepper motor, for displaying the message in the train we are using intelligent LCD display of two lines. The train is designed for three stations, named as A, B and C. The stoppage time for every station is 3sec and time to travel from one station to another is 6sec, there is a LCD display for showing various messages in the train for passengers. There are indicators, which are used to show the train direction i.e. UP path and DOWN path .before stopping at the station, the train blows the buzzer. it also includes an emergency brakes system due to which the train stops as soon as the brakes are applied and resumes journey when he emergency situation is over.

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Application Based Analysis and Design Using Microcontroller

Ashutosh Tripathi

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I. Introduction

In the paper two mobiles are employed one at user side which is carried by the user and second at the receiver part. At receiver part the mobiles DTMF output is fed thought the ear phone jack to the receiver circuit. When the DTMF tone is fed to the receiver circuit It converts the analog DTMF signal to digital output and this digital output is fed to the Microcontroller 892051. In Microcontroller a specific code is written to process the details of the digital output from the decoder chip MT8870. For every input from MT8870 there is a specific command is written in the Microcontroller 892051 and corresponding to the input code makes one of the output pin of Microcontroller 892051 high which commands the relay driver IC chip ULN2803. As according to the input from Microcontroller 892051 the relay makes only one of the output pin high among all.fig (I) describes the circuit of the designed system. Basically a receiver which used to:

1) Receive DTMF tone send by the Transmitter Mobile
2) Analog DTMF tone to Digital data generator
3) Microprocessor Unit (AT892051)
4) Relay driver IC (ULN2803)

Circuit Diagram:

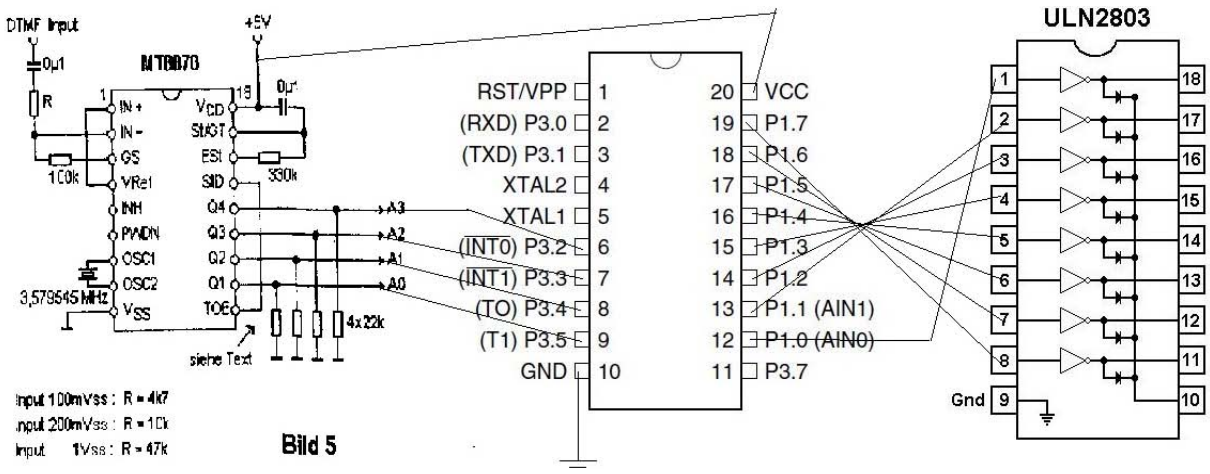

Fig I : Circuit diagram of Mobile Automation circuit

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II. Working

Before starting with Motorola IC MT8870 it should be configured properly. Power supply is connected on +5v on pin 18 and ground on pin 9. The DTMF input is supplied to the pin 3 through a resistance of 100k so that a proper amount of current is drawn to the pin 3 for operating the IC. Crystal oscillator of frequency 3.57MHz is deployed between pin 7 and pin 8. Output is taken from pin 11, 12, 13, 14 through pull up resistors.

III. Microcontroller 89C51

The use of microcontroller ensures the reliability of the system. Before starting with the working of Microcontroller 892051 it should be configured properly. Pin 20 is connected with Vcc and Pin 10 with Ground. An oscillator of 11.0592 MHz is deployed between the pin 4 and pin 5. Input from the MT8870 is fed to the pin 6, 7, 8, 9 which are general purpose input/output pins. These pins are also considered as Port 3, so while programming the controller programmer consider input Port as P3 here. And output is taken from general purpose input/output Port 1. The out put is a 8 bit output so that it can control the eight pins of relay driver IC.

The Microcontroller code according to the input of MT8870 is given as:

Coding of motion of the train is controlled by the stepper motor, for displaying the message in the train we are using intelligent LCD display of two lines.

The coding of the metro train prototype is given in the assembly language. The Programmer main routines are the routines for running of stepper motor in forward

Direction and in reverse direction. The routines for this purpose are Stepper f and stepper b. The routines display and command are used in conjunction with LCD display. Program for a stepper having connected at p2 (from p2.0 to p2.3) & to show

```
Message on the LCD
data e q u  p1
busy e q u p1.7
r s e q u p3.5
r w e q u p3.4
en e q u p3.3
B z r e q u p0.2
led f e q u  p0.0
led b e q u  p0.1

org 400h
show0: db 'Welcome To All','0'
show1: db 'Current Station','0'
show2: db 'Next Station','0'
show3: db 'A','0'
show4: db 'B,'0'
Show5: db 'C','0'
org 0000h
a j m p main
org 0003h
test: m o v c,p3.2
j n c halt
set b bz r
r e t i
halt:
c l r b z r ;till zero blow on the b z r
a j m p test
main:
mo v ie,#00h
set b ea
set b ex0
here:
mo v p2,#00h
a call I n i
m o v dptr,#show0
a call read
c l r led f ;p1.0
a call delay

m o v a,#01h
a call command; Now make memory clear
cursor home
m o v dptr,#show1
a call read

set b ex0 ;##############
mo v a,#0c0h
a call command
m o v dptr,#show3
a call read
a call delay ;Stopage1 time 3 sec A
a call delay
c l r b z r
a call delay
 m o v a,#01h
a call command
m o v dptr,#show2
```


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```
a call read
m o v a,#0c0h
a call command
m o v dptr,#show4
a call read
set b b z r
a call delay10
a call stepper f
m o v a,#01h
a call command
m o v dptr,#show1
a call read
m o v a,#0c0h
a call command
m o v dptr,#show4
a call read
a call delay ;Stopage2 time 3 sec shsar
a call delay
c l r b z r
a call delay

mo v a,#01h
a call command
mo v dptr,#show2 ;display ne
a call read
mo v  a,#0c0h
a call command
m o v dptr,#show5
a call read
set b b z r
a call delay10
a call stepper f

m o v a,#01h
a call command
mo v dptr,#show1
a call read
mo v a,#0c0h
a call command
m o v dptr,#show5
a call read
a call delay ;Stopage2 time 3 sec B
a call delay
c l r b z r
a call delay

set b  led f ; p1.0 ;off led at
p1.0 for forward journey
c l r led b ; p1.1 ; 0n Led
for back ward journey

m o v a,#01h
a call command
m o v dptr,#show2 ;display ne s h a r
a call read
mo v a,#0c0h
a call command
mo v dptr,#show4
a call read
set b bzr
a call delay10
a call stepper b

mo v a,#01h
a call command
mo v dptr,#show1
a call read
mo v a,#0c0h
a call command
mo v dptr,#show4
a call read
a call delay ;Stopage2 time 3 sec shsar
acall delay
clr bzr
acall delay

m o v a,#01h
a call command
mo v dptr,#show2 ;display ne roor
a call read
mo v a,#0c0h
a call command
mo v dptr,#show3
a call read
set b b z r
a call delay10
a call stepper b

mo v a,#01h
a call command
mo v dptr,#show1
```


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```
a call read
mo v a,#0c0h
a call command
mo v dptr,#show3
a call read
set b led b ;p1.1
l j m p here
;routine for stepper motor
Delay Routine ;one sec delay
delay:
push acc
push 00h
push 01h
push p0
push p1
mo v r0,#0eh
loop r:
mo v a,#0ffh
loop b:
mo v b,#0ffh
loop a: d  j n z b, loop a
d j n z 0e0h,loopb
d j n z r0,loopr
pop p1
pop p0
pop 01h
pop 00h
pop acc
ret

;d l ay stepper
delays:
push acc
push 00h
push 01h
push p0
push p1

m o  v a,#0ffh
loopa1: mo v b,#0fh
loopb1: d j n z b,loopb1
d j n z 0e0h,loopa1
pop p1
pop p0
pop 01h
pop 00h
pop acc
ret

delay10:
mo v tmod,#01h
mo v tcon,#00h
mo v tl0,#0f0h
mo v th0,#0f8h
set b tr0
no: j n b tf0,no
c l r tr0
c l r tf0
ret
;=============== Routine to read data
from prog mem

read:
n e x: c l r a
mo v c  a ,@ a + d p  t r
c j ne a,#'0',aga
s j mp down
a g a: a call display
inc d p t r
 s j m p next
down:
ret
;================ stepper routine

stepper f:
push acc
push p1
mo v a,#88h
mo v r1 ,#04h
loop1: mo v r0,#0e0h
loop: mo v p2,a
a call delays
r r a
d j n z r0,loop
d j  n z r1,loop1
pop p1
```


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```
pop acc
ret

stepper b:
push acc
push p1
mo v a,#88h
mo v r1,#04h
loop12:
mo v r0,#0e0h
loop0: mo v p2,a
a call delays
r l a
d j n z r0,loop0
d j n z r1,loop12
pop p1
pop acc
ret
;**********************************
*******************
;LCD strobe subroutines

I n i: mo v a,#38h
a call command
mo v a,#38h
a call command
mo v a,#38h
a call command
mo v a,#38h
a call command
mo v a,#0eh
a call command
mo v a,#06h
a call command
mo v a,#01h
a call command
mo v a,#80h
a call command
ret

command:
a call ready
mo v d a t a ,a
c l r   r s
c l r r w
set b en
c l r en
ret

display:
a call ready
mo v d a t a ,a
set b r s
c l r r w
set b en
c l r en
ret

ready:
c l r en
mo v data,#0ffh
c l r r s
set b r w
wait: c l r en
set b en
j b  b u s y, wait
c l r en
Ret

End
```

Coding of mobile networking using GSM or CDMA, Duel Tone Multiple Frequency and basic encoding and decoding techniques.

```
   1   $mod52                                           3
0000              2   ORG 0000h         0000 A2B5        4   main: mov c,p3.5
0002 404A         5   jc label          0048 759086   44   l7: mov p1,#86h
                  6                     004B 020000   45       ljmp main
0004 A2B4         7   mov c,p3.4        004E A2B4     46   label: mov c,p3.4
```

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```
0006 4022          8    jc l1
                   9
0008 A2B3         10    mov c,p3.3
000A 400E         11    jc l2
                  12
000C A2B2         13    mov c,p3.2
000E 4005         14    jc l3
                  15
0010 7590C0       16    mov p1,#0c0h
0013 80EB         17        sjmp main
                  18
0015 759080       19    l3: mov p1,#80h
0018 80E6         20        sjmp main
                  21
001A A2B2         22    l2: mov c,p3.2
001C 4006         23        jc l4
                  24
001E 759099       25        mov p1,#99h
0021 020000       26        ljmp main
                  27
0024 7590C6       28    l4: mov p1,#0c6h
0027 020000       29        ljmp main
                  30
002A A2B3         31    l1: mov c,p3.3
002C 4010         32        jc l5
002E A2B2         33        mov c,p3.2
0030 4006         34        jc l6
                  35
0032 7590A4       36        mov p1,#0a4h
0035 020000       37        ljmp main
0038 759088       38    l6: mov p1,#88h
003B 020000       39        ljmp main
003E A2B2         40    l5: mov c,p3.2
0040 4006         41        jc l7
0042 759082       42        mov p1,#82h
0045 020000       43        ljmp main
0050 4024         47        jc l8
0052 A2B3         48        mov c,p3.3
0054 4010         49        jc l9
0056 A2B2         50        mov c,p3.2
0058 4006         51        jc l10
005A 7590F9       52          mov p1,#0f9h
005D 020000       53          ljmp main
0060 759090       54    l10: mov p1,#90h
0063 020000       55        ljmp main
0066 A2B2         56    l9:  mov c,p3.2
0068 4006         57        jc l11
006A 759092       58        mov p1,#92h

006D 020000       59        ljmp main
0070 7590A1       60    l11: mov p1,#0a1h
0073 020000       61        ljmp main
0076 A2B3         62    l8: mov c,p3.3
0078 4010         63       jc l12
007A A2B2         64        mov c,p3.2
007C 4006         65       jc l13
007E 7590B0       66        mov p1,#0B0h
0081 020000       67       ljmp main
0084 759083       68    l13: mov p1,#83h
0087 020000       69        ljmp main
008A A2B2         70    l12: mov c,p3.2
008C 4006         71        jc l14
008E 7590F8       72        mov p1,#0f8h
0091 020000       73        ljmp main
0094 75908E       74    l14: mov p1,#08eh
0097 020000       75        ljmp main
                  76
                  77        end
```

IV. Results and Conclusion

The whole system is perfectly developed and tested under the laboratory. This system is very cost effective and easy to deploy in the existing systems. This system adds one more degree of comfort to the human luxury list.

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Real-Time Face Recognition System Based On Morphological Gradient Features and ANN

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Abstract - Faces represent complex, multidimensional, meaningful visual stimuli. A real-time face recognition system has been implemented which is based on Artificial Neural Network. The system integrates three phases. At the initial phase, an image or a frame is grabbed from a real-time video source or webcam. Then the face region is detected using Local SMQT features and Split up SNoW Classifier and after that the detected face is sent for recognition using Backpropagation Neural Network. Feature extraction has been performed on Gray-Scale images of detected faces using Gray-Scale Morphology that are nonlinear and translationinvariant. The feature extraction and classification networks are trained together, allowing the network to simultaneously perform feature extraction and classification. This system performs extremely well under constrained conditions such as gross variation in expression, position, orientation and illumination which are the complications of face recognition.

Keywords : *Face Recognition, Real-Time, Artificial Neural Network, Backpropagation, SMQT Features, SNoW Classifier, Gray-Scale Morphology.*

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Real-Time Face Recognition System Based On Morphological Gradient Features and ANN

Pallab Kanti Podder [α], Dilip Kumar Sarker [σ] & Diponkar Kundu [ρ]

Abstract - Faces represent complex, multidimensional, meaningful visual stimuli. A real-time face recognition system has been implemented which is based on Artificial Neural Network. The system integrates three phases. At the initial phase, an image or a frame is grabbed from a real-time video source or webcam. Then the face region is detected using Local SMQT features and Split up SNoW Classifier and after that the detected face is sent for recognition using Backpropagation Neural Network. Feature extraction has been performed on Gray-Scale images of detected faces using Gray-Scale Morphology that are nonlinear and translationinvariant. The feature extraction and classification networks are trained together, allowing the network to simultaneously perform feature extraction and classification. This system performs extremely well under constrained conditions such as gross variation in expression, position, orientation and illumination which are the complications of face recognition.

Keywords : Face Recognition, Real-Time, Artificial Neural Network, Backpropagation, SMQT Features, SNoW Classifier, Gray-Scale Morphology.

I. Introduction

Face is the most precise and extensively used key to a person's identity. Face recognition has attracted perceptible attention in the advancement of human-machine interaction as it provides a natural and efficient way to communicate between humans and machines. In recent years considerable progress has been made in the area of face recognition through which computers can now compete favorably with humans in many face recognition tasks, particularly those in which large databases of faces must be searched. The problem of detecting and recognizing faces in real-time video sequences has become a popular area of research due to emerging applications in humancomputer interface, surveillance systems; secure access control, video conferencing, financial transaction, forensic applications, pedestrian detection, driver alertness monitoring systems, image database management system and so on. The goal of this work is to develop an efficient, real-time face recognition system that would be able to recognize a person as soon as he will be in front of camera.

II. System Architecture

The process of identifying/recognizing a person in this research is based on mainly three phases:

i. Image Acquisition from pc camera.
ii. Face Detection using Local SMQT Features and Split up SNoW Classifier.
iii. Face Recognition,

a) Facial Feature Extraction using Gray-Scale Morphology
b) Classification using Artificial Neural Network.

Internally, all pattern recognition systems have the following processes [1].

1. Image acquisition
2. Image enhancement
3. Image segmentation
4. Feature extraction
5. Neural training and classification
6. Detection/recognition

Since the output of each operation is the input to the next, the functional parts (1-6) must execute in sequence. In our research, Task 4 and 5 are combined. The size of every image (input and output) is to be kept standard so that there is better control and accuracy during matrix computation and parameter training.The project did not work well when it was first created.

There were a lot of tests and changes along the way. At that time, it was decided that as long as we had enough images to give a good training to reveal the mapping structure, we should keep the algorithm and the training data simple. Fig. 1 pictorially describes the whole system.

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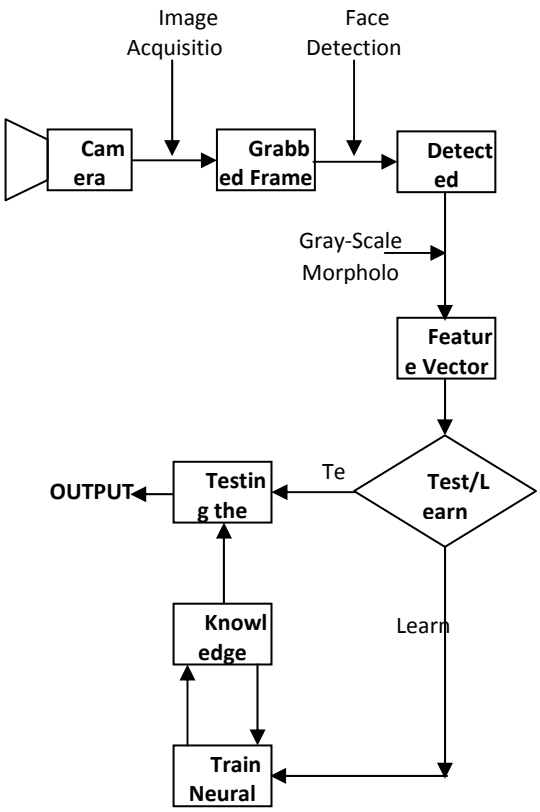

Figure 1 : Our Proposed System.

III. Face Detection Using Local SMQT Features and Splipt up SNow Classifier

Pattern recognition in the context of appearance based on face detection can be approached in several ways [5], [6]. Techniques proposed for this task are for example the Neural Network (NN) [7], probabilistic modeling [8], cascade of boosted feature (AdaBoost) [9], Sparse Network of Windows (SNoW) [4], [10], combination of AdaBoost and SNoW [11] and the Support Vector Machine (SVM) [12]. We used a framework for face detection which is proposed using illumination insensitive features gained from the local SMQT features and rapid detection is achieved by the split up SNoW classifier. SMQT (The Successive Mean Quantization Transform) [4] is used for automatic enhancement of gray-scale images. The SMQT enhanced image histogram retains the basic shape of the original but stretches it to explore the whole dynamic range. Hence, the SMQT adapts the shape of the histogram by performing a nonlinear stretch. The nonlinear properties of the SMQT will yield a balanced stretch of the histogram which shows in Fig. 2.

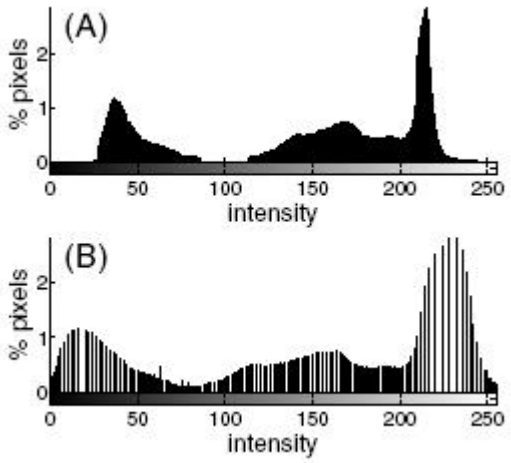

Figure 2 : (A) Original Image Histogram. (B) SMQT Enhanced Image Histogram.

The SNoW learning architecture is a multi-class classifier that is specifically tailored for large scale learning tasks and for domains in which the potential number of features taking part in decisions is very large. With the SNoW and the split up SNoW classifier, a pre trained lookup table searched for face. Overlapped detections are pruned using geometrical location and classification scores. Each detection is tested against all other detections. If one of the area overlap ratio is over a fixed threshold, then the different detections are considered to belong to the same face. Given that two detections overlap each other, the detection with the highest classification score is kept and the other one is removed. This procedure is repeated until no more overlapping detections are found.

IV. Facial Feature Extraction Using Gray-Scale Morphology

Morphological operation [2], [14] is used as a tool for extracting image components that are useful in the representation and description of region shape namely, boundaries, skeletons, and the convex hull.

Morphological processes have nonlinear and translation-invariant properties [2], while neural networks have good generalization capabilities [3]. Therefore our system is a heterogeneous network that produces highorder features based on local features extracted by morphological operations. Information obtained by mathematical morphology is highly dependent on structuring elements or kernels [2].

In its initial stage, we performed a combination of grayscale erosion and dilation known as the hit-miss transform [14]. Each input image was eroded by a hit structuring element and dilated by a miss structuring element separately. Both outputs are then deducted to derive their overlapping difference. The result from this process forms the feature map shows in Fig. 3, which becomes the direct input to a Backpropagation network [3]. The network can have one or more layers, and each layer can also have one or more feature maps.

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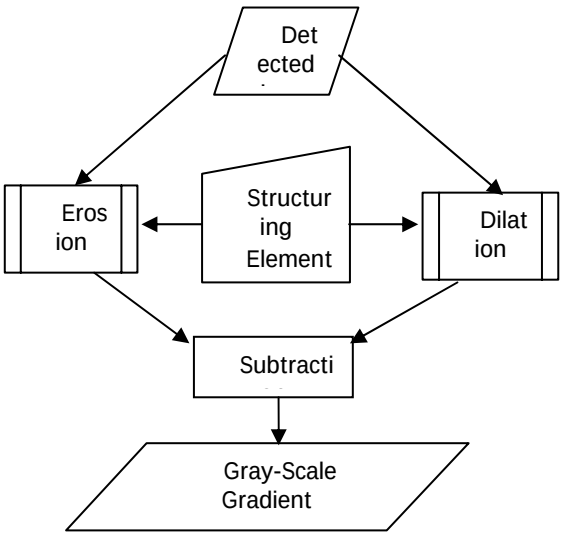

Figure 3 : Diagram of feature extraction.

Morphology [1] is a tool for extracting image components that are useful in the representation and description of region shape, such as boundaries, skeletons, and the convex hull. It is about adding or removing pixels from a binary image according to certain rules depending on neighborhood patterns. Dilation, erosion, closing, and opening are the more common morphological operations. As the names indicate, a dilation operation enlarges a region, while erosion makes it smaller [2].

The dilation and erosion which for gray-scale images are defined in terms of minima and maxima of pixel neighborhoods.

The gray-scale dilation of f by structuring element b, denoted $f \oplus b$, is defined as

$$(f \oplus b)(x,y) = \max\{ f(x-x', y-y') + b(x', y') \mid (x', y') \in D_b \}$$

Where D_b is the domain of b and $f(x, y)$ is assumed to equal $-\infty$ outside the domain of f. In practice grayscale dilation usually is performed using flat structuring elements in which the value (height) of b is 0, and then the simplified gray-scale dilation is,

$$(f \oplus b)(x,y) = \max\{ f(x-x', y-y') \mid (x', y') \in D_b \}$$

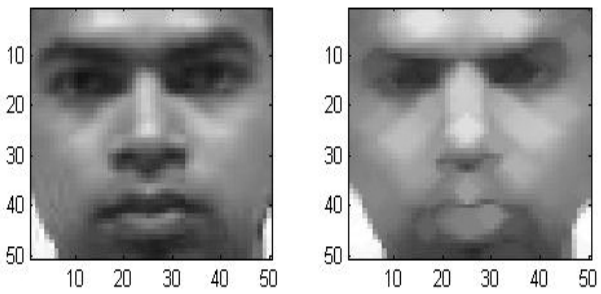

Figure 4 : (A) Original Face. (B) Dilated Image.

The gray-scale erosion of f by structuring element b, denoted $f \Theta b$, is defined as

$$(f \Theta b)(x,y) = \min\{ f(x+x', y+y') - b(x', y') \mid (x', y') \in D_b \}$$

Where Db is the domain of b and f(x, y) is assumed to equal $+\infty$ outside the domain of f. In practice grayscale dilation usually is performed using flat structuring elements in which the value (height) of b is 0, and then the simplified gray-scale dilation is,

$$(f \Theta b)(x,y) = \min\{ f(x+x', y+y') \mid (x', y') \in D_b \}$$

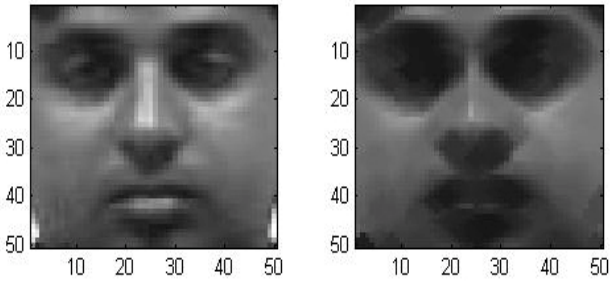

Figure 5: (A) Original Image. (B) Eroded Image.

Dilation and erosion can be combined to achieve a variety of effects. For instance, subtracting an eroded image from its dilated version produces a "morphological gradient" which is a measure of local gray level variation in the image and which is shown in Fig. 6.

Morphological gradient = $(f \oplus b) - (f \Theta b)$

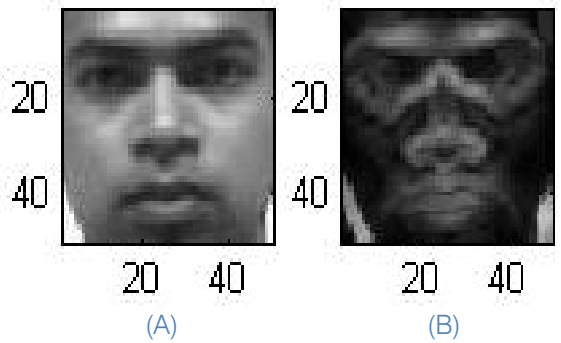

Figure 6: (A) Original Face. (B) Morphological Gradient Face .

V. Face Recognition Using Artificial Neural Network

A Neural Network based face recognition system is used for recognizing front-view face images [4]. The standard backpropagation algorithm is redesigned with multiple hidden layers to simultaneously perform hitmiss transformation, train, and classify features within the same iteration. The recognized image

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is determined by the corresponding output value that lies within a certain threshold.

There are virtually no tools to help us select an appropriate architecture and learning parameters for a neural network. In most cases, learning parameters are determined by experience or based on the trial and error method [3]. We may work both ways to select our best set of parameters:

a. Start from a large network and successively remove some neurons and links until network performance degrades.
b. Start with a small network and introduce new neurons until performance is satisfactory.

Our proposed system is special because it has an extra network stage that depends on structuring elements to extract features. Feature extraction is performed over the entire image as well as its sub image in separate networks. We found that besides gray-level shifts, Won [13] and Skubic [14] were also concerned with the sensitivity of network performance to the size of the structuring element. We use the size of structure element is 2, it can be varied 1 to 3 but by testing we found that size of 2 is the best for our system.

The complete system can be described in two stages:

1) Learning phase and
2) Testing phase.

In the learning phase, some reference faces are selected to create a knowledge base. Facial images are acquired directly from camera device. The next step is face detection in which face region from a total image is detected. Then the step is preprocessing in which necessary enhancement is applied to improve the quality of images. The next phase is the feature extraction in which face feature is extracted which is the form of 50×50 face image matrix. These features are fed into the neural network for training and after training the weights are saved as knowledge base.

In the testing phase, the system is allowed to recognize an unknown face. In this case, the all steps are done in the same way as in the learning stage before classification. In the phase of classification, the selected features having enough information within it are used to identify each facial image uniquely. This is done by the system using the knowledge base (weights) and extracted features of unknown face as input to the network. At the last step, final decision about the unknown face is taken by comparing the test output with the target defined for each person or class during training phase by specifying a threshold value for deciding 0 or 1 like target digit. Our proposed Backpropagation Network consists of one input layer of 2500 neurons, three hidden layers (855-500-30) and one output layer of 10 neurons. The Fig. 7 shows our proposed Network:

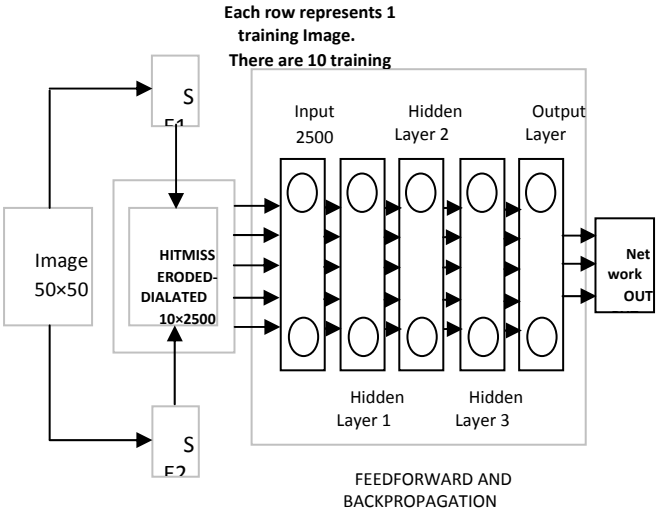
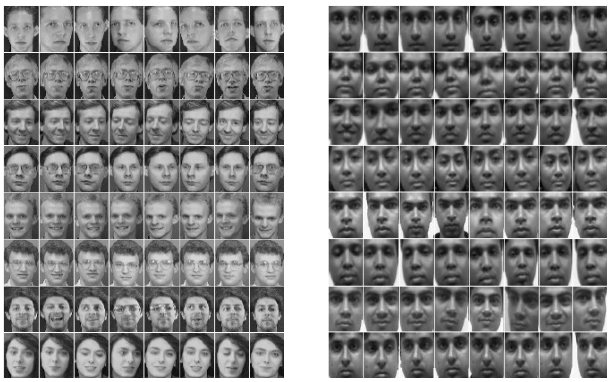


Figure 7 : Our Proposed Backpropagation Neural Network.

VI. Result and Discussion

At first to check the reliability of the system we use offline testing using ORL (Olivetti Research Laboratory) database [15] as well as our locally created database (Fig. 8), where the recognition rate was approximately 98% and 94% respectively.

This rate of accuracy can be made high if the number iteration of backpropagation is 20000 or more. This accuracy also extensively depends on the sensing devices or camera and lighting conditions. If high quality camera is used and approximately constant lighting system can be managed then the recognition rate will increase.



(A) (B)

Figure 8 : (A) ORL Database. (Olivetti Research Laboratory) (B) Locally Created Database (Automatically Cropped by Face Detection Phase).

Finally, an attempt was made to recognize Human Faces using online interface, where as soon as any person present himself in front of the camera, the result of recognition procedure will be shown almost simultaneously frame by frame. For the online purpose we strictly try to reduce false recognition rather than

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unrecognizing. Due to the use of very high threshold (0.98) on the test output the chance of appearing false recognizing result is reduced but the rate of showing unrecognizing result was going high.

VII. Concluding Remarks

This system works predictably and fairly reliably. A face recognition system must be able to recognize a face in many different imaging situations. The appearance of a face in a 2D image is not only influenced by its identity but by other variables such as brightness, dimension and direction of face in photo. We have tested our project for slightly different directions. The performance of our online system heavily depends on the learning phase. With the increase of the number of faces per person of varying different directions and illuminations in the training phase, the result of recognition appearing more accurate. Our future work includes developing a new algorithm which will eliminate the drawbacks of this system by enhancing the capacity of the face database. For this purpose Clustered Network can be implemented.

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Capacitance-Voltage characteristics of nanowire trigate MOSFET considering wave function penetration

By Md. Alamgir Hossain, Arif Mahmud, Mahfuzul Haque Chowdhury, Md. Mijanur Rahman

Dhaka University of Engineering & Technology

Abstract - Capacitance is the heart of MOSFET because of its application in the real life. Capacitance indicates switching speed of the MOSFET. It is our goal to minimize capacitance as possible as we can in MOSFET. Due to our necessary to compact the Integrated Circuit as possible as we can for getting small electronics devices. Capacitance determine the speed of the IC. Every engineer in this section should know capacitance of his implementing device MOSFET to get exert result from this device. Whenever we deal with 10X10 nm scale or less device of MOSFET. We must be concerned the effect of wave function penetration into device in this stage classical mechanics fails to describe exact result of the system because electron can move in only one direction (say x) where in 3Dimention, it cannot move in other two direction (y, z). i.e. confined in two direction which is not predictable by classical mechanics here quantum mechanics (QM) gives better solution of this problem. Therefore we consider QM in our study. Here we presented how wave function play vital role when you consider small area of trigate MOSFET. This result will be helpful when you are determining capacitance of trigate MOSFET.

Keywords : *Trigate MOSFET, wavefunction penetration, classical mechanics.*

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Capacitance-Voltage characteristics of nanowire trigate MOSFET considering wave function penetration

Md. Alamgir Hossain[α], Arif Mahmud[σ], Mahfuzul Haque Chowdhury[ρ], Md. Mijanur Rahman[ω]

Abstract - Capacitance is the heart of MOSFET because of its application in the real life. Capacitance indicates switching speed of the MOSFET. It is our goal to minimize capacitance as possible as we can in MOSFET. Due to our necessary to compact the Integrated Circuit as possible as we can for getting small electronics devices. Capacitance determine the speed of the IC. Every engineer in this section should know capacitance of his implementing device MOSFET to get exert result from this device. Whenever we deal with 10X10 nm scale or less device of MOSFET. We must be concerned the effect of wave function penetration into device in this stage classical mechanics fails to describe exact result of the system because electron can move in only one direction (say x) where in 3Dimention, it cannot move in other two direction (y, z). i.e. confined in two direction which is not predictable by classical mechanics here quantum mechanics (QM) gives better solution of this problem. Therefore we consider QM in our study. Here we presented how wave function play vital role when you consider small area of trigate MOSFET. This result will be helpful when you are determining capacitance of trigate MOSFET.

Keyword : Trigate MOSFET, wavefunction penetration, classical mechanics

I. Introduction

Trigate is a new technology which controls gate current using three wing around silicon dioxide of MOSFET. This device is called nanowire when its gate length is less than 100nm. Wave function penetration becomes vital role when cross section area of silicon of MOSFET becomes less than 10x10nm. We will consider 7x7 nm cross section area of silicon and channel length will be 20nm. Which is shown in figure(1). We also consider SiO_2 as insulator and Aluminum as electrode in our experiment. It is necessary to know the capacitance-voltage characteristics of trigate MOSFET whenever we implement this type of MOSFET. As transistor per chip is reducing day by day so we have to consider quantum mechanics not classical mechanics because quantum mechanics give actual probability of C-V characteristics than classical mechanics. To get actual result from quantum mechanics we used here self –consistent of Schrödinger-Poisson's solver. Capacitance has mainly three region 1) accumulation region 2) depletion region and 3) inversion region. Actually inversion layer becomes volume inversion in our selected area this is cause of quantum effect.

II. Theory

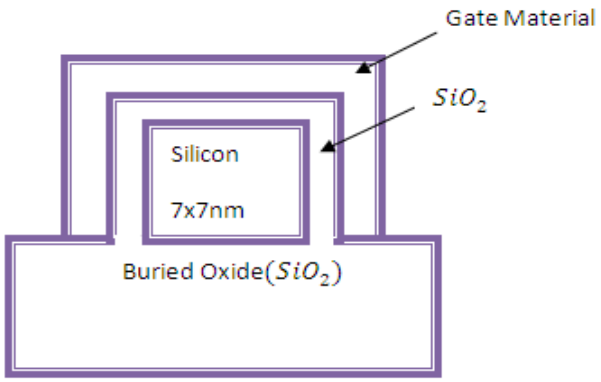

Figure1 : Cross section area of trigate MOSFET.

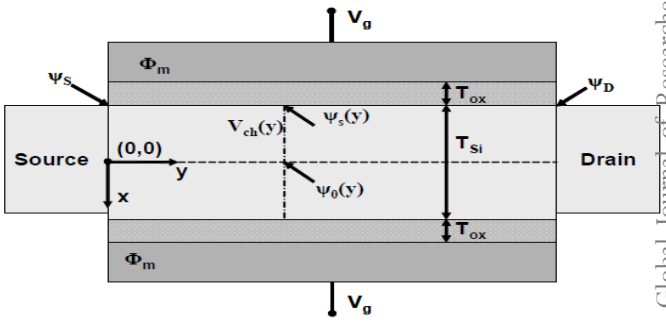

Figure 2 : Schematic of the symmetric common-gate DG-FET under study.

The I-V model is adequate only for describing the DC behavior but for transient description the capacitances are absolutely essential. The intrinsic capacitances of the transistor are derived from the terminal charges. The charge on the top and bottom gate electrodes is equal to total charge in the body. The total charge is computed by integrating the charge

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along the channel since the two gates are electrically interconnected, we have

$$Q_g = 2WC_{ox}\int_0^L \left(V_g - V_{fb} - \psi_s(y)\right)\cdot dy \quad (1)$$

Where

Qg = the charge on the electrically interconnected gate.

ψs(y)=surface potential as a function of the position y along the length of the transistor.

The inversion charge in the body is divided between the source and drain terminals using the Ward-Dutton charge partition approach [1].

The charge on source terminal (Qs) is:

$$Q_s = -2WC_{ox}\int_0^L \left(1-\frac{y}{L}\right)\cdot\left(V_g - V_{fb} - \psi_s(y) - \frac{Q_{bulk}}{C_{ox}}\right)\cdot dy \quad (2)$$

Where

Vg = the gate voltage.

Qbulk =bulk charge=$\sqrt{2q\varepsilon_{Si}N_A\psi_{pert}}$

ψpert =perturbation potential.

Vfb= the flat band voltage.

Using charge conservation, the charge on drain terminal (Qd) can be expressed as:

$$Q_d = -2WC_{ox}\int_0^L \frac{y}{L}\cdot\left(V_g - V_{fb} - \psi_s(y) - \frac{Q_{bulk}}{C_{ox}}\right)\cdot dy \quad (3)$$

The surface potential as a function of the position y along the length of the transistor (ψs(y)) is obtained using current continuity. Current continuity states that the current is conserved all along the length of the transistor.

$$I_d(L) = I_d(y) \quad \text{where} \quad 0 \le y \le L$$

ψs(y) can be related to ψS and ψD by

$$\frac{y}{L}\cdot(B-\psi_S-\psi_D)(\psi_D-\psi_S) = (B-\psi_S-\psi_s(y))(\psi_s(y)-\psi_S)$$

where

$$B = 2\left(V_g - V_{fb} - Q_{bulk}/C_{ox} + 2kT/q\right)$$

ψD= the surface potential at the drained .

ψS = Surface potential at source terminal.

$$\psi_s = 2\frac{kT}{q}\left(\ln(\beta) - \ln(\cos(\beta)) + \ln\left(\frac{2}{T_{Si}}\sqrt{\frac{2\varepsilon_{Si}kTN_A}{qn_i^2}}\right)\right) + \psi_{pert}$$

Where

$$\beta = \frac{T_{Si}}{2}\sqrt{\frac{q^2}{2\varepsilon_{Si}kT}\frac{n_i^2}{N_A}e^{\frac{q(\psi_0(y)-V_{ch}(y))}{kT}}}$$

Where

Vch(y)=the channel potential.

ψ0(y) = the potential at the center of the body.

The terminal charges are obtained by substituting ψs(y) in Eqs. (1-3) and evaluating the integrals

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$$Q_g = 2WLC_{ox}\left(V_{gs} - V_{fb} - \frac{\psi_S + \psi_D}{2} + \frac{(\psi_D - \psi_S)^2}{6(B - \psi_D - \psi_S)}\right)$$

$$Q_d = -2WLC_{ox}\left(\frac{V_{gs} - V_{fb} - Q_{bulk}/C_{ox}}{2} - \frac{\psi_S + \psi_D}{4} + \frac{(\psi_D - \psi_S)^2}{60(B - \psi_D - \psi_S)} + \frac{(5B - 4\psi_D - 6\psi_S)(B - 2\psi_D)(\psi_S - \psi_D)}{60(B - \psi_D - \psi_S)^2}\right) \quad (4)$$

$$Q_s = -(Q_{fg} + Q_{bg} + Q_{bulk} + Q_d)$$

The expressions for terminal charges are continuous and are valid over sub-threshold, linear and saturation regimes of operation. The terminal charges are used as state variables in the circuit simulation. All the capacitances are derived from the terminal charges to ensure charge conservation. The capacitances are defined as:

$$C_{ij} = \frac{\partial Q_i}{\partial V_j} \quad (5)$$

Where, i and j denote the multi-gate FET terminals. Note that Cij satisfies

$$\sum_i C_{ij} = \sum_j C_{ij} = 0 \quad (6)$$

Effect of Quantum mechanics on capacitances

Using a self-consistent Schrodinger–Poisson solver, we can analyze the effect of wave function penetration on the capacitance. The study reveals that accounting for wave function penetration into the gate dielectric causes carrier profile to be shifted closer to the gate dielectric reducing the electrical oxide thickness. This shift increases with increasing gate voltage. This shifting results in an increased capacitance.

It is well known that direct tunneling currents become significant in this regime and that the penetration of the wave function cannot be neglected [2]–[3], the capacitance of NMOS capacitors in the inversion region accounting for wave function penetration into the gate dielectric. The physical basis has been presented in [4] and [5].

In this work, the Schrodinger and Poisson equations are solved self consistently assuming that the wave function penetrates the gate dielectric. The wave function is assumed to go to zero at some point deep inside the substrate, while a traveling wave boundary condition is imposed at the gate dielectric-gate electrode interface. The wave function inside the gate dielectric is connected to the asymptotic wave function in the gate electrode using the quantum transmitting boundary method [6].

The gate capacitance under strong-inversion conditions can be described by the equivalent circuit shown in Figure 3 consisting of the oxide capacitance *C*ox and the inversion-layer capacitance *C*inv [7], [8]. The latter includes the contributions of both the electrostatic capacitance *C*es,Si and the quantum capacitance *Cq*[9] of the inversion layer. While *C*es,Si is related to the average distance of the channel electrons from the Si/SiO2 interface, *Cq* is related to the density of states (DOS) in the inversion layer.

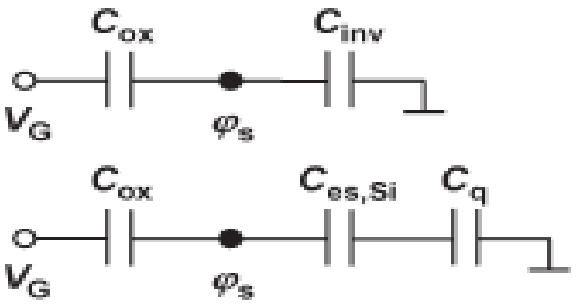

Figure 3 : Equivalent circuit for the gate capacitance in silicon MOS structures

Where

Cq=quantum capacitance.

Ces,si= electrostatic capacitance.

Cox= oxide capacitance .

Cinv= inversion-layer capacitance.

III. Result and Discussion

In the text [2], Schrodinger's equation has been solved by forcing the wave function to zero at the dielectric-gate electrode boundary.

The C-V characteristics have come by solving Schrodinger-Poisson equation. These figure indicate that how wave function penetration play vital role in the case of small thickness of oxide. In our simulation we present wave function penetration in the gate electrode rather than classical mechanics.

The *C–V* calculated assuming such a border condition differs by an immaterial quantity from the *C–V* calculated by letting the wave function penetrate into the gate electrode.

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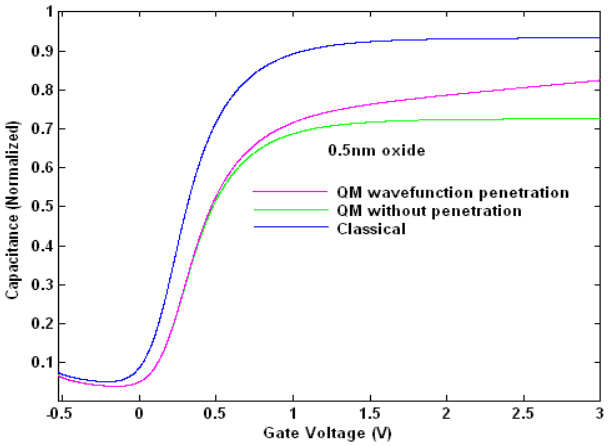

Figure 4 : Normalized classical and quantum mechanical capacitance obtained with and without wave function penetration for 0.5 nm oxide capacitor.

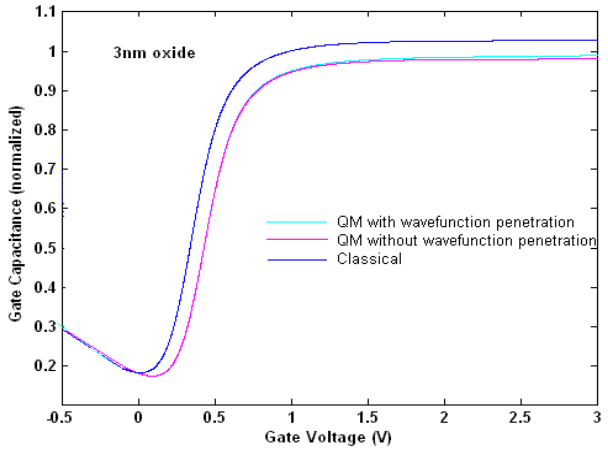

Figure 5 : Normalized classical and quantum mechanical capacitance obtained with and without wave function penetration for 3 nm oxide capacitor.

The classical and quantum-mechanical C–V individuality with and without wave function penetration for a metal–SiO_2 –Si system of gate oxide thicknesses 0.5 nm and 3.0 nm are exposed in Figs. 4 and 5 correspondingly. The capacitances are normalized to the strong inversion.

Classical capacitance values to help comprehend the impact of accounting for wave function penetration. It can be undoubtedly seen that the impact is larger for the 0.5 nm gate oxide case. There are two effects that contribute to the considerably superior impact for the 0.5 nm case. They are

1) the field across the 3 nm gate oxide device is weaker than the field across the 0.5 nm device and
2) the percentage contribution of the shift of the wave function closer to the interface is larger for the 0.5 nm gate oxide device the impact of this shift would be larger for the thinner oxide case.

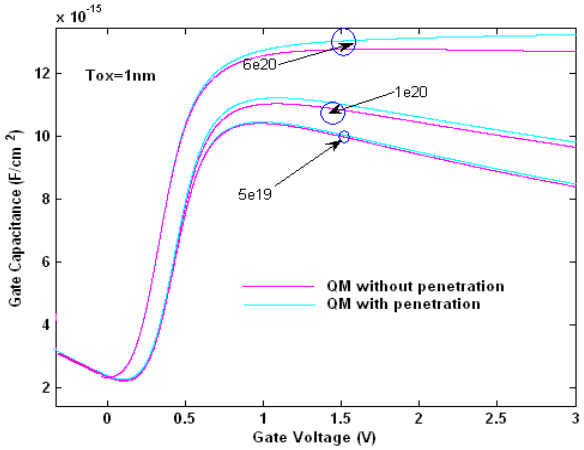

Figure 6 : Capacitance values for a 1.0 nm gate oxide capacitor with different doping with and without wave function penetration.

The C–V simulations discussed thus far were performed on devices with a metal gate. However, despite detrimental effects, poly silicon is still being used as the gate electrode. Hence, simulations were also performed with poly silicon replacing the metal as the gate electrode. The simulation results (Figure 6) show that the wave function shift in the wave function influences the C–V significantly only for poly doping of greater than 1×10^{20} cm. This seems to indicate that the poly-depletion effect dominates over the shift effect due to wave function penetration and the models developed so far seem sufficient. It must, however, be pointed out that as the devices are scaled down to sub-20 nm gate lengths, metal gate electrodes will have to be used to obtain lower effective oxide thicknesses and higher capacitance values. Thus when metal gate electrodes are used the effect of wave function penetration will have to be considered.

Accounting for wave function penetration into the gate electrode causes a shift in the wave function closer to the interface, the more so the greater the voltage. This bias dependent shift results in a lower electrical oxide thickness and hence higher gate capacitance. The poly depletion effect is dominant over the wave function penetration effect. However, this effect is significant when highly doped poly silicon gates are used and will become significant when metal gate electrodes are used and the oxide thickness is reduced.

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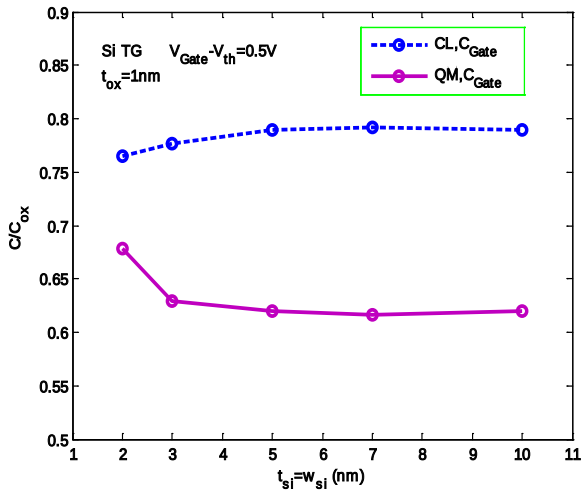

Figure 7 : C_{ox} in series and C_q and gate capacitance normalized to the C_{ox} of trigate MOS structures as a function of the silicon cross section. (Full symbols) Quantum–mechanical and (open symbols) classical results are compared.

Figure 7: the gate capacitance is shown normalized to C_{ox} , i.e., the maximum achievable capacitance value for every structure, as a function of the silicon size. Both quantum–mechanical and classical results are compared. From Figure 7 a continuous increase in the C_G/C_{ox} ratio can be observed as the channel cross section is scaled below 7 nm x 7 nm. We have actually observed an increase in the C_G/C_{ox} ratio when the channel cross section is scaled below 7 nm x 7 nm. We have related this to quantum effects since no increase in C_G/C_{ox} has been observed from classical calculations. The gate capacitance of trigate MOS structures is affected by quantum effects mainly via the spatial electron distribution. The quantum effects on C_q have been found to be less important for the gate capacitance except for very small cross sections in the order of 2 nm x 2 nm.

IV. Conclusion

A comprehensive analysis of the effects of wave function penetration on the capacitance of NMOS capacitors has been performed. The study reveals that accounting for wave function penetration into the gate dielectric causes carrier profile to be shifted closer to the gate dielectric reducing the electrical oxide thickness. This shift increases with increasing gate voltage. In our work we present Capacitance-Voltage characteristics of Trigate MOSFET considering wave function penetration which is necessary for implementing Integrated Circuit in real life. We hope it will be helpful instrument for working in practical life.

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Dispersion Compensation in Optical Fiber Communication Using Fiber Bragg Grating

By Md. Jahidul Islam, Md. Saiful Islam, Md. Mahmudur Rahman
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Abstract - Optical fiber is one of the most important communications media in communication system. Due to its versatile advantages and negligible transmission loss it is used in high speed data transmission. Although optical fiber communication has a lot of advantages, dispersion is the main performance limiting factor. Dispersion severely degrades the performance of optical fiber. There are various methods for dispersion compensation. Due to some superior advantages Fiber Bragg Grating is a well known hot cake in the field of dispersion compensation in optical fiber communication. Generally Fiber Bragg Grating has a very narrow operating window. An effective method for broadening the window of Fiber Bragg grating is shown in this thesis work, which gives a satisfactory operating window. In this thesis paper a typical MATLAB simulation work is done to compensate dispersion up to a fiber length of 300 Km.

Keywords : Dispersion, Fiber Bragg Grating, Pulse Broadening Characteristics, Window Broadening, Dispersion compensation.

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Dispersion Compensation in Optical Fiber Communication Using Fiber Bragg Grating

Md. Jahidul Islam [α], Md. Saiful Islam [σ], Md. Mahmudur Rahman [ρ]

Abstract - Optical fiber is one of the most important communications media in communication system. Due to its versatile advantages and negligible transmission loss it is used in high speed data transmission. Although optical fiber communication has a lot of advantages, dispersion is the main performance limiting factor. Dispersion severely degrades the performance of optical fiber. There are various methods for dispersion compensation. Due to some superior advantages Fiber Bragg Grating is a well known hot cake in the field of dispersion compensation in optical fiber communication. Generally Fiber Bragg Grating has a very narrow operating window. An effective method for broadening the window of Fiber Bragg grating is shown in this thesis work, which gives a satisfactory operating window. In this thesis paper a typical MATLAB simulation work is done to compensate dispersion up to a fiber length of 300 Km.

Index Terms : Dispersion, Fiber Bragg Grating, Pulse Broadening Characteristics, Window Broadening, Dispersion compensation.

I. Introduction

Dispersion is the main performance limiting factor in optical fiber communication. Dispersion greatly hampers the performance of optical fiber communication. Due to dispersion, broadens optical pulse as they travel in single mode fiber. Limiting the ultimate data rate supported by fiber which causes spreading and overlapping of chips and degrades system performance due to increase inter chip interference and reduced received optical power. So if dispersion can be minimized then a further performance can be obtained from optical fiber communication. There are a lot of methods of dispersion compensation. Fiber Bragg Grating is one of these.

When a pulse travels through an optical fiber due to dispersion it becomes broadened. The dispersion is proportional to the length of the fiber. If the length is increased the width becomes bulk and the magnitude reduces. We tested here for the length up to 700 km using interval of 100 km. For uniform grating period in reflectivity vs. detuning curve the window width increases with increase of coupling constant. In our thesis work we varied the value of coupling constant from one to six with interval one. We tested a Gaussian pulse passing through an optical fiber from one hundred to three hundred km long with an interval of fifty km with Fiber Bragg Grating and without Fiber Bragg Grating at receiving end. The performance we measured as dispersion with lengths when the Gaussian pulse travels through Fiber Bragg Grating and without Fiber Bragg Grating. Fiber Bragg gratings are created by "inscribing" or "writing" the periodic variation of refractive index into the core of a special type of optical fiber using an intense ultraviolet (UV) source such as a UV laser. Two main processes are used: interference and masking. Which is best depends on the type of grating to be manufactured. A special germanium-doped silica fiber is used in the manufacture of fiber Bragg gratings. The germanium-doped fiber is photosensitive, in that the refractive index of the core changes with exposure to UV light, with the amount of the change a function of the intensity and duration of the exposure. The first in-fiber Bragg grating was demonstrated by Hill in 1978. Initially, the gratings were fabricated using a visible laser propagating along the fiber core. In 1989, Meltz and colleagues demonstrated the modern transverse holographic technique from the side of the fiber utilizing the interference pattern of ultraviolet light.

II. Pulse Broadening Characteristics

We have used a super-Gaussian pulse whose RMS pulse width after transmission in a dispersive medium is given analytically. Its RMS width c normalized by initial RMS width 00 is given by, shown at the end of this paragraph, where r is the Gamma function. We have defined to = 1/(k . B), where B is the bit rate, k = 1.665 for m = 1 and 1.825 for m = 2 and LD= t_0^2 /|β2| is the dispersion length, so that FWHM of the pulse equals l/B. The equation of the broadening factor is shown in below

$$\frac{\sigma}{\sigma_0}=\sqrt{1-\frac{\Gamma(1/2m)}{\Gamma(3/2m)}\frac{\alpha\beta_2 L}{t_0^2}+\frac{\Gamma(2-1/2m)}{\Gamma(3/2m)}\frac{(1+\alpha^2)(m\beta_2 L)^2}{t_0^4}}$$

$$\frac{\sigma}{\sigma_0}=\sqrt{1-\frac{\Gamma(1/2m)}{\Gamma(3/2m)}\frac{\alpha\beta_2 L}{t_0^2}+\frac{\Gamma(2-1/2m)}{\Gamma(3/2m)}\frac{(1+\alpha^2)(m\beta_2 L)^2}{t_0^4}}$$

The variation of the broadening factor with respect to distance is shown in figure below

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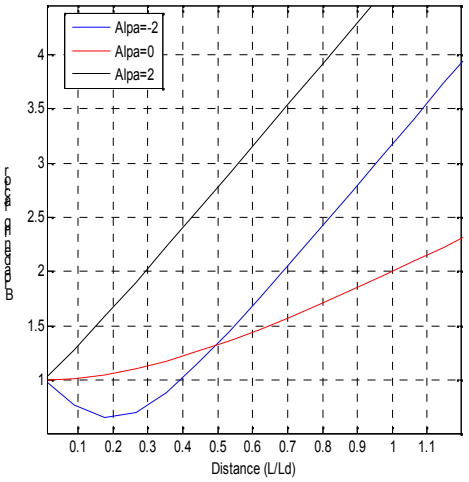

Fig 2.1: Variation of broadening factor with propagating distance for Gaussian input pulse when $\beta 2 < 0$.

From the Fig 2.1 we see that the broadening increases linearly for positive value of alpha. The level of the broadening factor is minimum when distance L/LD =0.2 and α= -2. The variation of the broadening factor with respect to α is shown in figure below

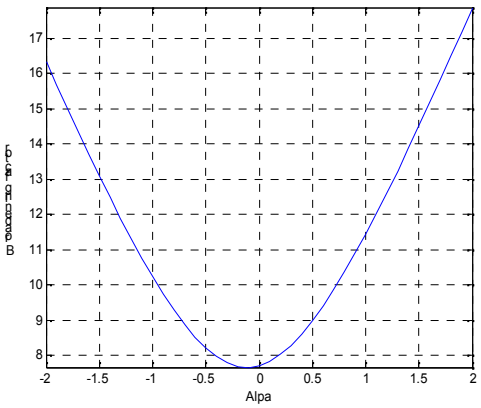

Fig 2.2 : Variation of broadening factor with α for Gaussian input pulse when $\beta_2 < 0$.

From Fig3.6.2 we see that with the increase of the positive value of α, the broadening increases. Also with the increase of the negative value of α, the broadening also increases. The broadening is minimum when α= 0.

III. Effect of the Length of the Fiber only Considering the Dispersion

The fiber dispersion index is directly proportional to the length of the fiber. With increasing the length of the fiber dispersion index also increases. The effect of the fiber length under transmitted data through the fiber are given below

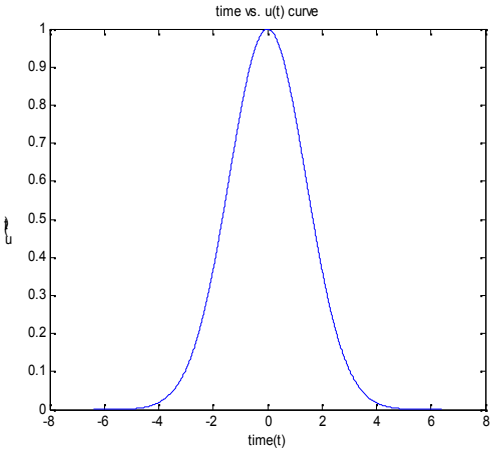

Figure 3.1 : Input data as a Gaussian Pulse

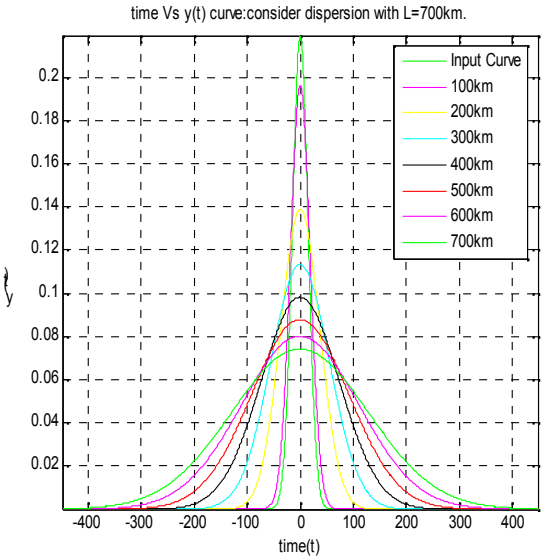

Fig 3.2 : Graphical representation of the effect of the fiber length in presence of dispersion of the transmitted signal when input data is a Gaussian pulse, bit rate B=10 Gbps, wavelength λ= 1.55μm.With increase in the length of the fiber broadening of the pulse will be increased. By MATLAB simulator, it is shown that above 700 km pulse broadening increases severely.

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IV. Window Broadening Characteristics for Uniform Period Grating

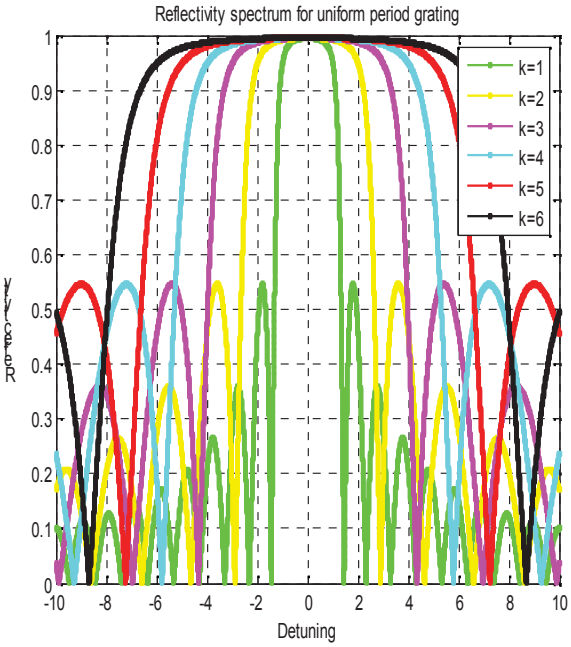

Figure 4.1 : Reflectivity of six gratings with coupling constants KL =1 to 6, as a function of normalized detuning. For KLg=1(green), KLG=2(yellow),KLg=3 (magenta) , kLg=4(cyan) ,KLg=5(red) ,KLg=6(black) .The side-mode structure increases rapidly for stronger gratings.

V. Dispersion Compensation

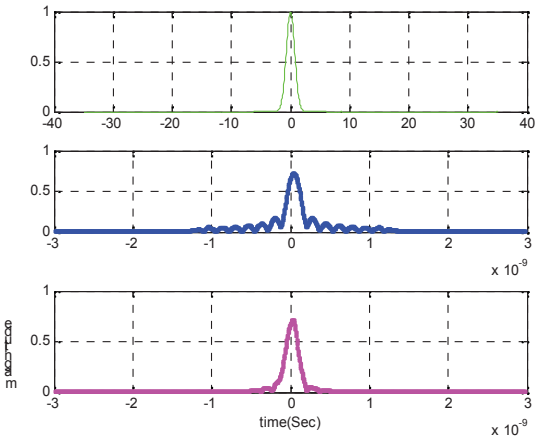

Figure 5.1 : Shows that the input data as a Gaussian pulse of bit rate B=10Gbps and wavelength **λ= 1.55μm** (Green figure), for 100 km length of fiber, Gaussian pulse after travelling through optical fiber without passing through Fiber Bragg Grating (Deep blue figure),Gaussian pulse after travelling through optical fiber and Fiber Bragg Grating (Magenta figure),

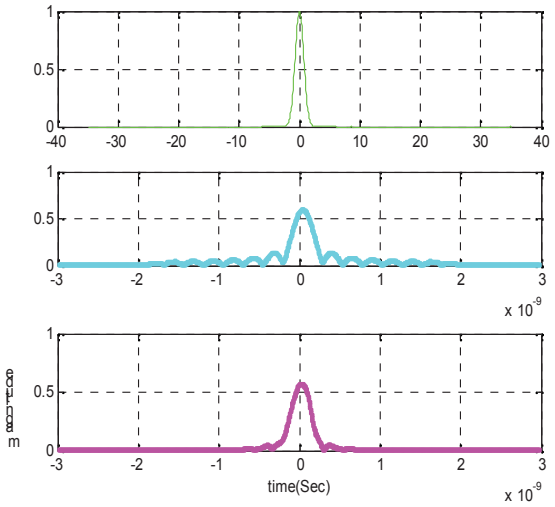

Figure 5.2 : Shows that the input data as a Gaussian pulse of bit rate B=10Gbps and wavelength **λ= 1.55μm** (Green figure), for 150 km length of fiber, Gaussian pulse after travelling through optical fiber without passing through Fiber Bragg Grating (cyan figure), Gaussian pulse after travelling through optical fiber and Fiber Bragg Grating (Magenta figure),

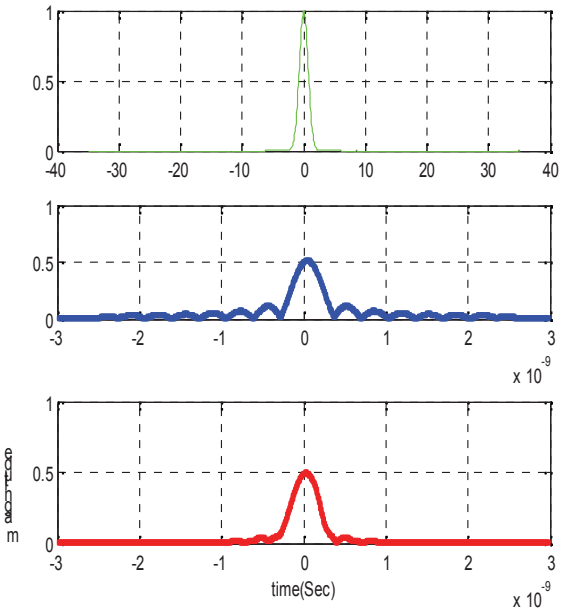

Figure 5.3 : Shows that the input data as a Gaussian pulse of bit rate B=10Gbps and wavelength **λ= 1.55μm** (Green figure), for 200 km length of fiber, Gaussian pulse after travelling through optical fiber without passing through Fiber Bragg Grating (Deep blue figure), Gaussian pulse after travelling through optical fiber and Fiber Bragg Grating (Deep red figure),

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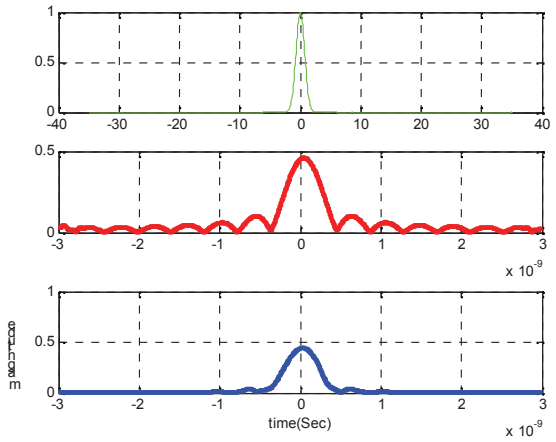

Figure 5.4 : Shows that the input data as a Gaussian pulse of bit rate B=10Gbps and wavelength λ= 1.55μm (Green figure), for 250 km length of fiber,Gaussian pulse after travelling through optical fiber without passing through Fiber Bragg Grating (Deep red figure), Gaussian pulse after travelling through optical fiber and Fiber Bragg Grating (Deep blue figure),

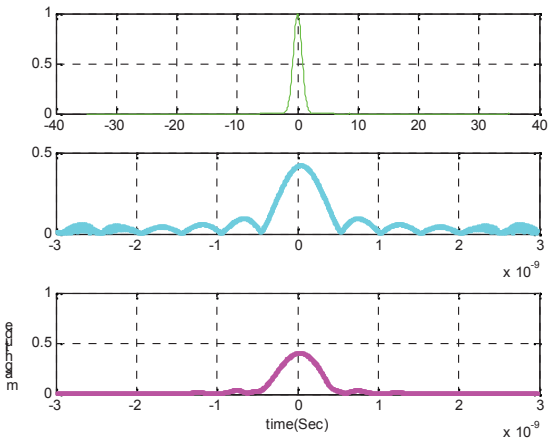

Figure 5.5 : Shows that the input data as a Gaussian pulse of bit rate B=10Gbps and wavelength λ= 1.55μm (Green figure), for 300 km length of fiber, Gaussian pulse after travelling through optical fiber without passing through Fiber Bragg Grating (cyan figure),Gaussian pulse after travelling through optical fiber and Fiber Bragg Grating (Magenta figure),

VI. Measurement of Dispersion and Comparison

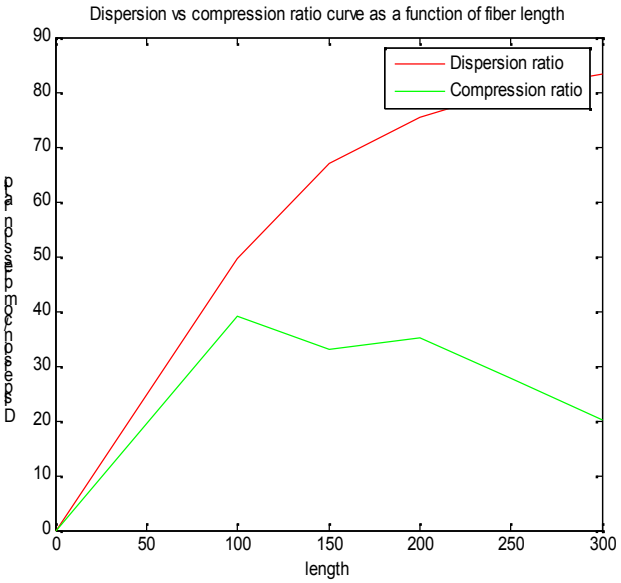

Figure 6.1 : Dispersion Vs Compression ratio curve as a function of fiber length without FBG (red curve) after FBG (green curve).

Table : Simulation Results for the FBG dispersion compensation of uniform grating period receiver

Length In Km	Dispersion without compensation (ps/nm/km)	Dispersion after compensation (ps/nm/km)
100	49.5	39
150	66.9	33.1
200	75.5	35.1
250	80.5	27.69
300	83.2	20.23

VII. Conclusion

It is shown in this thesis that the recent advances in Fiber Bragg grating technology now allow the realization of a highperformance, high speed optical fibers with good in line dispersion compensation. The characteristic of optical fiber is analyzed. The dispersion is computed by sending a Gaussian pulse as an input. For 200km length of fiber this is observed that dispersion is approximate 75.5ps/nm/km. This is quite impossible to remove but in our thesis we have succeeded to compensate dispersion up to 33.8 for 150

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Km length of fiber. That's why Fiber Bragg Grating is worthy compensation system in optical fiber communication. A narrow bandwidth is observed for data transmission in Fiber Bragg Grating. This is widened in our thesis at a satisfactory value. But for length more than 300 Km the result is not satisfactory. In this thesis this is resulted that for a length of 500 Km the dispersion compensation is not satisfactory. So the future work of thesis is chosen as to solve the problem using Fiber Bragg Grating beyond 500 Km length of fiber.

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Design and Implementation of Wireless Digital Energy Meter using Microcontroller

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Abstract - This paper presents a micro-controller based wireless digital energy meter to facilitate energy consumption measurement and its corresponding billing scheme. Details of design for the construction of energy meter using (Current transformer, Potential transformer, microcontroller, Atmega 16, LCD, Transmitter, Receiver, and a load). Electricity has become one of the basic requirements of human civilization, being widely used for domestic, industrial and agricultural purposes. At present, the need and demand for electricity requires no special mention. In spite of very well developed sources for electricity, both traditional and alternate versions, there are a lot of problems with distribution, metering and billing of electrical energy and its consumption measurement. The problem worsens further in collecting the meter readings and generating the bill. In this paper, a method of using a wireless digital system for automated transmission of data was utilized to make easy energy consumption measurement and its consequent billing system. If we use this energy meter it will be beneficial for the power energy system. It is very cost effective and effortless to operate.

Keywords : *Current transformer, Potential transformer, microcontroller (Atmega 16), LCD, Transmitter, Receiver.*

GJRE-F Classification: *FOR Code: 090604*

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Design and Implementation of Wireless Digital Energy Meter using Microcontroller

Md. Ashiquzzaman[α], Nadia Afroze [σ], Taufiq Md. Abdullah[α]

Abstract - This paper presents a micro-controller based wireless digital energy meter to facilitate energy consumption measurement and its corresponding billing scheme. Details of design for the construction of energy meter using (Current transformer, Potential transformer, microcontroller, Atmega 16, LCD, Transmitter, Receiver, and a load). Electricity has become one of the basic requirements of human civilization, being widely used for domestic, industrial and agricultural purposes. At present, the need and demand for electricity requires no special mention. In spite of very well developed sources for electricity, both traditional and alternate versions, there are a lot of problems with distribution, metering and billing of electrical energy and its consumption measurement. The problem worsens further in collecting the meter readings and generating the bill. In this paper, a method of using a wireless digital system for automated transmission of data was utilized to make easy energy consumption measurement and its consequent billing system. If we use this energy meter it will be beneficial for the power energy system. It is very cost effective and effortless to operate.

Keywords : Current transformer, Potential transformer, microcontroller (Atmega 16), LCD, Transmitter, Receiver.

I. Introduction

New and advanced technologies are being discovered and implemented every day. Everyday life serves as a testament to this amazing reality. This science depends on thoughts, logic and dedication. Our surroundings buzz with the advent of new technology. In this thesis, a wireless digital energy meter was made that had the capability to measure power consumption. This project was divided into the following parts:

- A burner, via which programs can be burned (i.e. incorporated into) into the working microcontroller (Atmega 16 in this case) was prepared.
- The energy consumption was calculated in Wh (watt-hour) and shown at the subscriber end.
- The Wh value was transmitted, via a wireless medium and the power system was monitored on a computer using custom software.

A basic high level programming language ("C" in this case) was used to write the codes for the operation of the energy meter. The microcontroller was programmed by using the software Code Vision AVR. This project has been field tested several times and was proved to be highly accurate and effective.

This thesis describes one method used to accomplish the above task. It is able to show voltage, current, power factor, power consumption and maximum demand. This thesis also contains the details of the method of UART (universal synchronous receiver/transmitter) communication to transmit the data to the PC. After several attempts, a unique design of this digital energy meter was achieved.

II. Objectives

The objective was to create something that would be helpful to modern civilization and take man a step closer in his endeavor to ease the tasks of routine life. Thus, the idea of making a wireless digital energy meter was born. The main objective of this thesis divides into the following different steps:

- Measurement of current using current transformer.
- Measurement of voltage using potential transformer.
- Measurement of power factor.
- Taking the current, voltage and power factor value as ADC input of the microcontroller (Atmega16) and then calculating Wh.

Efforts were also made to solve the random problems which might occur in real life situations. However, the functional capacity could not be tested in a commercial establishment because of the lack of time. Further work on the improvement of this project, can take this it to a level where it can be industrially viable.

This project "Wireless Digital Energy Meter" consists of the complicated, intricate and elaborate use of electrical and electronic components and coding, with the aim of digitizing and automating the process of electrical energy measurement as far as possible. The project was implemented by using components and software that were available in the market. Analyzing the various methods of implementation of the energy meter, the method described in this thesis was judged to be the best.

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III. Operation and Results

The basic operation of the energy meter is to measure the power consumed in Wh (watt-hour) for a given load. Using the network of all interconnections the current and voltage of the line are obtained from their appropriate transformers.

a) Microcontroller Coding

Microcontroller coding has been done in Code Vision AVR software. At first using the ADC subsystem of the microcontroller, analog data inputs of voltage and current have been taken. Digital value is generated for both the sinusoidal waves of voltage and current. Peak value is monitored only when the wave is at rising period. After that voltage peak is determined and actual voltage value is calculated. Similar procedure is applied for determining current value. After that power factor is calculated. Timer subsystem is used for the calculation of power factor.

After getting all necessary values, the energy consumption is calculated and updated according to the time. After the calculations, energy consumption and maximum demand value is transmitted using wireless transmitter. The procedure is described in Fig. 1. The readings obtained are stepped down as the microcontroller (Atmega 16) has a working voltage of 5V, which, if exceeded will damage it. The current transformer is connected in series and the potential transformer in parallel with the line. From the current transformer, two outputs are taken as inputs of the microcontroller at the ports ADC (1) & ADC (2). They are as follows:

ADC (1): taking current value as input for calculation of power factor

ADC (2): taking current value as input for calculating current rating.

Similarly, from the potential transformer, two outputs are taken as inputs of the microcontroller at the ports ADC (0) & ADC (3):

ADC (0): output of voltage power factor.

ADC (3): output of voltage peak.

Another set of outputs from the potential transformer is also taken as input of a full bridge rectifier to convert 12V AC voltage to a 12V DC voltage. The rectified voltage is then passed through a network of some capacitors, switch, voltage regulator to obtain a voltage of 5V, which is sufficient as the working voltage for the microcontroller and LCD. To convert the 12V DC voltage to a fixed 5V DC voltage, a voltage regulator with a switch was used.

A capacitor bank was used to minimize noise in the output voltage. The block diagrams in Fig. 2 and Fig. 3 show the connections (in a simplified manner) for the operation of the meter, at the transmitter and receiver end respectively.

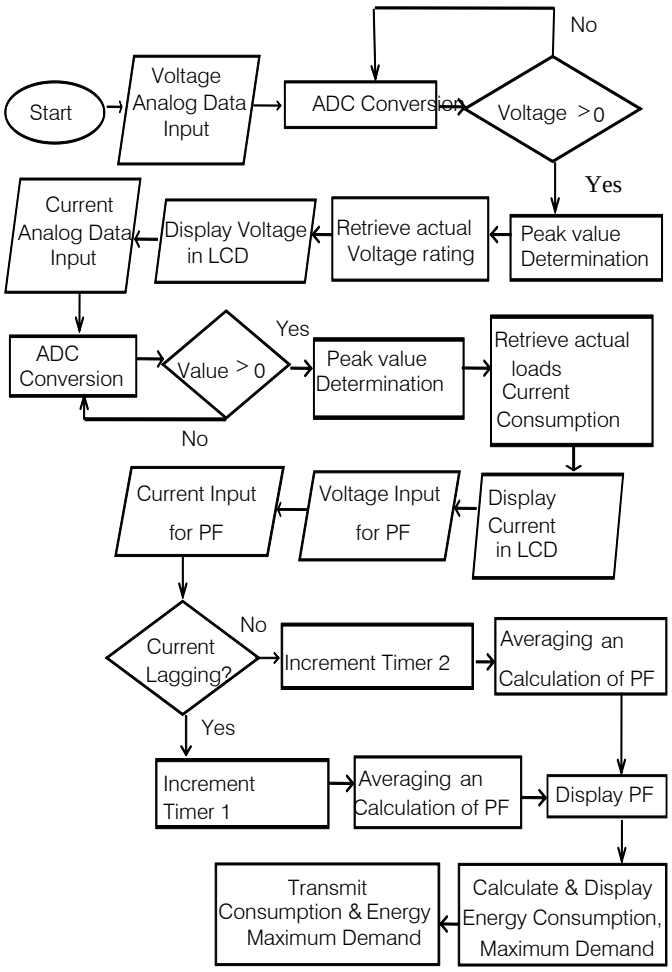

Fig. 1 : Microcontroller programming flowchart.

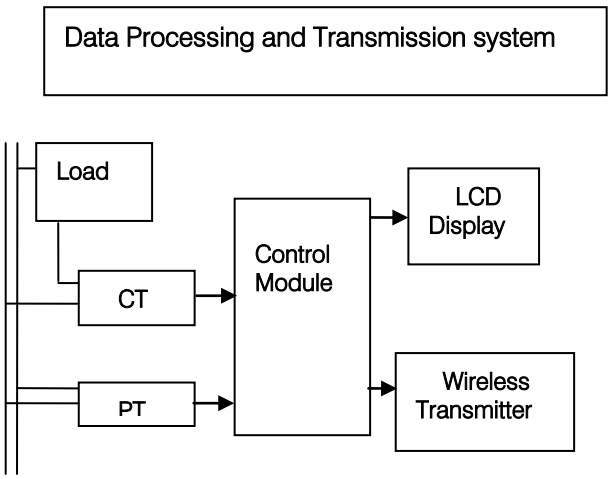

Fig. 2 : Block diagram of the energy meter system showing the subscriber's end.

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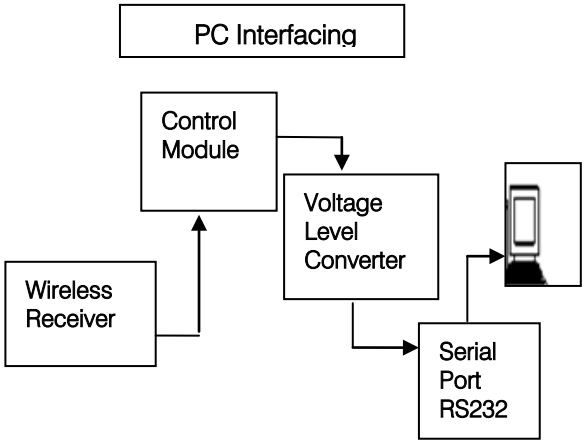

Fig. 3 : Computer interfacing at the receiver end.

b) Determining voltage and current

The ADC subsystem converts the analog signal input of voltage and current to a discrete value [1]. While monitoring the ADC input, for the maximum (peak) value the corresponding actual voltage and current value is calculated by multiplying the discrete value with 0.579 and 0.000925 respectively. To determine the peak value of voltage, output from the PT is connected to a voltage divider circuit which consists of a fixed 10KΩ resistor and a variable resistor. The voltage across the variable resistor is then provided to the ADC (3) pin to calculate the peak value of the voltage. The same strategy is applied in case of determining the peak of the current. For peak value of current, the ADC (2) pin was used.

c) Determining power factor (PF)

For determining the power factor, the ADC subsystem and timer subsystem was used. When the voltage crosses zero from positive to negative, the timer is started and its incremented with a frequency of 31.25KHz (or 32 us).When current crosses zero from positive to negative the timer is stopped. This digital value of the timer is then multiplied with two constant terms to get the actual degree deviation.

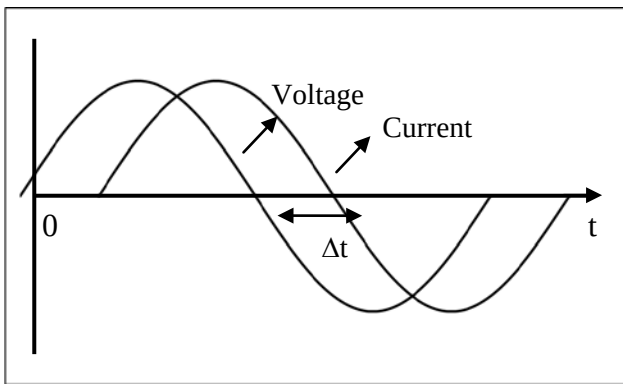

Fig. 4 : Time difference between zero crossing & negative going voltage and current waves.

The desired power is calculated from: $P = VI\cos\theta$ [2]. The value of voltage, current and power factor is displayed in the LCD with a 2 second interval. So about after each 9 seconds we are calculating the power. This time is converted to hour and multiplied with the power value to get the energy consumption.

$$E = P*Time = Watt\text{-}hour \quad [3]$$

The data is transmitted with the transmitter of the wireless transmitter-receiver pair to the PC Interface unit. On that unit, the data is received with the help of the wireless receiver. At the supplier end, the receiver is interfaced with a computer to display the following values:

1. Maximum demand 2. Total energy consumption

d) Experimental values

The values measured for different types of loads during test runs are as follows:

Load	Voltage	Current	Power factor
100W bulb (resistive load)	214.16V	0.42A	1.0
40W tube light (inductive load)	214.23V	0.38A	0.60
100Wbulb+40W tube light	214.81V	0.64A	0.91

Table. 1 : Experimental values for different loads.

The above readings are consistent with known values for these loads.

IV. Computerized Monitoring System

As part of the project, the data received through the serial port needs to be displayed in a computer monitor and a mechanism is required to store the values in a database. For making the monitoring system, Visual Basic 6.0 was used as the IDE (Integrated Design Environment).

a) Visual Basic IDE

Visual Studio 6.0 consists of all necessary components which are called control required for software creation. Some necessary control items that are used in this project's graphical user interface are label, textbox, and data, MSFlexGrid, VScrollbar, Timer and Command Button.

b) Coding Strategy

Energy consumption and maximum demand values are transmitted as a data packet. Now in the receiver part, from the data packet the necessary values are separated using text manipulation of strings.

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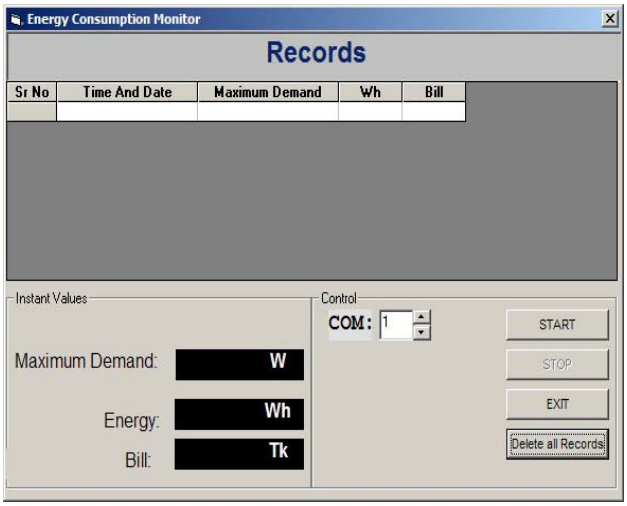

Fig. 5 : Computerized monitoring system (model) screenshot.

Then after the separation values are displayed as well as stored in the database along with the date and time information. As this energy meter served as a prototype for employing the concepts shown in the project, there is significant room for modifications and improvement. If the need arises, that additional readings are required than the ones shown, then the only adjustment required is an addition of new functions via the software. For example, the voltage and current could also be displayed just by coding the relevant details in the software.

A computerized monitoring system helps to easily identify the detailed information of the electricity consumption. This chapter aims to provide adequate information about the software and its backend programming concept.

V. Experimental Analysis

The aim of the project was to achieve an effective digital wireless system of measurement and billing of the electrical energy consumption of loads. This system would have the flexibility and capability to be modified and manipulated to suit varying environments of electrical load combinations, just by a few minor adjustments. However, the adjustments made as deemed necessary, would have to be cost effective and simple, as such reasons of economic feasibility and complexity may arise and eventually lead to a rejection of the implementation of the project. Another point of consideration in the aim of digitizing the measurements was to simplify the codifying procedures of the microcontrollers and digital display devices to be used. By taking this consideration into account, major changes in the methods and techniques of measurement of the voltages and currents, calculation of the cost of consumption, billing etc. can be made just by alteration of the codes. The programming language used in this regard had to be of a general nature, which would not require highly specialized personnel for maintenance and thus entail further cost of implementation. Therefore, the programming language chosen was "C". With these factors in mind, a prototype device and system were developed successfully, incorporating the features discussed. It was a digital meter that was able to show the current, voltage, power factor, and maximum power demand and power consumption of the load. Further improvements and modifications can be implemented on the project to achieve more varying types of functions and usability.

a) Applications of the energy meter

This meter developed in the project serves as a prototype, and can measure consumption of small loads (up to 150W) successfully. Along with the consumption, the power factor and maximum demand are also displayed accurately. Based on this observation, and the fact that consumption of larger loads or a combination of loads can also be measured by making a few minor adjustments, this energy meter can be put to use in households as well as in industrial purposes.

For household applications, the primary concern is the kilowatt-hour rating and the corresponding billing associated with it. The power factor does not hold too great a significance, as the loads in households are mainly either inductive or resistive. So, there will be no major power factor change in these applications. Since the cost of installation and setup of this meter is inexpensive, it will act as an economically feasible choice for this application.

For industrial applications, the power factor is also a primary concern. Various electrical machines, mainly induction motors, synchronous motors, alternators etc. are utilized in industrial fields. Aside from real power, there is also the reactive power that these machines produce, which alters the power factor continuously. This is due to the varying inductive and capacitive loads that are present. So, unless a method of accurate power factor measurement and billing is devised, the values will be error prone. The energy meter developed in this project provides a cheap and reliable alternative.

b) Suggestions for future work

As stated earlier, the aim of the project was to devise an efficient digital energy measurement and billing system, which was cost effective and flexible in the sense that further applications were made possible by a relatively few minor adjustments. Therefore, the energy meter developed here is a prototype and some of the modifications that can be implemented are listed below:

1. Modification for measuring energy consumption of larger loads.
2. Inclusion of a group of users.

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3. Wi-Fi (also known as IEEE802.11 standard).
4. ZigBee.
5. Wi-Max (Worldwide Interoperability for Microwave Access).
6. Incorporating additional functions in the monitoring (or supplier) end.

VI. Conclusion

Modern civilization would be brought to its knees, if a crisis of electricity scarcity ever looms. The cusp of society would collapse. Therefore, the undeniable need for uninterruptible electricity is the prelude to development of any nation in the world today. Day by day, the electricity consumer group is expanding as more people are getting access to electricity. In lieu to this rising demand, there also arises the urgent need for a highly efficient monitoring system that can take into account the varying consumptions of the consumer populace. This project has thus provided a simple, accurate and useful solution in the form of the wireless digital energy meter. Although a prototype, it demonstrated the ease of measurement utilizing software, and thereby eliminating human errors. The robustness and simplicity of programming additional features is a great advantage of this meter. It also is an economical choice forward, as the cost of implementation is less than other similar types of wireless energy meters.

This project, therefore, comes one step closer to the ultimate dream of having a fully automated energy consumption monitoring system, in which a computer can provide all necessary information and incorporate additional features as deemed necessary by itself.

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A Compact L-slot Microstrip Antenna for Quad band Applications in Wireless Communication

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Abstract - A single feed compact rectangular microstrip antenna for quad band applications has been designed and developed. This antenna is incorporated by four L-shaped slot structure along the length on the patch. Four resonating frequencies are obtained at 1.845 GHz with return loss -21.19 dB, 2.59 GHz with return loss -17.69 dB, 3.29 GHz with return loss -21.56 dB and 4.825 GHz with return loss -22.31 dB. The size of the antenna has been reduced by 77.3% when compared to a conventional microstrip patch without slot. An extensive analysis of the return loss, radiation pattern and gain of the proposed antenna has been given in this paper. The characteristics of the designed structure are investigated by using MoM based electromagnetic solver, IE3D.The simple configuration and low profile nature of the proposed antenna leads to easy fabrication and multi frequency operation makes it suitable for the applications in Wireless Communication system.

Keywords : *Compact, patch antenna, Quad band, slot.*

GJRE-F Classification: *FOR Code: 090604*

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A Compact L-slot Microstrip Antenna for Quad band Applications in Wireless Communication

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Abstract - A single feed compact rectangular microstrip antenna for quad band applications has been designed and developed. This antenna is incorporated by four L-shaped slot structure along the length on the patch. Four resonating frequencies are obtained at 1.845 GHz with return loss -21.19 dB, 2.59 GHz with return loss -17.69 dB, 3.29 GHz with return loss -21.56 dB and 4.825 GHz with return loss -22.31 dB. The size of the antenna has been reduced by 77.3% when compared to a conventional microstrip patch without slot. An extensive analysis of the return loss, radiation pattern and gain of the proposed antenna has been given in this paper. The characteristics of the designed structure are investigated by using MoM based electromagnetic solver, IE3D.The simple configuration and low profile nature of the proposed antenna leads to easy fabrication and multi frequency operation makes it suitable for the applications in Wireless Communication system.

Keywords : *Compact, patch antenna, Quad band, slot.*

I. Introduction

Design of compact microstrip antenna has become an interesting topic of research in recent years due to the demand for small antennas in wireless communication systems [1-5]. The development of antenna for wireless communication also requires an antenna with more than one operating frequency. Therefore one antena that has multiband characteristic is more desirable than having one antenna for each frequency band. Unlike normal antenna a defected structure introduces discontinuities on the signal plane and disturbs the shielded current distribution in signal plane [6].As a result apparent permittivity of the substrate varies as a function of frequency. The work to be presented in this paper is a compact microstrip antenna design obtained by the insertion of four L-shaped slot on the two sides of the patch.Two inverted slots are inserted on the left side and two slots are inserted on the right side (one inverted and one simple L slot) on the patch (Fig: 2).The work to be presented in this paper is directed towards the reduction of the size of the antenna as well as to operate the antenna in multi-frequencies. The proposed antenna (substrate with εr=4.4) has four resonant frequencies and presents a size reduction of about 77.3% when compared to a conventional rectangular microstrip patch The simulation has been carried out by IE3D software which uses the MoM method [10]. Due to the Small size, low cost, low weight and multiband characteristics this antenna is a good candidate for application in Wireless communication system.

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II. Antenna Structure

The configuration of the conventional antenna is shown in Figure 1. The antenna is a 24 mm x 18 mm rectangular patch. The substrate selected for this design is an FR4 epoxy with dielectric constant (εr) =4.4 and height of the substrate (h) =1.5875 mm. Co-axial probe feed of radius 0.5 mm with a simple ground plane arrangement is used at the point (0,-3) where the centre of the patch is considered at point (0, 0).Figure 2 shows the configuration of proposed antenna which is designed with the similar substrate. The antenna is also a 24 mm x 18 mm rectangular patch. Four L-shape slots which are created on the rectangular patch (as shown in the figure 2). The location of the coaxial probe-feed (radius =0.5 mm) is also same as shown in antenna1.Optimal values of the parameter of the L-slots and their positions are given in fig 2.

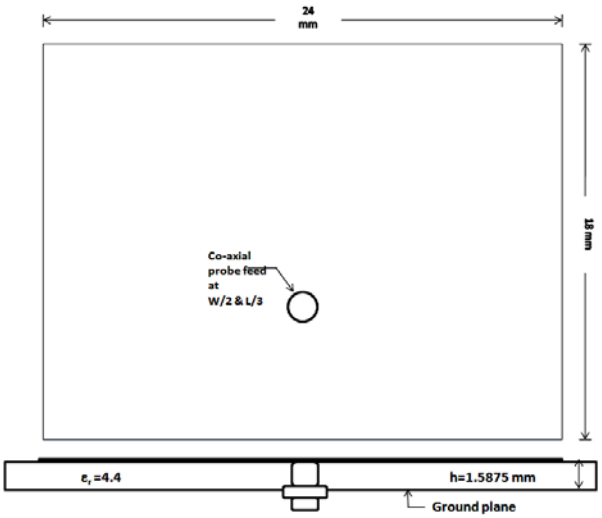

Fig.1 : Antenna 1 Configuration

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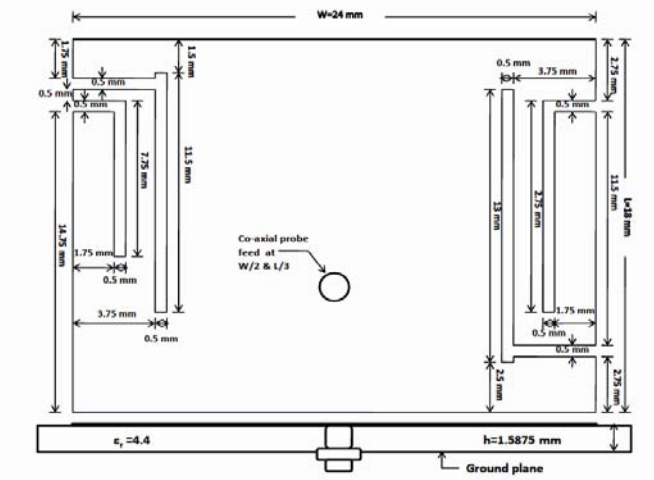


Fig.2 : Antenna 2 Configuration

III. Simulated Results

In this section, simulated return loss (of antenna 1 and 2) and normalized E-field and H-field radiation patterns (of antenna2) are shown. The simulated return loss of the conventional antenna (antenna 1) and the proposed antenna (antenna 2) are shown in fig. 3 and fig 4 respectively.

In conventional antenna only one resonant frequency is obtained below -10 dB which is 3.725 GHz and the return loss was found to be about -28.59 dB with 68(3.693-3.761) MHz bandwidth. For the proposed antenna resonant frequencies are 1.845 GHz, 2.59 GHz, 3.29 GHz, 4.825 GHz and their corresponding return losses are -21.19 dB,-17.69 dB,-21.56 dB and -22.31 dB respectively. Simulated 10 dB bandwidths are 16 (1.837-1.853) MHz, 16 (2.584-2.600) MHz, 40 (3.268-3.308) MHz and 49 (4.803-4.852) MHz respectively. Hence a significant improvement of frequency reduction is achieved in antenna 2 with respect to the conventional antenna1 structure for resonant frequencies of 1.845 GHz, 2.59 GHz and 3.29GHZ.

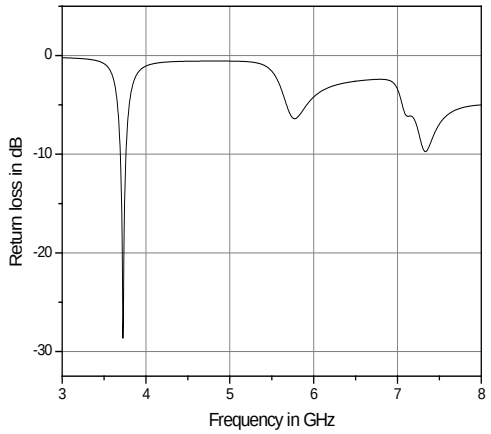


Fig .3 : Simulated return loss of the antenna1

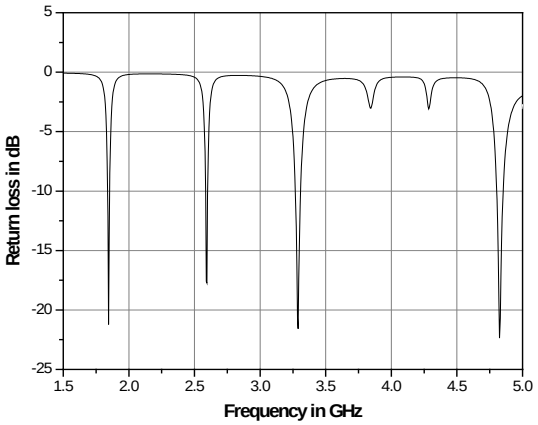
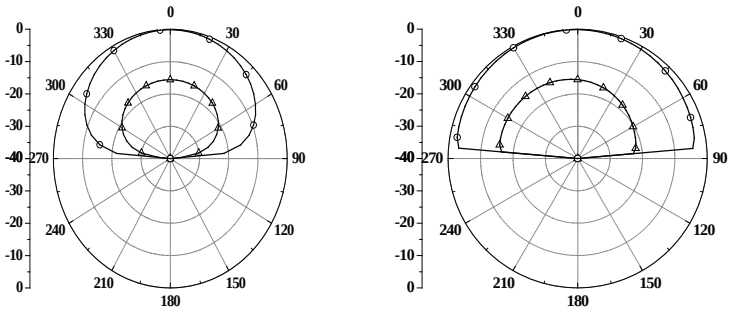


Fig .4 : Simulated return loss of the antenna2

The simulated E plane and H plane radiation patterns for antenna 2 are shown in Figure 5-8.

Isolation between co-polarization and cross pola-rization is more than -15 dB for 1.845 GHz and it decreased with the increase of the frequency for 2.59 GHz and 3.29 GHz. 3 dB E-plane beamwidths are found to be reasonably good for all the cases.



(a) E-field pattern (b) H-field pattern

Fig .5. : Simulated normalize radiation pattern at 1.845 GHz

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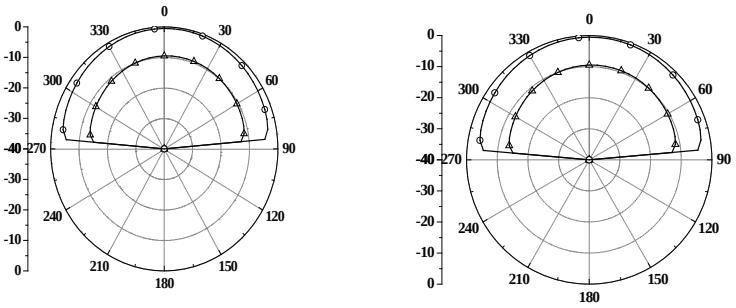
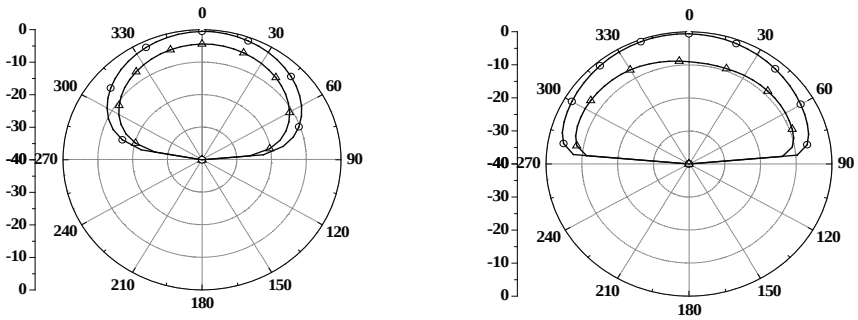


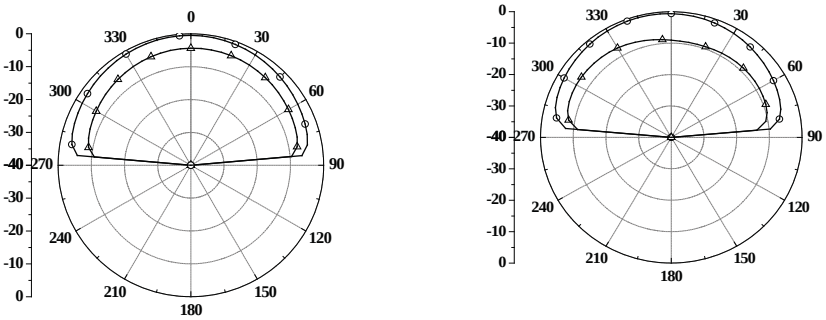
(a) E -field pattern (b) H -field pattern

Fig .6 : Simulated radiation pattern at 2.59 GHz.



(a) E-field pattern (b) H-field pattern

Fig .7 : Simulated normalize radiation pattern at 3.29 GHz



(a) E-field pattern (b) H-field pattern

Fig. 8 : Simulated normalize radiation pattern at 4.825 GHz

IV. Experimental Results

The prototype of the antenna 1 (conventional) and antenna 2 (proposed antenna) was fabricated and tested, which are shown in Fig. 9 and 10. All the measurements are carried out using Vector Network Analyzer (VNA) Agilent N5 230A.

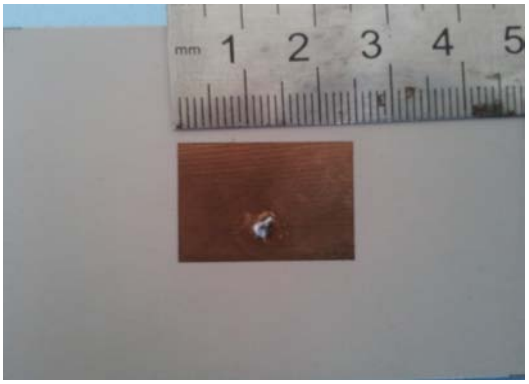


Fig .9 : Antenna 1

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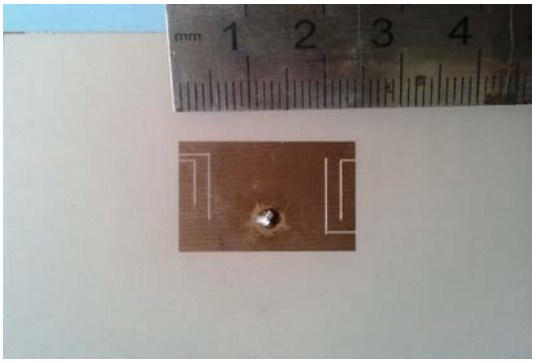

Fig.10 : Antenna 2

The measured return losses of the antennas are illustrated in Fig. 11-12.

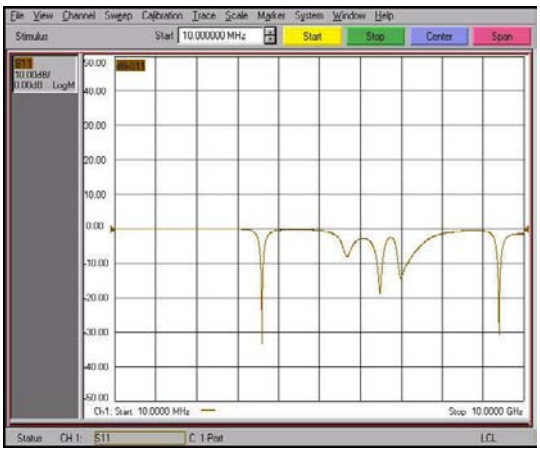

Fig .11 : Measured return loss of antenna 1

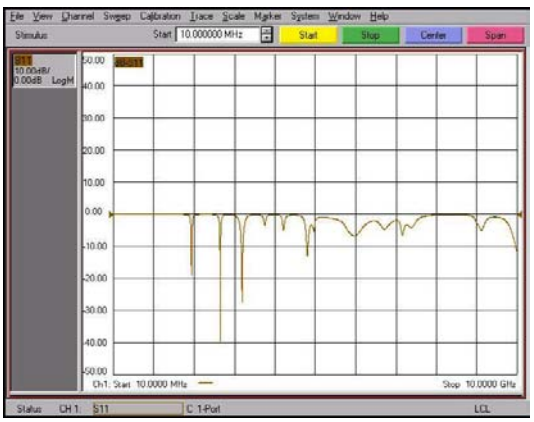

Fig .12 : Measured return loss of antenna 2

Comparisons between the measured return loss with the simulated ones are shown in Fig.13 and 14. The agreement between the simulated and measured data is reasonably good. The discrepancy between the measured and simulated results is due to the effect of improper soldering of SMA connector or fabrication tolerance.

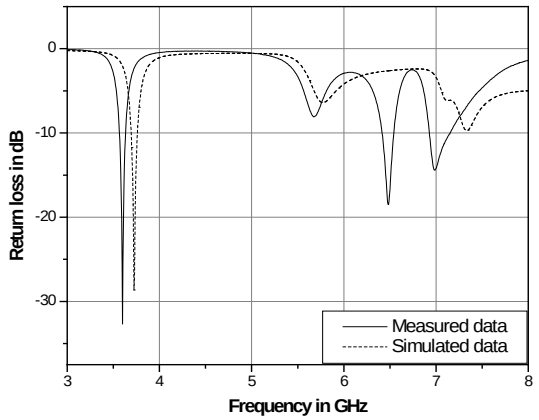

Fig.13 : Comparison between measured and simulated return losses for antenna1

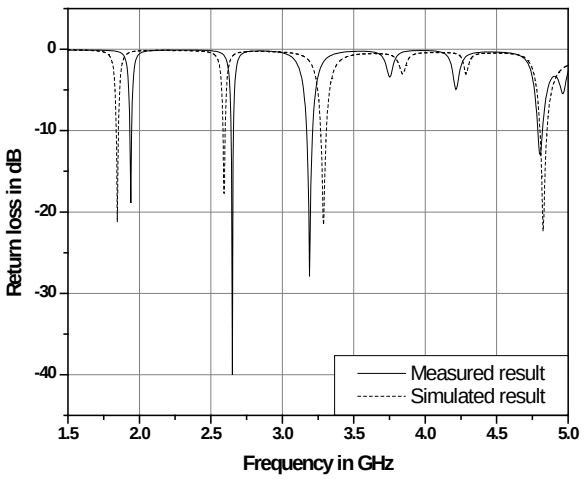

Fig.14 : Comparison between measured and simulated return losses for antenna 2

V. Conclusion

A single feed single layer rectangular microstrip antenna with L-shaped slot insertion has been proposed in this paper. It is shown that the proposed antenna can operate in four frequency bands in the frequency ranges of GSM (1800 MHz), WiMAX (2.5-2.69 GHz and 3.2-3.8 GHz) and Hyperlan (4.8-5.8 GHz). The polarization type of the antenna is linear and due to the perturbation of the time varying current, effective patch area of the proposed antenna is reduced by 77.3 % when compared to a conventional patch (without slot). Maximum gain of the proposed antenna is found to be about 5 dBi at 3.29 GHz. The location and length of the L-slots are optimized in such a way that the antenna can operate in four suitable band. The experimental result shows that this design is ideally practical for quad band applications.

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Performance Evaluation of AODV based on black hole attack in ad hoc network

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Abstract - A Mobile Ad hoc Network (MANET) is a new networking paradigm. In the development of Mobile Ad hoc networks routing is the main issue. There are different security flaws and attacks on routing protocols in MANETs. These attacks can affect the performance of different routing protocols. Blackhole is one of these attacks. The blackhole attack can affect the performance of different routing protocols. During this attack, a malicious node captures packets and not forwards them in the network. This paper illustrates how blackhole attack can affect the performance of routing protocol, AODV, in Mobile Ad hoc networks by using NS-2.34 simulator.

Keywords : *MANET, AODV, Black Hole attack;.*

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Performance Evaluation of AODV based on black hole attack in ad hoc network

Yatin Chauhan[α], Prof Jaikaran Singh[α], Prof Mukesh Tiwari[α], Dr Anubhuti Khare[σ]

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I. Introduction

Mobile ad hoc network (MANET) is a collection of wireless mobile nodes which have the ability to communicate with each other without having fixed network infrastructure or any central base station. Since mobile nodes are not controlled by any other controlling entity, and network management are done, they have unrestricted mobility and connectivity to others. Nodes routes cooperatively by each other nodes. Due to limited transmission power, multi hop architecture is needed for one node to communicate with another through network. In this multi hop architecture, each node works as a host and as well as a router that forwards packets for other nodes that may not be within a direct communication range. Each node participates in an ad hoc route discovery protocol which finds out multi hop routes through the mobile network between any two nodes. These infrastructure-less mobile nodes in ad hoc networks dynamically create routes among themselves to form own wireless network on the fly. Thus, mobile ad hoc networks provide an extremely flexible communication method for any place where geographical or terrestrial constraints are present and any fixed architecture, such as battlefields, and some disaster management situations. Recent research on MANET shows that the MANET has larger security issues than conventional networks [1, 2].

In our study, we simulated the blackhole attack on AODV routing protocol. Extensive simulations have been carried out using NS-2.34 simulator. We have analyzed the network performance with and without blackhole attack. This paper is organized as follows; section II describes the background or related work and section III explains about the AODV. Section IV describes blackhole attack. In section V simulation results shows the impact of blackhole attack on the performance of routing protocols which is followed by conclusion in section VI.

II. Background

The problem of security has received considerable attention by researchers in the ad hoc network community. In this section, some of these contributions are presented. The problem of securing the routing layer using cryptographically secure messages is addressed by Hu et al. [4], Papadimitratos and Haas [5], and Sanzgiri et al. [6]. Schemes to handle authentication in ad hoc networks assuming trusted certificate authorities have been proposed by Kong et al. [7]. Hubaux et al. [8] have employed a self-organized PGPbased scheme to authenticate nodes using chains of certificates and transitivity of trust. Stajano and Anderson [9] authenticate users by imprinting in analogy toducklings acknowledging the first moving subject they see as their mother.

In contrast to securing the routing layer of ad hoc networks, some researchers have also focused on simply detecting and reporting misleading routing misbehavior. *Watchdog* and *Pathrater* [10] use observation-based techniques to detect misbehaving nodes, and report observed misbehavior back to the source of the traffic. Pathrater manages trust and route selection based on these reports. This allows nodes to choose better paths along which to route their traffic by routing around the misbehaving nodes. However, the scheme does not punish malicious nodes; instead, they are relieved of their packet forwarding burden.

CONFIDANT [11] detects misbehaving nodes by means of observation and more aggressively informs other nodes of this misbehavior through reports sent around the network. Each node in the network hosts a *monitor* for observations, *reputation records* for firsthand and trusted second-hand reports, *trust records* to control the trust assigned to the received warnings, and a *path manager* used by nodes to adapt their behavior according to reputation information. Subsequent research has found that reputation schemes can be beneficial for fast misbehavior detection, but only when one can deal with false accusations [12].

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Researchers have also investigated means of discouraging selfish routing behavior in ad hoc networks, generally through payment schemes [13]. These approaches either require the use of tamperproof hardware or central bankers to do the accounting securely, both of which may not be appropriate in some truly ad hoc network scenarios. In the per-hop payment scheme proposed by Buttyan and Hubaux [15], the payment units are called *nuglets* and reside in a secure tamper-proof module in each node. They have observed that given such a module, increased cooperation is beneficial not only for the entire network but also for individual nodes. The scheme can result in unfairness to some hosts, but its simplicity and performance may be appropriate in some cases.

Bansal and Baker [14] have proposed a scheme that relies on first-hand observations. Directly observed positive behavior increases the rating of a node, while directly observed negative behavior decreases it by an amount larger than that is used for positive increments. If the rating of a node dips below the faulty threshold, the node is added to a faulty list. The faulty list is appended to the route request by each node broadcasting it to be used as a list of nodes to be avoided. A route is rated good or bad depending on whether the next hop is on the faulty list. If the next hop of a route is in the faulty list, the route is rated as bad. As a response to misbehavior of a node, all traffic from that node is rejected. A second chance mechanism for redemption employs a timeout after an idle period. After a timeout, the node is removed from the faulty list with its rating remaining unchanged.

Sen et al. have presented a scheme for detection of malicious packet dropping nodes in a MANET [15]. The mechanism is based on local misbehavior detection and flooding of the detection information in a controlled manner in the network so that the malicious node is detected even if moves out a local neighborhood.

Deng, Li and Agarwal [3] have suggested a mechanism of defense against black hole attack in adhoc networks. In their proposed scheme, as soon as the *RouteReply* packet is received from one of the intermediate nodes, another *RouteRequest* is sent from the source node to a neighbor node of the intermediate node in the path. This is to ensure that such a path exists from the intermediate node to the destination node. For example, let the source node *S* send *RouteRequest* packets and receive *RouteReply* through the intermediate malicious node *M*. The *RouteReply* packet of *M* contains information regarding its nexthop neighbor node. Let it contain information about the neighbor *E*. Then, the source node *S* sends *FurtherRouteRequest* packets to this neighbor node *E*. Node *E* responds by sending a *FurtherRouteReply* packet to source node *S*. Since node *M* is a malicious node, and thus not present in the routing list of node *E*, the *FurtherRouteReply* packet sent by node *E* will not contain a route to the malicious node *M*. But if it contains a route to the destination node *D*, then the new route to the destination through node *E* is selected, and the earlier selected route through node *M* is rejected. While this scheme completely eliminates the black hole attack by a single attacker, it fails completely in identifying a cooperative black hole attack involving multiple malicious nodes.

III. AODV

In this section, a brief overview of the AODV routing protocol is presented and the security threat that are associated with this routing protocol are briefly discussed.

AODV is a reactive routing protocol that does not require maintenance of routes to destination nodes that are not in active communication. Instead, it allows mobile nodes to quickly obtain routes to new destination nodes. Every mobile node maintains a routing table that stores the next hop node information for a route to the destination node. When a source node wishes to route a packet to a destination node, it uses the specified route if a fresh enough route to the destination node is available in its routing table. If such a route is not available in its cache, the node initiates a route discovery process by broadcasting a *RouteRequest* (RREQ) message to its neighbors. On receiving a RREQ message, the intermediate nodes update their routing tables for a reverse route to the source node. All the receiving nodes that do not have a route to the destination node broadcast the RREQ packet to their neighbors. Intermediate nodes increment the hop count before forwarding the RREQ. A *RouteReply* (RREP) message is sent back to the source node when the RREQ query reaches either the destination node itself or any other intermediate node that has a current route to the destination. As the RREP propagates to the source node, the forward route to the destination is updated by the intermediate nodes receiving a RREP. The RREP message is a unicast message to the source node.

AODV uses sequence numbers to determine the freshness of routing information and to guarantee loop-free routes. In case of multiple routes, a nodeselects the route with the highest sequence number. If multiple routes have the same sequence number, then the node chooses the route with the shortest hop count. Timers are used to keep the route entries fresh.

When a link break occurs, *RouteError* (RERR) packets are propagated along the reverse path to the source invalidating all broken entries in the routing table of the intermediate nodes. AODV also uses periodic *hello* messages to maintain the connectivity of neighboring nodes.

Since AODV has no security mechanisms, malicious nodes can perform many attacks just by not

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behaving according to the AODV rules. A malicious node M can carry out many attacks against AODV. This paper provides routing security to the AODV routing protocol by eliminating the threat of 'Black Hole' attacks.

IV. Black Hole Attack

In black hole attack [17], all network traffics are redirected to a specific node, which does not exist at all. Because traffics disappear into the special node as the matter disappears into Black hole in universe. So the specific node is named as Black hole. A black hole has two properties. First, the node exploits the ad hoc routing protocol, such as AODV, to advertise itself as having a valid route to a destination node, even though the route is spurious, with the intention of intercepting packets. Second, the node consumes the intercepted packets. Black hole attacks in AODV protocol routing level can be classified into two categories -- RREQ Blackhole attack and RREP Blackhole attack.

a) Black hole attack caused by RREQ

An attacker can send fake RREQ messages to form black hole attack [17]. In RREQ Blackhole attack, the attacker pretends to rebroadcast a RREQ message with a non-existent nodes will update their route to pass by the non destination node.

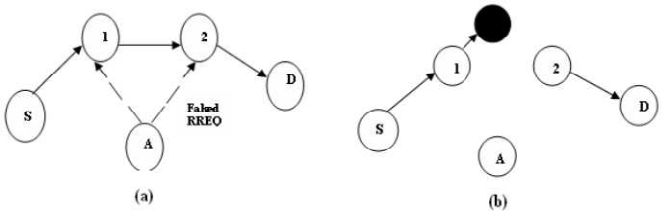

Fig.1 : Black hole is formed by Faked RREQ

As a result, the normal route will be broken down. The attacker forms a Black hole attack between the source node and the destination node by faked RREQ message. It is shown in figure 1.

b) Black hole attack caused by RREP

The attacker unicasts the faked RREP message to the originating node. When originating node receives the faked RREP message, it will update its route to destination node through the non existent node. Then RREP Black hole is formed. It is shown as figure 2.

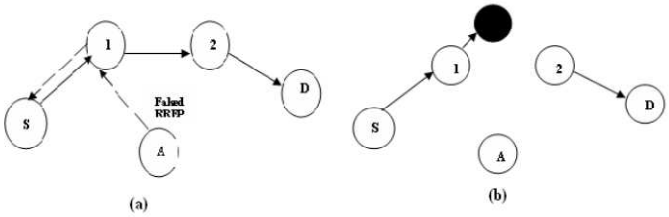

Fig.2 : Black hole is formed by Faked RREP

V. Simulation Environment

We have implemented blackhole attack in simulator. For our simulation, we use CBR (constant bit rate) application, IEEE 802.11 MAC, and a physical channel based on two ray propagation model. The simulated Mobile Ad hoc network consists of 25 nodes in 1200*1200 m2. The node transmission range is 250 meters. Random waypoint model is used for scenarios with node mobility. The size of data payload is 512 bytes. The simulation is done to analyze the performance of the network by varying node speed under blackhole attack. The following performance met used in the above mentioned scenario.

Throughput: It indicates the fraction of channel capacity used for successful data transmission.

Average End-to-End Delay: End-to-End Delay can be defined as the time a packet takes to travel from source to destination. Average End-to-End Delay is the average of the end-to-end delays taken over all received packets.

Node Mobility: Node mobility indicates the mobility speed of nodes.

a) Simulation Results

The Fig.3 shows the effect to measured for the AODV protocol when the node increased. The result shows both the cases, with the blackhole and without the blackhole attack. It is measured that the packet delivery ratio is dramatically decreases nodes in the network. For example, the packet when there is no effect of Blackhole attack and moving at the speed 50 m/s. but due to effect of the Blackhole the packet delivery ratio decreases to 47 packets are dropped by the blackhole node.

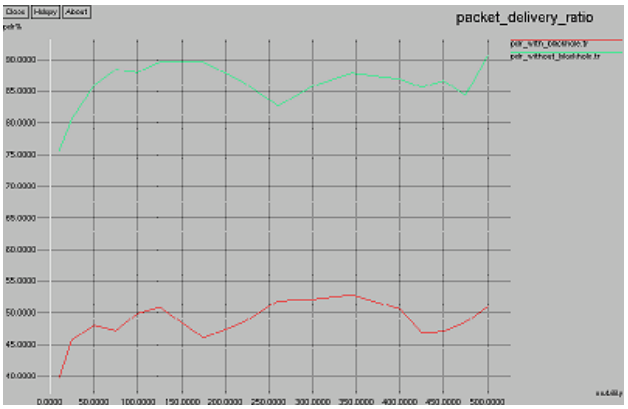

Fig.3 : Impact of Blackhole attack on packet delivery ratio

Figure 4 shows the effect of throughput for AODV protocol when node mobility is increased. The result shows the cases, with blackhole and without blackhole attack on AODV. It has been measured that throughput decreases with blackhole nodes in the Ad hoc network on AODV routing protocol as compared to without blackhole nodes.

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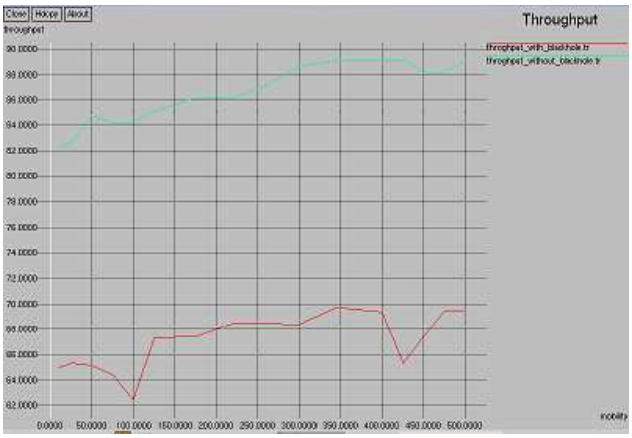

Fig.4 : Impact of Blackhole attack on the Network Throughput.

From the figure 5 it can be observed that, there is slight increase in the average end-to-end delay without the effect of blackhole, as compared to the effect of blackhole attack, This is due to the immediate reply from the malicious node i.e. the nature of malicious node here is it would not check its routing table.

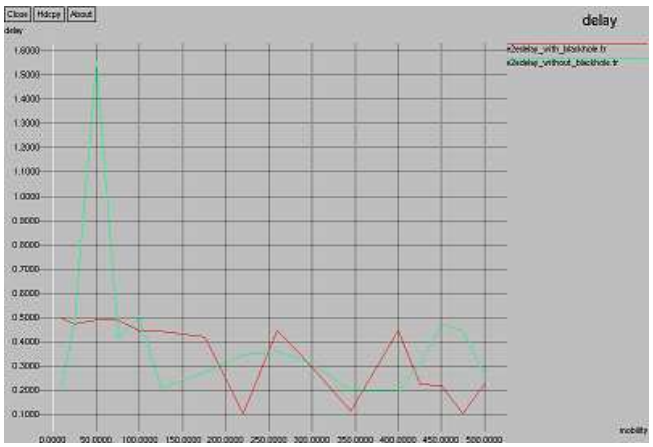

Fig.5 : Impact of Blackhole attack on the Avg. E -E delay.

It is observed from the figure 6 that, avg. jitter between the nodes is more without the blackhole attack, as compared to the Avg jitter between the nodes with the effect of blackhole attack. This is due to the malicious nodes provides the path with fewer number of nodes, or smaller path. Thus average jitter between the nodes is reduces.

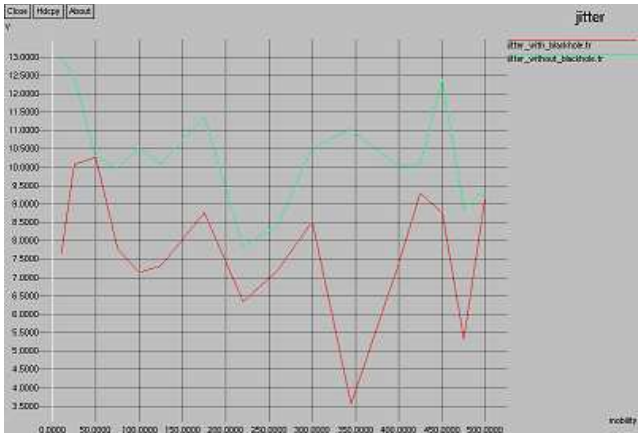

Fig.6 : Impact of Blackhole attack on the Avg. Jitter

VI. Conclusion

With development in computing environments, the services Based on Ad Hoc Networks have been increased. Wireless Ad Hoc Networks are vulnerable to various attacks due to the physical characteristic of both the environment and the nodes. In this paper the effect of packet delivery ratio, Throughput, End -to-End Delay and Jitter has been detected with respect to the variable node mobility. There is reduction in Packet Delivery Ratio, Throughput, E-E Delay, and Jitter as shown in fig. 3-6. In Black hole attack all network traffics are redirected to a specific node or from the malicious node causing serious damage to networks and nodes as shown in the result of the simulation. The detection of Cooperative Black holes in ad hoc networks is still considered to be a challenging task.

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3. Submission of Manuscripts,

4. Manuscript's Category,

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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

Introduction:

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.
- Shape the theory/purpose specifically - do not take a broad view.
- As always, give awareness to spelling, simplicity and correctness of sentences and phrases.

Procedures (Methods and Materials):

This part is supposed to be the easiest to carve if you have good skills. A 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.
- Embrace particular materials, and any tools or provisions that are not frequently found in laboratories.
- 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.

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- 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

Discussion:

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."
- Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work
- You may propose future guidelines, such as how the experiment might be personalized to accomplish a new idea.
- 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
- Submit to work done by specific persons (including you) in past tense.
- Submit to generally acknowledged facts and main beliefs in present tense.

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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

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