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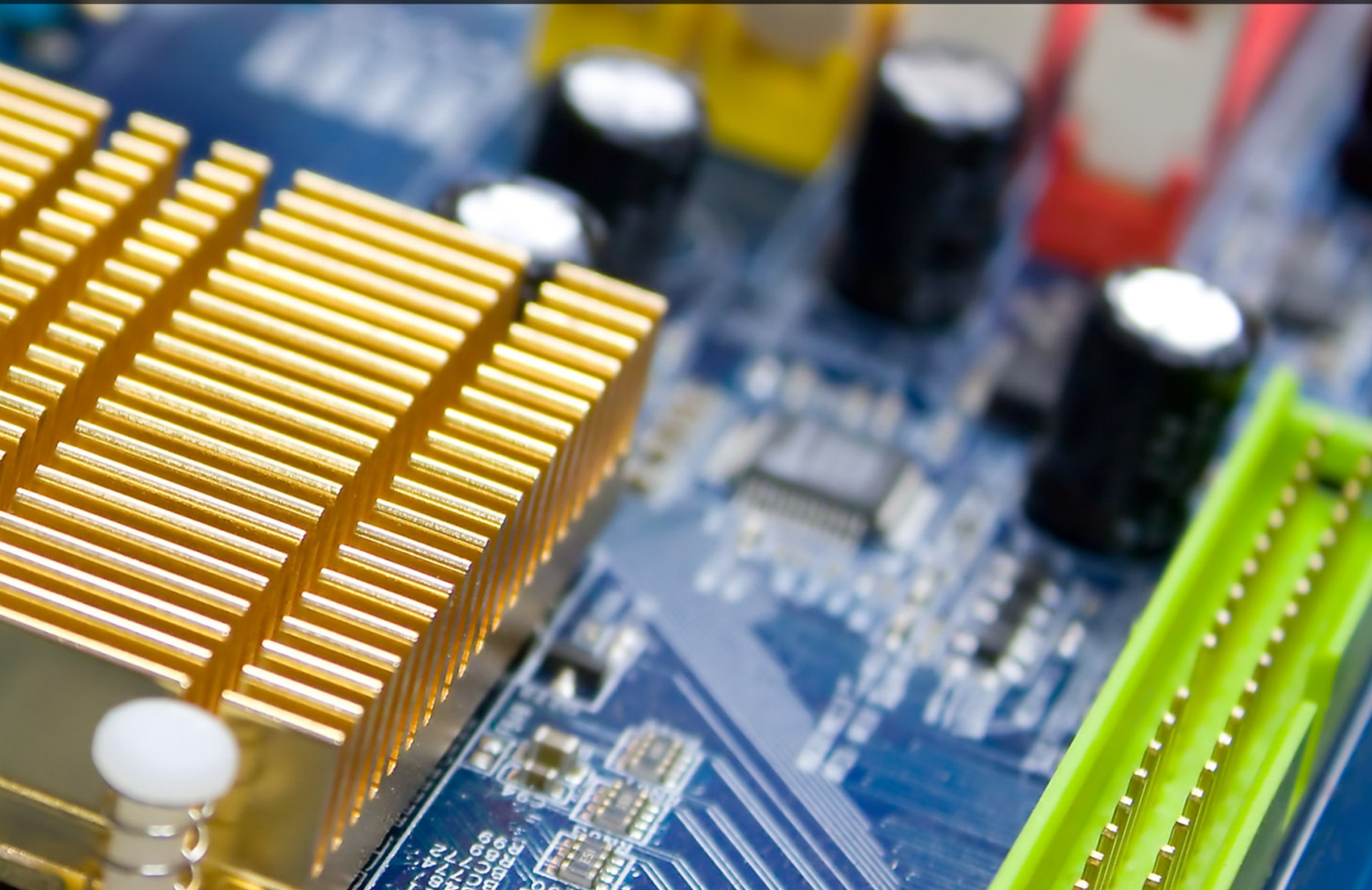

Highlights

- Wireless Zigbee Technology
- Hypothetical Semiconductor Laser
- Solar Power Generation
- Automated Car Parking System

Discovering Thoughts, Inventing Future

VOLUME 13 ISSUE 16 VERSION 1.0

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Contents of the Volume

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By Christian Kwaku Amuzuvi & Joseph Cudjoe Attachie
University of Mines and Technology, Ghana

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Keywords: by-emitter, emitter, defect, smile-shaped temperature profile, emitter power, quantum well, degradation, threshold current, slope efficiency, band gap energy.

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INVESTIGATINGAHYPOTHETICALSEMICONDUCTORLASERBARWITHASMILESHAPEDTEMPERATUREPROFILEUSINGALASERDIODESIMULATIONEMULATIONTOOL

Strictly as per the compliance and regulations of :

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Keywords: by-emitter, emitter, defect, smile-shaped temperature profile, emitter power, quantum well, degradation, threshold current, slope efficiency, band gap energy.

I. Introduction

Research in the optoelectronic field has improved tremendously leading to the widespread use [1] of optoelectronic devices. As a consequence, progress in the development of high power laser bars has skyrocketed due to their high demand and their improved reliability and durability. Numerous applications of high power lasers have therefore emerged, including light detection and ranging and free space optical communications [2], apart from their traditional applications [3] in recent times.

Barlase therefore presents an attempt to understand further, the by-emitter degradation analysis technique developed over recent years [4-8]. This tool is also an addition to the by-emitter analysis technique where the effects of certain factors that affect the degradation of laser emitters/bars can be investigated. Barlase[9] in this book is used to perform a by-emitter analysis of a laser bar, when a smile-shaped temperature profile is used since it is well known that central emitters turn to emit more power and therefore are the hottest within a bar.

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II. Materials and Methods

Bars are made up of multiple emitters, and therefore there was a need to find an innovative way to include the interactions between individual emitters within the bar. This gave rise to the Barlase concept as indicated in Figure 1 as a flow chart showing the communication between emitters in a bar. A bar is considered as a monolithic block of multiple emitters connected in parallel with each other with a common voltage connected across them as shown in Figure 2.

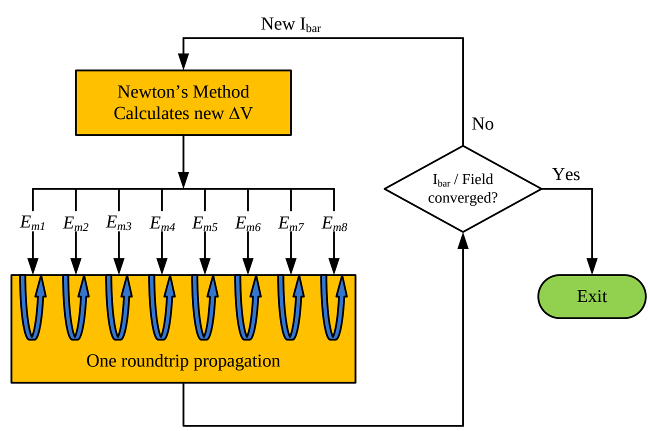


Figure 1 : Flow chart showing the communication between emitters in Barlase

Each emitter is biased with a common voltage, but the emitter currents and powers change depending on the details of the individual emitters and their environment.

III. Results and Discussion

In this paper, the scenario investigated was the impact of a curved heatsink temperature profile across the bar, with a maximum temperature at the centre of the bar. The edges of the bar were held at 300 K. Temperature variations of this magnitude (up to 30 K) have been measured in high-power laser bars with 25 –

50 emitters operating at high currents (e.g. 30 A – 50 A). Comparing the average current per emitter in those cases with the hypothetical 8 emitter bar at a current of 10 A investigated here, we see that the assumed temperature distribution is realistic. Using these values, multi-emitter simulations were carried out in constant current mode for bar currents of 2, 4, 6, 8 and 10 A. Figure 3 show the heatsink temperature profile for the investigation, with Table 1 showing the table of values of the heatsink temperatures assigned to each emitter in the bar.

Figure 4 shows the P-I characteristic of the bar together with the P-I and P-V characteristics of each of the individual emitters. The threshold current and slope efficiency for the bar are also shown as legend in Figure 4a. From the emitter P-I curves in Figure 4b, the threshold current and slope efficiency have been calculated for each individual emitter. These quantities are plotted as a function of emitter number in Figure 5. The results for the different emitters clearly show an increased threshold current, decreased slope efficiency and earlier onset of thermal roll-over for the hotter emitters (as expected). The threshold currents of the individual emitters vary by +/– 5% from the average value, whilst the slope efficiencies deviate by +3/–5% from the average value. Nevertheless, the hotter emitters draw more current and emit more power. This can be attributed to the fact that the temperature-induced changes in the "apparent" threshold current and the "apparent" slope efficiency are opposite to the changes in the actual threshold current and slope efficiency. This is due to the temperature induced band gap reduction, which lowers the turn-on voltage and strongly affects the current competition between emitters. Strain-induced changes in the band gap energy are expected to give similar behaviour of the apparent threshold current and slope efficiency, but this is not expected for increases in the defect or trap density (since it does not change the turn-on voltage of the diode). Finally, this example also shows temperature as a principal cause of emitter threshold current and slope efficiency variations.

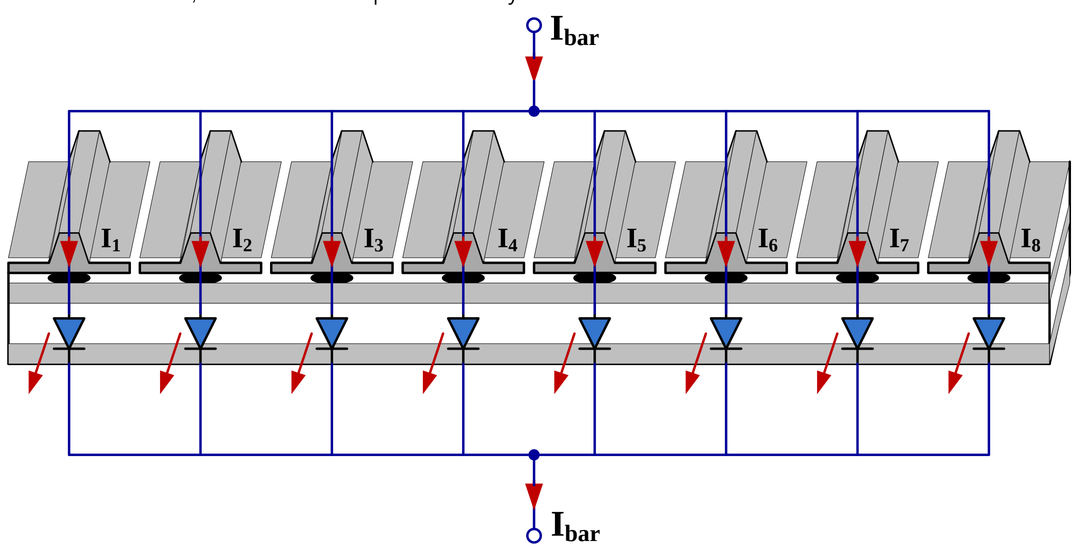


Figure 2 : The representation of an eight emitter laser bar

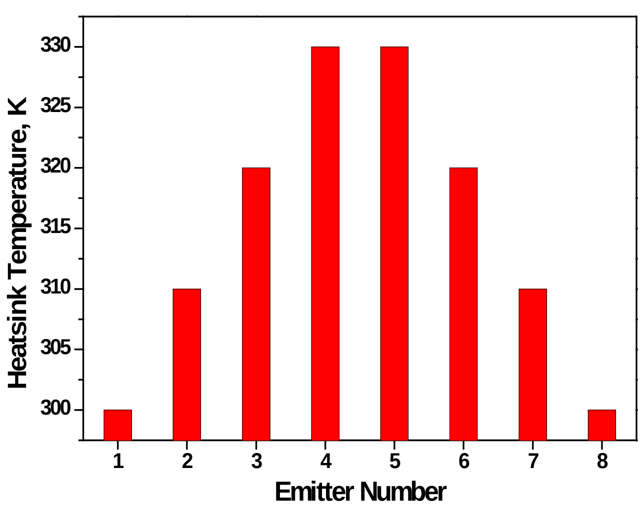
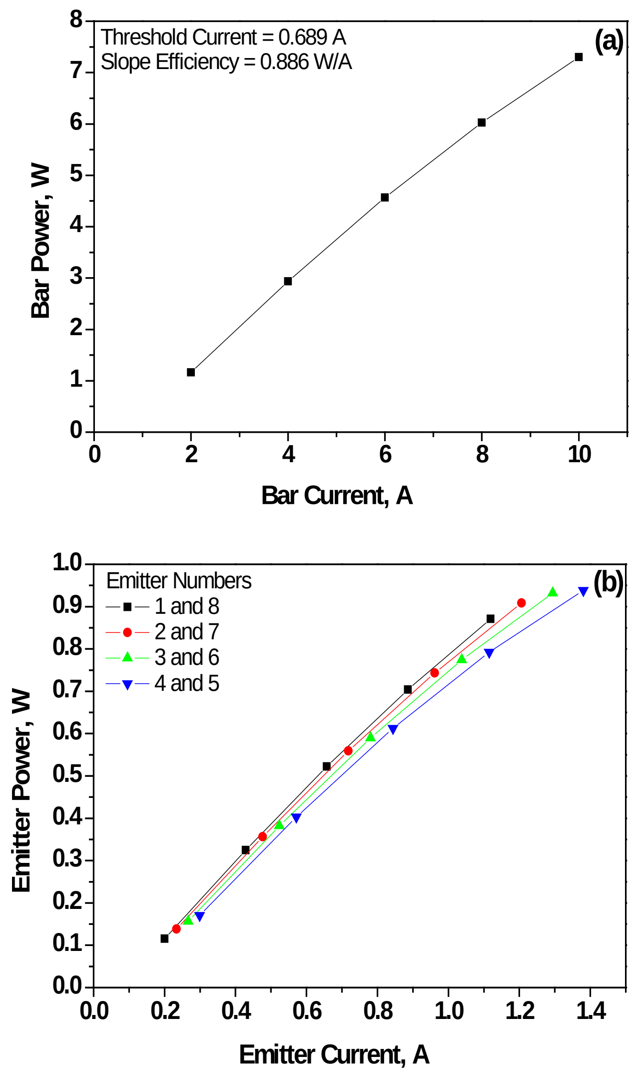


Figure 3 : The heatsink temperature profile for the eight-emitter bar

Table 1 : The values of heatsink temperatures assigned to each emitter in the bar

Emitter Number	Heatsink Temperature (K)
1	300
2	310
3	320
4	330
5	330
6	320
7	310
8	300

Figure 6 shows the distribution of current, power and maximum quantum well (QW) temperature across the bar for a total bar current of 2 A. Figure 7 shows the same quantities for a total bar current of 10 A. The horizontal broken lines in Figures 6 and 7 represent the ideal values of emitter current and power found by dividing the values from the total bar P-I characteristic by the number of emitters. In these graphs, the effects of current competition and the distribution of the power between emitters are made clear. The emitter currents vary by up to +/–10% from the average value, whilst the emitter output powers vary by up to +3/–5%.



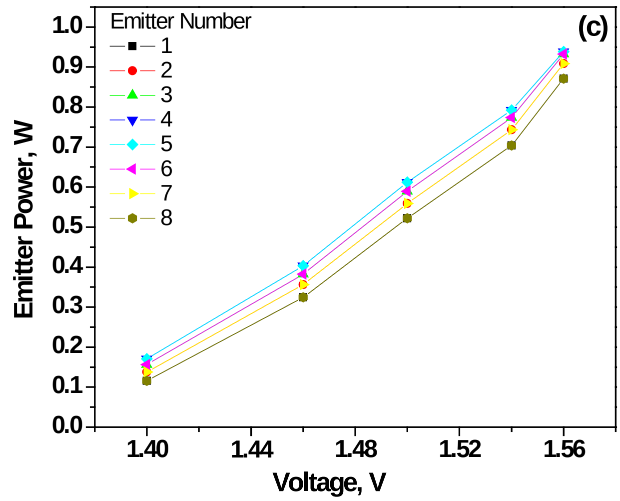


Figure 4 : (a) Bar power-current characteristics (b) power-current characteristics of the individual emitters and (c) power versus individual emitter voltage

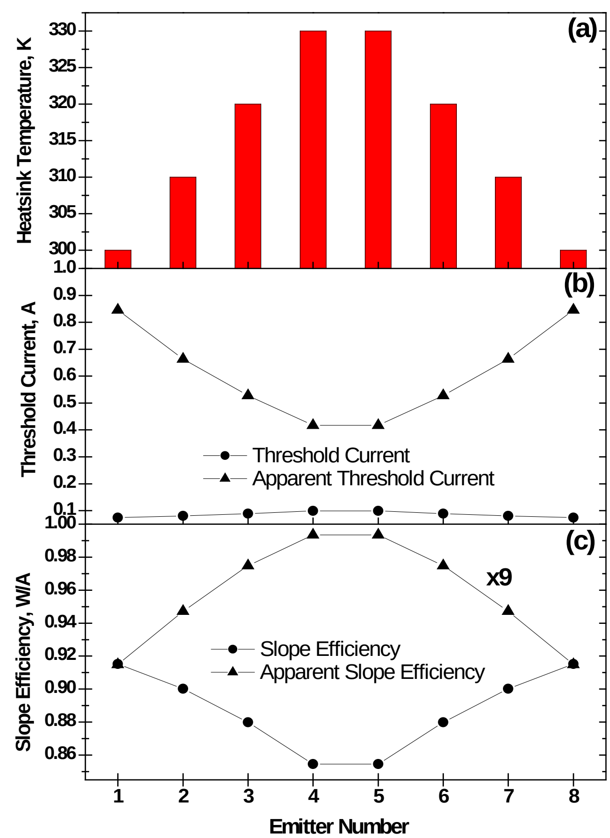


Figure 5 : (a) Heatsink temperature profile of each emitter, (b) variation of apparent threshold/threshold current and (c) apparent slope/slope efficiency of individual emitters

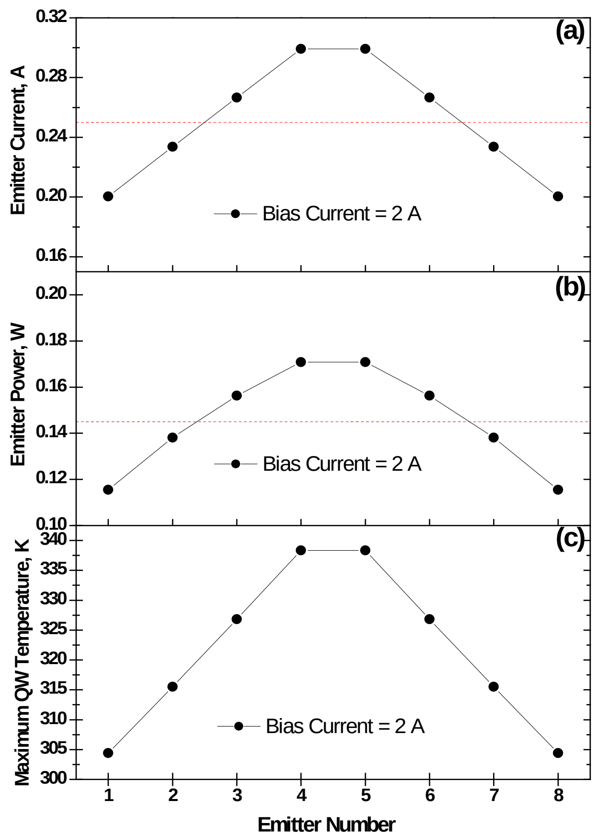


Figure 6 : (a) Distribution of the emitter currents (b) emitter powers and (c) maximum emitter QW temperatures across the bar at a total bar bias current of 2 A

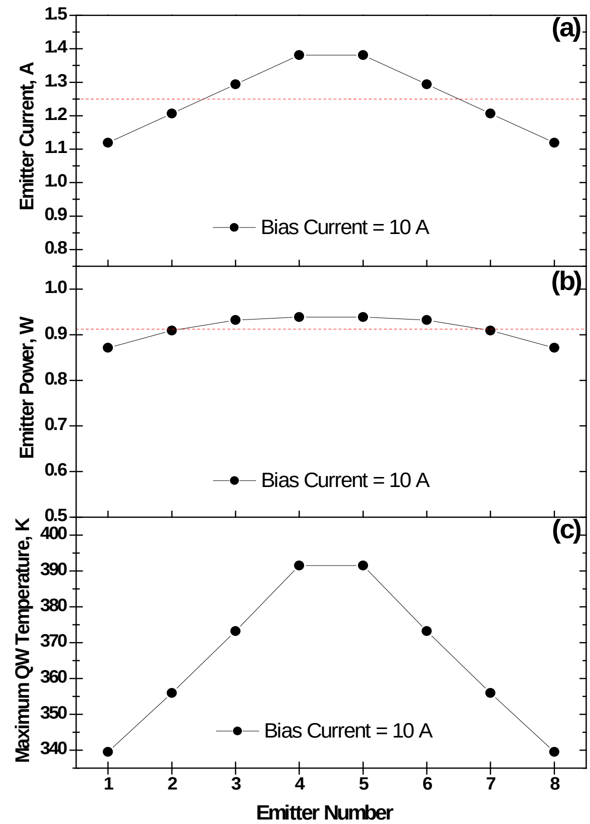


Figure 7 : (a) Distribution of the emitter currents (b) emitter powers and (c) maximum emitter QW temperatures across the bar at a total bar bias current of 10 A

Barlase therefore has been again used in this scenario to gain more knowledge about the interaction between emitters in a laser bar when a curved temperature (smile) profile with maximum temperature at the centre of the bar is investigated. In fact, this is the practical outcome of most semiconductor laser bars as the central emitters emit more power and therefore degrade faster with aging [10].

IV. Conclusion

The case investigated in this paper using multi-emitter simulations show that variations in the operating conditions and environment of the individual emitters also affect the performance of other emitters and of the bar as a whole. The introduction of a non-uniform temperature profile caused the most significant change in the bar and emitter operating conditions and in its performance. However, it should be remembered that this scenario is for devices at the start of the aging process. When all of the relevant effects are combined and allowed to interact over time, high levels of defects are expected to play a more important role. This will be caused by current competition due to a reduction in the turn-on voltage as a result of local temperature and/or strain-induced changes in the band gap energy. Indeed, it is well known that the propagation and growth of defects increases with increasing temperature. Thus, the rate of defect generation and propagation within emitters are inextricably linked with the temperature profile of the bar.

V. Acknowledgement

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Handoff / Handover Mechanism for Mobility Improvement in Wireless Communication

By Liton Chandra Paul
Pabna University of Science & Technology, Bangladesh

Abstract- The aim of this paper is to investigate the handoff / handover concepts in wireless communication. Mobility is the distinct feature of wireless mobile cellular system. As a mobile subscriber move between different radio networks, a handover process is needed to change its point of attachment. The continuation of an active call is one of the most important quality measurements in cellular systems. Handoff process enables a cellular system to provide such a facility by transferring an active call from one cell to another. Usually, continuous service is achieved by supporting handoff which is the transfer of an ongoing call from the current cell to the next adjacent cell as the mobile moves through the coverage area. The paper represents the current approaches of handoff initialization, detection strategies and their relative benefits and disadvantages.

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I. Introduction

Mobility is the most important feature of a wireless cellular communication system. Usually, continuous service is achieved by supporting handoff (or handover) from one cell to another. Handoff is the process of changing the channel (frequency, time slot, spreading code, or combination of them) associated with the current connection while a call is in progress. On the other hand, in cellular telecommunications, the term handover or handoff refers to the process of transferring an ongoing call or data session from one channel connected to the core network to another channel. In satellite communications, it is the process of transferring satellite control responsibility from one earth station to another without loss or interruption of service.

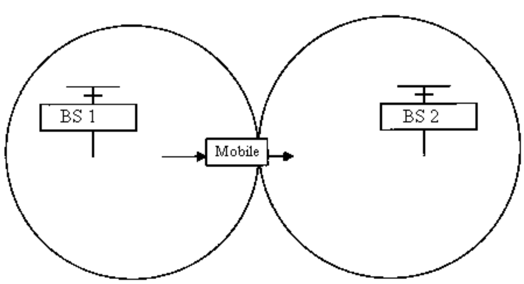

Figure 1 : Handoff / Handover

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American English uses the term handoff, and this is most commonly used within some American organizations such as 3GPP2 and in American originated technologies such as CDMA2000. In British English the term handover is more common, and is used within international and European organizations such as ITU-T, IETF, ETSI and 3GPP, and standardized with in European originated standards such as GSM and UMTS. The term handover is more common than handoff in academic research publications and literature, while handoff is slightly more common within the IEEE and ANSI organizations [1]. The time over which a call is maintained within a cell without handoff is called dwell time.

II. Typesof Handoff Handover

Handoffs are broadly classified into two categories—hard and soft handoffs. Usually, the hard handoff can be further divided into two different types—intra- and inter cell handoffs. The soft handoff can also be divided into two different types—multi way soft handoffs and softer handoffs.

Hard handoff means ―break before makeǁ that is the connection to the source is broken before or 'as' the connection to the target is made. In a hard handoff, the link to the prior BS is terminated before or as the user is transferred to the new cell's BS. That is why hard handoff is also known as ―break before makeǁ. In this case, the MS is linked to no more than one BS at any given time. Hard handovers are intended to be instantaneous in order to minimize the disruption to the call. A hard handover is perceived by network engineers as an event during the call. It requires the least processing by the network providing service. When the mobile is between base stations, then the mobile can switch with any of the base stations, so the base stations bounce the link with the mobile back and forth. This is called ping-ponging [1].Hard handoff is primarily used in OFDMA (orthogonal frequency division multiple access) and TDMA (time division multiple access) (i.e. GSM), where different frequency ranges are used in adjacent channels in order to minimize channel interference. So when the MS moves from one BS to another BS, it becomes impossible for it to communicate with both BSs (since different frequencies are used).

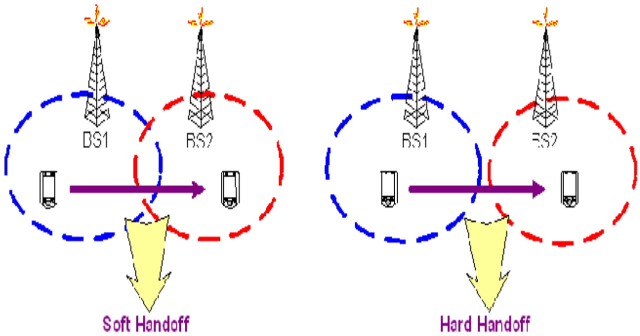

Figure 2 : Representation of Soft handoff & Hard handoff

If the handoff is performed between two time slot or channel in the same base station, it is called intra cell handoff or intra base station handoff. On the other hand, if the link is transferred between two base stations (BS) connected to the same base station controller (BSC), is called inter cell handoff or inter BS handoff.

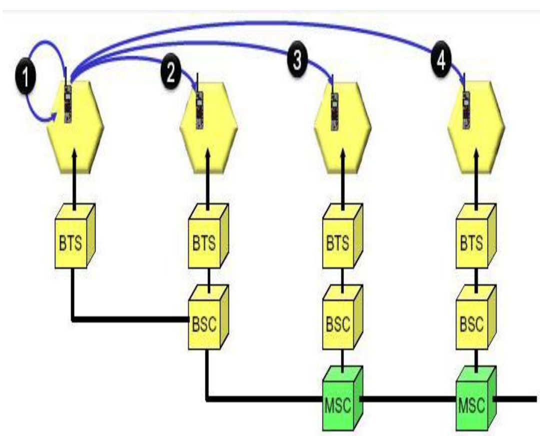

Figure 3 : (1) Intra cell handoff
(2)Inter cell / intra BSC
(3)Inter BSC / intra MSC
(4)Inter MSC handoff

Further, if the link is transferred between two base stations (BS) connected to the different BSCs on the same mobile switching center (MSC), is called inter BSC handoff. The inter BSC handoff is also known as intra MSC handoff. And, if the link transfer takes place at two base stations connected to different BSCs, it is known as inter MSC handoff.

If during ongoing call mobile unit moves from one cellular system to adjacent cellular system which is controlled by same mobile telephone switching office (MTSO), a handoff procedure which is used to avoid dropping of call is referred as Intra System Handoff. When a mobile signal becomes weak in a given cell and MTSO find other cell with in its system to which it can transfer the call then it uses Intra system handoff. Finally, if during ongoing call mobile unit moves from one cellular system to a different cellular system which is controlled by different MTSO, a handoff procedure which is used to avoid dropping of call is referred as Inter System Handoff. When a mobile signal becomes weak in a given cell and MTSO cannot find other cell with in its system to which it can transfer the call then it uses Inter system handoff. On the other hand, Inter system handoff is the handover between different radio systems, e.g. UMTS - GSM.

Figure 4 : Inter system handoff

III. Soft Handoff

Soft handoff is a "Make before break" handoff. That is, the mobile station (MS) is up on a call and moves from one base station (BS) to another, but the MS starts communicating with a new BS before terminating communications with the old BS. Soft handoffs can only be used between BSs on the same frequency. The technique improves reception as MSs move between cells (on cell boundaries). During soft handoff the MS actually communicates with more than one BS at a time, so that when it's time to move from the weaker BS to the stronger one, the MS is already in communication with the stronger one. During a soft handoff, the mobile station receives independent closed loop power control bits from the two BSs and perform "Or of Downs" logic to determine how to adjust its power. That means the mobile station will increase its power level if and only if both power control bits from the two BSs are 0 (indicating up). If the power control bit from any base station equals to '1' (indicating down), the mobile station shall decrease its power. Soft handover or soft handoff refers to a feature used by the CDMA and W-CDMA standards, where a cell phone is simultaneously connected to two or more cells (or cell sectors) during a call. If the sectors are from the same physical cell site, it is referred to as softer handoff.

In power controlled CDMA systems soft handoff is preferred over hard handoff strategies. This is more pronounced when the IS-95 standard is considered wherein the transmitter [the base station] power is adjusted dynamically during the operation. Here the power control and soft handoff are used as means of interference-reduction, which is the primary concern of such an advanced communication system. The previous and the new wideband channels occupy the same frequency band in order to make an efficient use of

Global Journal of Researches in Engineering (F) Volume XIII Issue XVI Version I Year 2013

bandwidth, which makes the use of soft handoff very important. The primary aim is to maintain a continuous link with the strongest signal base station otherwise a positive power control feedback would result in system problems. Soft handoff ensures a continuous link to the base station from which the strongest signal is issued. A softer handoff occurs when the MS is communicating with two sectors of a cell.

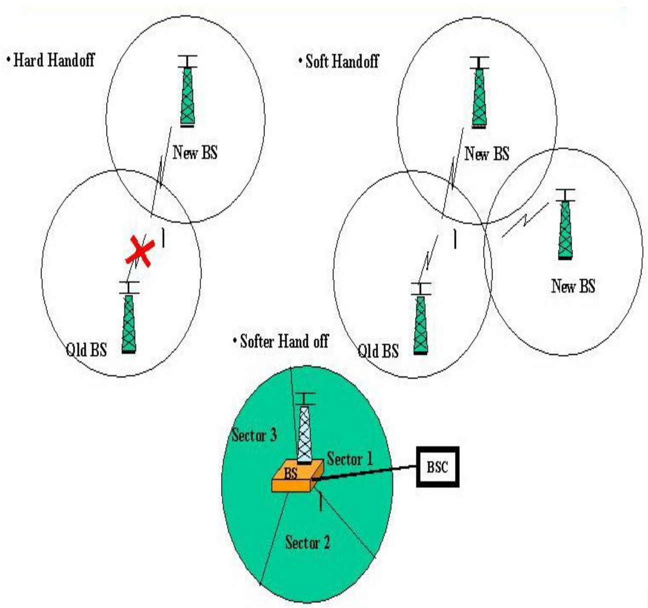

Figure 5 : Hard, Soft & Softer handoff

IV. Comparison Between Hard & Soft Handoff

a) Hard Handoff

- Break before make.
- The terminal is linked to more than one base station at any given time.
- Primarily used in FDMA and TDMA where different frequencies are used in adjacent cells.

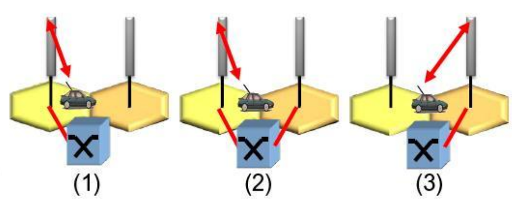

Figure 6 : Hard Handoff

b) Soft Handoff

- Make before break.
- New connection is established before the old connection is released, avoiding a cut in the connection during handoff.
- After the successful handoff the old connection is released.
- Used in CDMA where adjacent cells use same frequency rage.

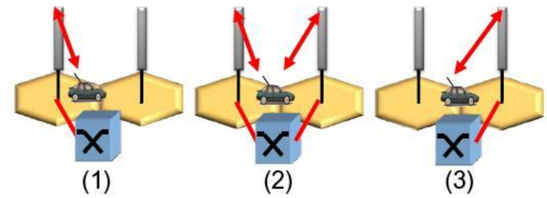

Figure 7 : Soft Handoff

V. Handoff Management

Handoff management means maintaining the traffic connection with a moving user when crossing cell boundaries. Handoff occurs when the quality or the strength of the radio signal falls below certain parameters (signal quality reason) it may also occur when the traffic capacity of a cell has reached its maximum or is approaching (traffic reason). GSM standard identifies about 40 reasons for a handoff. Handoff is initialized by the mobile or by the base station.

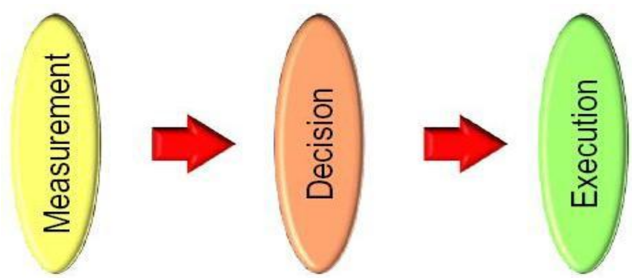

Figure 8 : Overview of handoff process

c) Measurement

- Measurement criteria: signal strength (between mobile and current base station as well as between mobile and neighboring base stations), distance, quality (e.g., in terms of error rates), traffic volume etc.
- Measurement reports exchanged between mobile and base station

d) Decision

- Decision parameters: thresholds and hysteresis margin.
- Network-controlled, mobile-assisted, mobile-controlled handoff

e) Execution

- Handover signaling
- Radio resource allocation
- Re-establishing connections in core and access networks

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- Hard and soft handoff
- Inter-cell and intra-cell handoff
- Inter-frequency and intra-frequency handoff
- inter-system and intra-system handoff

VI. Handoff Initialization

A hard handoff occurs when the old connection is broken before a new connection is activated. The performance evaluation of a hard handoff is based on various initiation criteria.

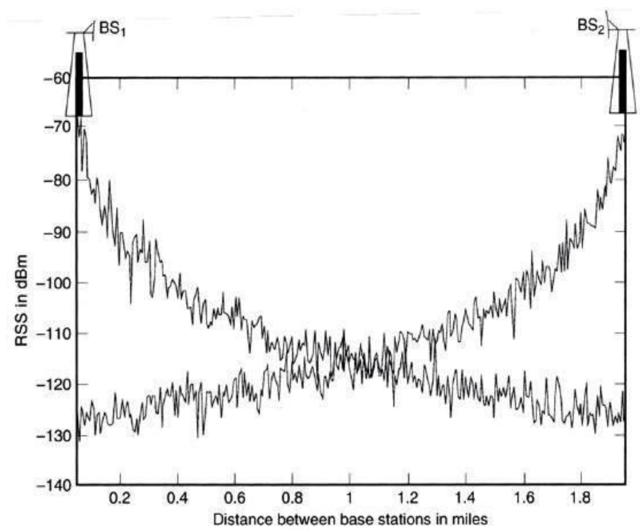

Figure 9 : Signal strength Vs distance

It is assumed that the signal is averaged over time, so that rapid fluctuations due to the multipath nature of the radio environment can be eliminated. Figure-9 shows a MS moving from one BS (BS1) to another (BS2). The mean signal strength of BS1 decreases as the MS moves away from it. Similarly, the mean signal strength of BS2 increases as the MS approaches it.

a) Relative Signal Strength (RSS)

Mobile terminal is handed off from BS A to BS B when the signal strength at B first exceeds that at A. If the signal strength at B first exceeds that at A, the mobile unit is handed back to A. In figure-10 handover occurs at point L_1. Because signal strength fluctuates due to multipath propagation effects, several handoffs may be occurred while BS1's RSS is still sufficient to serve the MS. These unnecessary handoffs are known as the ping-pong effect. As the number of handoffs increase, forced termination probability and network load also increases. But, handoff techniques should avoid such unnecessary handoffs.

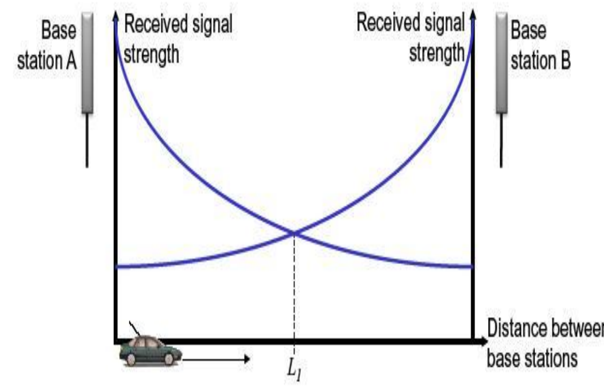

Figure 10 : Signal strength Vs distance for Relative Signal Strength (RSS)

b) Relative Signal Strength with Threshold (RSS-T)

Relative signal strength with threshold introduces a threshold value to overcome the ping-pong effect. Handover only occurs if the signal at the current BS is less than a predefined threshold and the signal from a neighboring base station is stronger.

For a high threshold (e.g., Th1), this scheme performs the same as the relative signal strength scheme. On the other hand, if the threshold is set quite low (e.g., Th3), the mobile may move far into the new cell. Threshold should not be used alone because its effectiveness depends on prior knowledge of the crossover signal strength between the current and the candidate base stations.

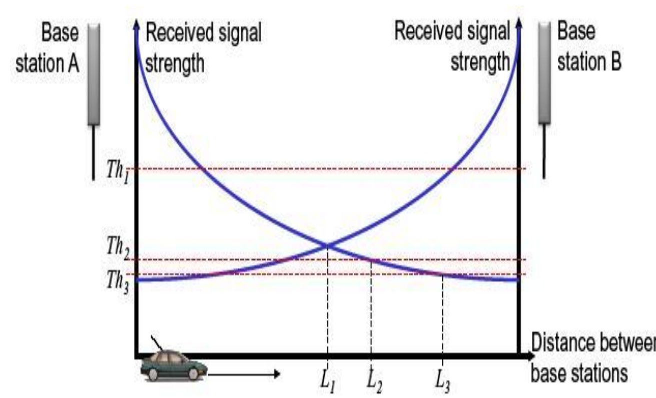

Figure 11 : Signal strength Vs distance for Relative Signal Strength with Threshold Scheme

c) Relative Signal Strength with Hysteresis (RSS-H)

Handover occurs only if the new base station is sufficiently stronger (by a margin H) than the current one. While the mobile is assigned to base station A, the scheme will generate a handover when the relative signal strength reaches or exceeds H. Once the mobile is assigned to B, it remains so until the relative signal strength falls below –H, at which point it is handed back to A. This scheme prevents the ping-pong effect but the first handover may still be unnecessary if base station A still has sufficient signal strength.

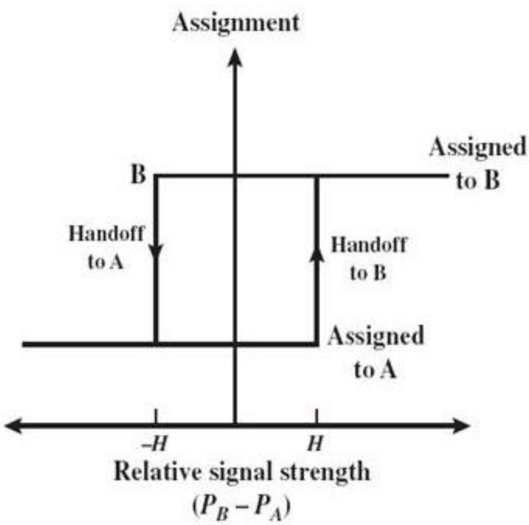

Figure 12 : Hysteresis mechanism

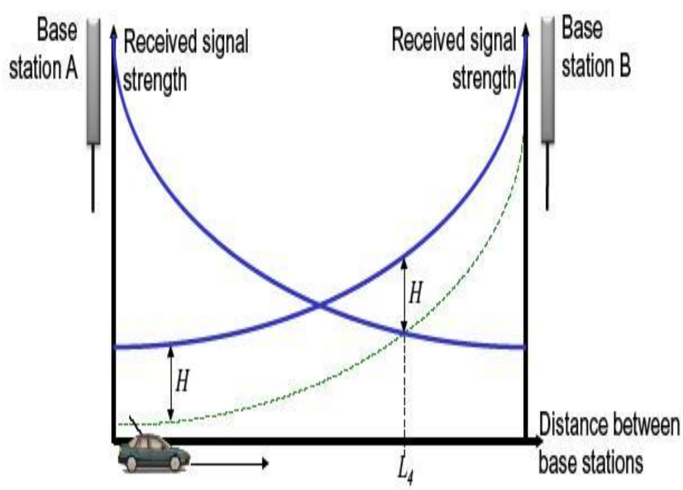

Figure 13 : Signal strength Vs distance for Relative Signal Strength with hysteresis Scheme

d) Relative Signal Strength with Threshold and Hysteresis (RSS-TH)

Handover occurs only if the current signal level drops below a threshold, and the target base station is stronger than the current one by a hysteresis margin H. Handover occurs at L4, if the threshold is either Th1or Th2. Handover occurs at L3, if the threshold is at Th3. Scheme avoids the ping-pong effect and execution of handover if signal from the serving base station is still strong enough. Decreasing threshold in the RSS-HT new cause increase the probability of handoff and therefore the number of handoffs and the number of wrong handoff increase.

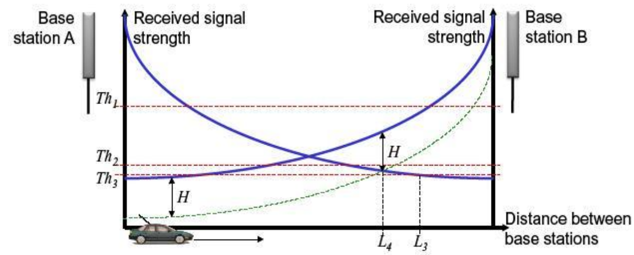

Figure 14 : Signal strength Vs distance for Relative Signal Strength with hysteresis and threshold Scheme

VII. Performance Matrics for Handoff

- Call blocking probability – The probability that a new call attempt is blocked.
- Handoff blocking probability – The probability that ahandoff attempt is blocked.
- Handoff probability – The probability that while communicating with a particular cell, an ongoing call requires a handoff before the call terminates. This metric translates into the average number of handoffs per cell.
- Call dropping probability – The probability that a call terminates due to handoff failure. This metric can be derived directly from the handoff blocking probability and the handoff probability.
- Rate of handoff – The number of handoff per unit time.
- Duration of interruption – The length of time during handoff for which the mobile terminal is in communication with neither base station.

VIII. Handoff Detection

Handoff decision is made & initiated based on measurement. Different systems use different approaches to execute handoff processes and these are characterized by handoff protocols. The terminal measures continuously level of signal in current channels and compare it with some other different channels. Based on the measurement results, the decision-making process of handoff may be centralized or decentralized i.e. handoff decision is made by handset, the network or the association between them, depending on the handoff control protocol. There are three strategies have been proposed to detect the need for handoff such as:

– Mobile Controlled Handoff (MCHO)

– Network Controlled Handoff (NCHO).

– Mobile Assisted Handoff (MAHO).

The evolution of mobile communications is toward decentralization, implying that both the management and setup of handoff procedures will be partially entrusted to the MS. Thus, advanced mobile systems typically follow MAHO.

a) Mobile Controlled Handoff (MCHO)

The mobile station (MS) continuously monitors the signals of the surrounding base stations (BSs) & initiates the handoff process when some handoff criteria are met. That is, in this method, the mobile station continuously monitors the signal strength and quality from the accessed base station and several handoff candidate base stations. This method has Very short reaction time (on the order of 0.1 seconds).

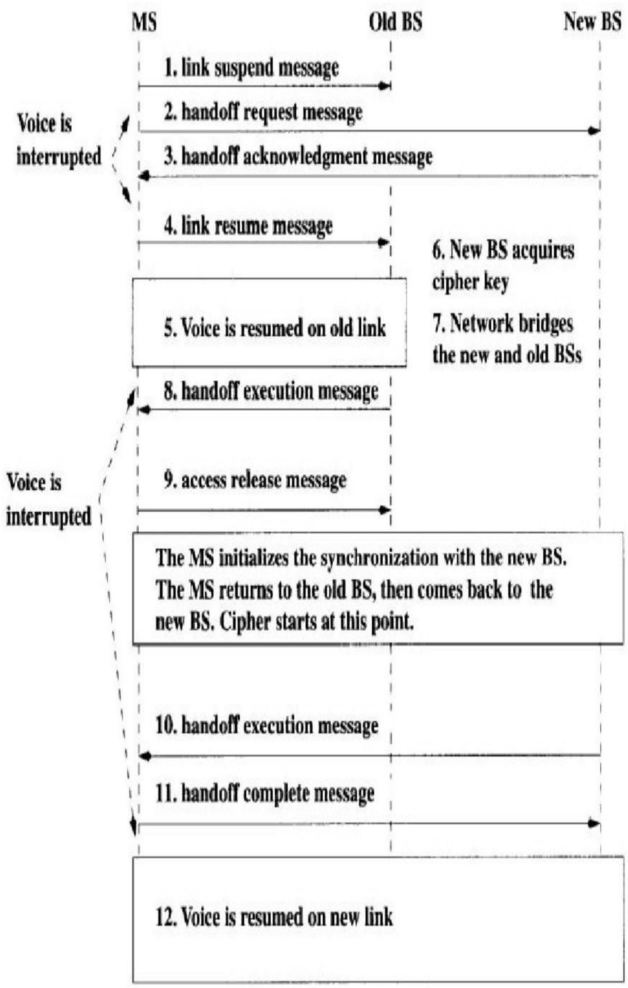

Figure 15 : MCHO inter BS hadoff message flow

b) Network Controlled Handoff (NCHO)

The surrounding base stations (BSs) measure the signal coming from mobile station (MS) & network initiates the handoff process when some handoff criteria are met. On the other hand, in this method, the base station monitors the signal strength and quality from the mobile station and when these deteriorate below some threshold, the network arranges for a handoff to another base station. The network examines all the surrounding base station to monitor the signal from the mobile station and report the measurement result back to the network. The network then chooses a new base station for the handoff and informs both the mobile station through the old base station and the new base station. NCHO is used in first generation cellular systems such as Advanced Mobile Phone System (AMPS), TACS (total access communication system), and NMT (advanced mobile phone system). In general, the handoff process (including data transmission, channel switching, and network switching) takes 100–200 ms.

c) Mobile Assisted Handoff (MAHO)

In this method, the handover is more decentralized. Both the mobile station & the base station supervise the quality of the link (i.e. RSSI, WEI). The network asks the MS to measure the signal from the surrounding BSs. But the network makes the handoff decision based on report from the MS. The mobile station does the received signal strength indication (RSSI) measurement of neighboring base stations. This handover strategy is used by the GSM cellular standard and mobile station transmits the measurement result to the base station twice a second. The decision as to when and where to execute the handover is still made in the network. In the circuit-switched GSM (global system mobile), the BS controller (BSC) is in charge of the radio interface management. This mainly means allocation and release of radio channels and handoff management. The handoff time between handoff decision and execution in such a circuit-switched GSM is approximately 1 second.

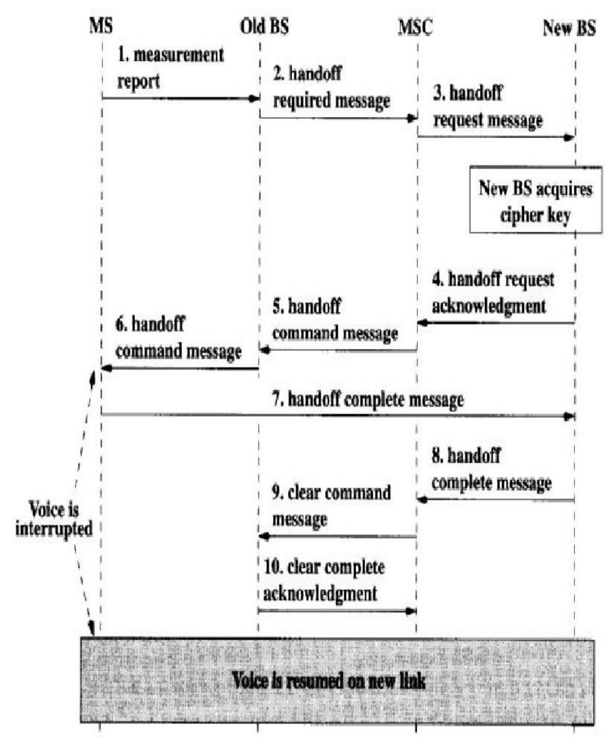

Figure 16 : MAHO inter BS hadoff message flow

For MCHO, NCHO and MAHO, handoff failure can occur for a number of reasons. Some of them are listed below:

a) The network takes too long to set the handoff after the handoff has been initiated.
b) There is no available channel on the target base stations.
c) The target link fails in some way during the execution of handoff.
d) Handoff is denied by the network, either for lack of resources or because the portable has exceeded some limit on the number of handoffs which may be attempted in some period of time.
e) In some other systems, handoffs can fail due to resource blocking (e.g. DECT).

Summary

Method	Measurement	Decision	Systems
MCHO	Mobile	Mobile	DECT, PACS, 802.11
NCHO	Network	Network	GSM, UMTS
MAHO	Mobile & Network	Network	AMPS,TACS, NMT

IX. Conclusion

Future generation wireless networks should ensure the best connectivity service to mobile subscriber anywhere at any-time. One way to improve the performance of wireless network is to use efficient handoff schemes when user is switching from one cell to another. In this paper we present an overview about the issues related to handoff initiation and decision and discuss about different types of handoff techniques in wireless communication. Throughout this paper we have gone through several scenarios and mechanisms of handover.

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Power Transmission Monitoring System using Wireless Zigbee Technology

By M. Banupriya, R. Punitha, B. Vijayalakshmi & C. Ram Kumar
SNS College of Engineering, India

Abstract- This paper proposes a wireless ZigBee technology to monitor the parameters of the transformer. The transformer parameters such as voltage, current, power factor and temperature can be monitored through wireless ZigBee technology. Embedded Ethernet is used to develop client and server applications. Acquisition of voltages, currents, temperatures, active and reactive power, controlling the switching devices and acquired data processing can be done by an embedded system. The modules in the embedded system are connected and the images of the transmission lines of the transformer during the power transmission will be noted and compared with the standard IR images by the use of image processing to observe the level of temperature passing through the transmission lines. Active power and the reactive power of the transformer which specifies the power usage and power wastage of the transformer respectively can be monitored. MATLAB simulations are carried out for the parameter monitoring.

Keywords: wireless zigbee technology, image processing, switchable distribution transformer, embedded ethernet.

GJRE-F Classification : FOR Code: 090607

Power Transmission Monitoring System using Wireless Zigbee Technology

M. Banupriya [α], R. Punitha [σ], B. Vijayalakshmi [ρ] & C. Ram Kumar [Ѡ]

Abstract- This paper proposes a wireless ZigBee technology to monitor the parameters of the transformer. The transformer parameters such as voltage, current, power factor and temperature can be monitored through wireless ZigBee technology. Embedded Ethernet is used to develop client and server applications. Acquisition of voltages, currents, temperatures, active and reactive power, controlling the switching devices and acquired data processing can be done by an embedded system. The modules in the embedded system are connected and the images of the transmission lines of the transformer during the power transmission will be noted and compared with the standard IR images by the use of image processing to observe the level of temperature passing through the transmission lines. Active power and the reactive power of the transformer which specifies the power usage and power wastage of the transformer respectively can be monitored. MATLAB simulations are carried out for the parameter monitoring.

Keywords: wireless zigbee technology, image processing, switchable distribution transformer, embedded ethernet.

I. Introduction

ZigBee is a specification for a suite of high level communication protocols using small, low-power digital radios based on an IEEE 802 standard for personal area networks. ZigBee devices are often used in mesh network form to transmit data over longer distances, passing data through intermediate devices to reach more distant ones. This allows ZigBee networks to be formed ad-hoc, with no centralized control or high-power transmitter/receiver able to reach all of the devices. Any ZigBee device can be tasked with running the network.

ZigBee is targeted at applications that require a low data rate, long battery life, and secure networking. ZigBee has a defined rate of 250kbit/s, best suited for periodic or intermittent data or a single signal transmission from a sensor or input device. Applications include wireless light switches, electrical meters with in-home-displays, traffic management systems, and other consumer and industrial equipment that requires short-range wireless transfer of data at relatively low rates.

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ZigBee is a low cost, low power, wireless mesh network standard. The low cost allows the technology to be widely deployed in wireless control and monitoring applications. Low power-usage allows longer life with smaller batteries. Mesh networking provides high reliability and more extensive range. ZigBee chip vendors typically sell integrated radios and microcontrollers with between 60 KB and 256 KB flash memory. Data transmission rates vary from 20 to 900 kilobits per second. The ZigBee network layer natively supports both star and tree typical networks, and generic mesh networks.

Every network must have one coordinator device, tasked with its creation, the control of its parameters and basic maintenance.ZigBee builds upon the physical layer and medium access control defined in IEEE standard 802.15.4 for low-rate WPANs. The specification goes on to complete the standard by adding four main components: network layer, application layer, ZigBee device objects and manufacturer defined application objects which allow for customization and favour total integration. Besides adding two high level network layers to the underlying structure, the most significant improvement is the introduction of ZDOs. These are responsible for a number of tasks, which include keeping of device roles, management of requests to join a network, device discovery and security.

II. Literature Survey

Remote monitoring has been implemented in many areas and it has a specific application to a three phase 10-kVA energy-efficient switchable distribution transformer. A designed embedded system and embedded Ethernet have been implemented to achieve a compact remote condition monitoring for the transformer. The embedded system performs acquisition of voltages, currents, and temperatures, controls the switching devices that connect the tappings of the transformer, and processes acquired data. Some protocols were developed as parts of software development of the whole system. Experimentation was done by applying the remote monitoring system to the transformer connected to three-phase variable supply voltage and load.

The development of integrated, portable, transformer condition monitoring (TCM) equipment for classroom demonstrations as well as for student exercises conducted in the field is discussed. Demonstrations include experimentation with real-world transformers to illustrate concepts such as polarization and depolarization current through oil-paper composite insulation. The developed equipment has also been used to understand and illustrate the phenomenon of recovery voltage. Finally, the portability and robustness of the equipment enables students to collect data from transformers installed on-site for the purpose of validating the nature of curves obtained in real-world environments.

There are plenty of proper monitoring methods to evaluate the condition and possible incipient failures of a power transformer. For distribution transformer monitoring, the methods are usually too expensive and/or time consuming to use. However, cost-efficient methods for distribution transformer monitoring are needed and one possibility for this is to utilize loading and temperature information measured from the network. The monitoring methods are based on the existing IEC and IEEE standards and neural-network analysis. The methods are used to calculate the top-oil and hot-spot temperature as well as the loss of life of a transformer. The calculated results are verified with measured top-oil temperature values.

We describe a recently developed DC motor position control experimental setup that can be accessed via the Internet. This setup consists of two primary elements communicating with each other: i) a server consisting of a low-cost microcontroller, Parallax's 40-pin Basic Stamp 2, interfaced with an embedded Ethernet IC, Cirrus Logic's Crystal CS8900A, and ii) a client computer. The client computer sends/receives data to/from the microcontroller using the user datagram protocol packets. The client computer connects to the server using Java applets that allow the user to command the position of the motor via a graphical user interface.

III. System Analysis

a) *Existing System*

In the existing system the parameters of the transformer were monitored and the modules of the embedded system were connected and communicated through the CAN bus which is wired communication. Wired communication has some drawbacks when they carry data such as loss of data and lack of effective communication. Another thing in this system is the parameters of the transformer such as voltage current temperature and power factor were measured but active power and the reactive power was not measured.

i. *Drawbacks*

- Since the communication is wired there will be considerable power loss and also data loss. Efficient data transmission is so much important in transformer monitoring. But there will be loss of data in the CAN bus.
- Active power and reactive power was not measured. By the use of active and reactive power measurement we can analyze the level of temperature passing on the transmission lines.

b) *Proposed System*

In the proposed system the transformer parameters such as voltage current and temperature can be monitored through wireless technology. The modules in the embedded system are connected through wireless ZigBee technology and the images of transformers during the power transmission will be noted and compared with the standard IR images by the use of image processing.

Active power and the reactive power of the transformer can be monitored. The monitored parameters will be given to the microcontroller and also the images will be sent to the embedded Ethernet which consists of microcontroller and acts as server and client.

i. *Advantages*

- No wires involved in the proposed system. Hence we can avoid power and data loss. It can able to detect the faults due to over current, under voltage, increased temperature.
- It can be operated in any environment in a Transformer. Monitoring multiple transformers sitting in an office is possible.

IV. System Description

a) *Transformer Module*

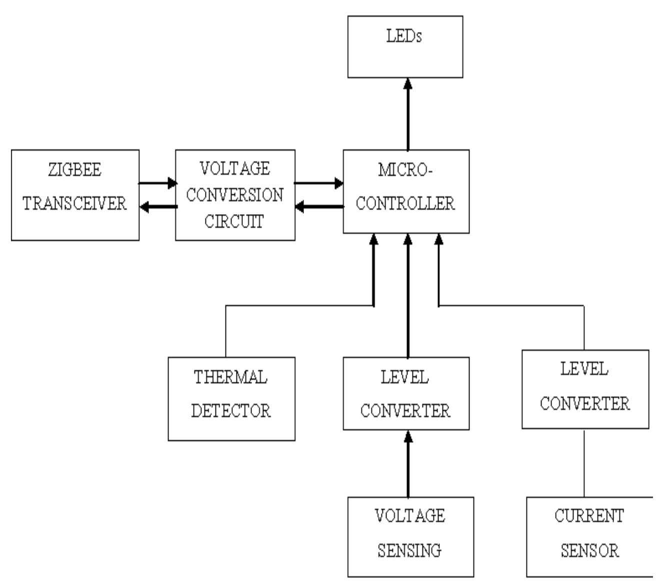

Figure 4.1 : Block Diagram for transformer Module

b) Control Room Module

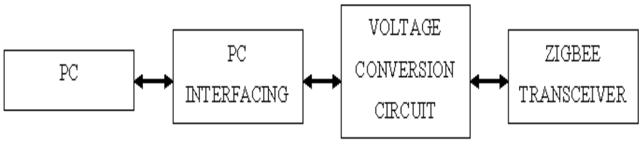

Figure 4.2 : Block Diagram for Control Room Module

c) Transformer Monitoring

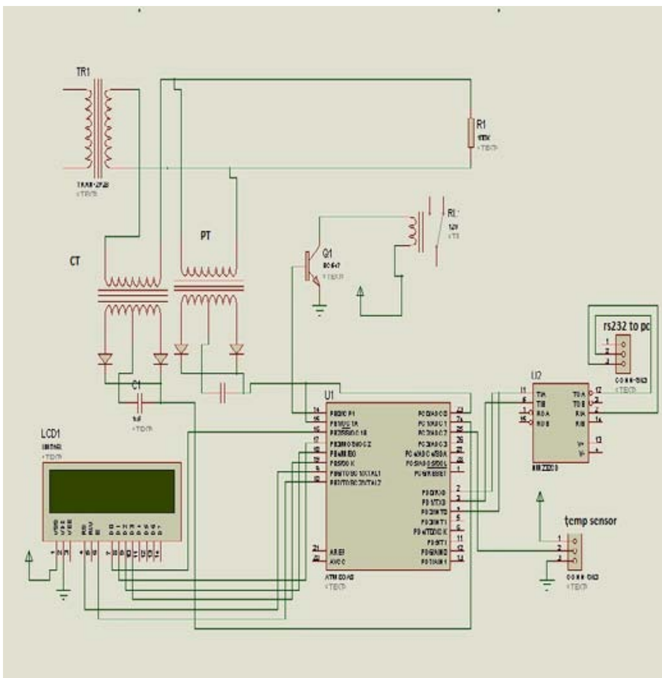

Figure 4.3 : Transformer Monitoring

V. Conclusion

Remote monitoring of systems has been increased today. Monitoring the transformer parameters such as current voltage temperature and power factor by the use of ZigBee technology is implemented.

The temperature passing on the transmission lines will be monitored and compared with the IR images by the help of image processing which provides the condition of the transmission lines and the level of the temperature passing through it. Additional parameters such as active and reactive power is measured to monitor the parameters effectively and to provide the proper precautions.

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A Manual Reconfigurable Multiband Cavity Backed Helical Antenna

By Rahul Yadav & VinitKumar Jayprakash Dongre
Mumbai University, India

Abstract- The paper presents a miniaturized design of helical antenna loaded inside an impedance matching L-wall shaped cavity to achieve multi-frequency bands in the range of 5-15 GHz. A detail analysis of helix orientation inside the designed cavity is carried out. The cavity and helix arrangement is made reconfigurable by placing the helix and RF feed in such a way that it can thus be rotated manually at various angles with respect to the cavity walls. A comparative analysis of antenna gain and bandwidth is also reported. The antenna has a peak gain of 11.28dB and highest bandwidth of 2.68GHz. The maximum power handling capacity of the design is found to be 40.67MW. Computer Simulation Tool is used in the modeling of antenna. The antenna being conformal in design finds its application in aerospace, military and personal wireless communication.

Keywords: l-wall cavity, 1½ turns helix, multiband, manual re-configurability, helix rotations.

GJRE-F Classification : FOR Code: 291701, 290903p

AMANUALRECONFIGURABLEMULTIBANDCAVITYBACKEDHELICALANTENNA

A Manual Reconfigurable Multiband Cavity Backed Helical Antenna

Rahul Yadav [α] & VinitKumar Jayprakash Dongre [σ]

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Keywords: l-wall cavity, 1½ turns helix, multiband, manual re-configurability, helix rotations.

I. Introduction

The helical antenna has always been in demand for wireless communication and has gone through various kinds modification for gain and bandwidth enhancement techniques [1-4] to improve the overall antenna performance. Another important feature as discussed in [5-6] which make the helical antenna more demanding is its power handling capacity. But the problem in helical antenna arrived when the helical antenna designs were only limited to WLAN (2.4 GHz) and S-band frequencies. The reason being that existing equations and mathematical proofs given by Kraus [7] and other authors showed that, the stability in helical antenna at much higher frequency is not feasible.

So a demand arises to demonstrate a stable frequency response and impedance matching in helical antenna for higher range of frequencies.

The work presented in this paper aims to show that helical antenna can still be used at higher frequencies even beyond C-band. Also here attention is focused on the enhancement of bandwidth and gain along with the reduction in size of helical antenna which finds important application in communication systems.

The issue of compact size in the antenna design has always been challenging barrier. So to overcome this barrier, a conformal partial cavity has been designed which backs the helical antenna. The name partial cavity is assigned because unlike the actual cavity which has its all side enclosed, the cavity designed here has opening in three different directions. To keep the system more compact, helix turns has been compromised in the design. In this paper, an L-wall partial cavity backed 1½ turn helical antenna is designed and its parameters like gain, bandwidth, radiation pattern and power handling capacity are investigated. In the design, the parameter like spacing between walls is also taken into account to carry out a detail analysis. To make the antenna reconfigurable, the helix is loaded inside the cavity in such a way that it can thus be rotated manually without disturbing the feed. This is done by digging a hole at the center of the ground plane whose diameter is 1mm extra compared to that of diameter of SMA connector. This allows soldering of the helix feed pin and SMA connector together conveniently. The bonding connection is coated with PTFE to prevent it from shorting with the cavity body.

It is important to note that the conventional helical antennas have generally a single resonant mode [8-9]. However in [10], the higher order mode can be realized by modifying the ground plane and geometry of the helical antenna. Although the helical antenna is a three dimensional entity whose modes are characterized by half wave variation along x, y and z axis, for simplicity the modes can be reduced to TM_{mn} by observing the wavelength variation in ‘x’ and ‘y’ direction only form the top view.

II. Antenna Design & Theory

The conventional design of helical antenna explains that to have proper circular polarization of electric fields, the helix should have atleast three turns and for that its circumference (C) should be in between 0.75λ-1.33λ. However the number of turns can be reduced to 1½ if the electric fields from the antenna can be confined with double the intensity from conventional helix. With the decrease in helical turns, there is possibility that the higher order modes may not be excited but this can be accounted by loading helix inside the cavity. It is important to note that the primary reason for reducing the turns of helix is the fact that it will follow odd symmetry with respect to each of the cavity wall and will provide greater degree of variation in the design. The pitch angle of the helix is kept as 14 degree.

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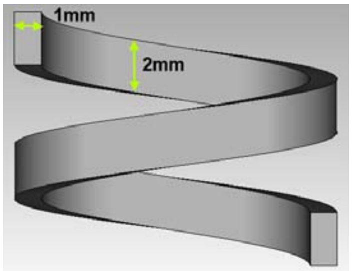


Figure 1 : Rectangular helix

The rectangular configuration of helical is chosen in order to have non-uniform distribution of current along the antenna which will eventually help to excite higher order modes along with the fundamental mode, whereas in case of conventional cylindrical helix only fundamental mode is excited. So a rectangular helix is designed with a strip width of 2mm and thickness of 1mm as shown in Fig.1.

a) Design of Impedance Matching Cavity

To demonstrate a stable response of helical antenna for higher range frequencies, an L-wall cavity has been designed as shown in Fig.2a. The design of L-wall shaped partial cavity begins with the assumption that not necessarily the cavity should always enclose the antenna to achieve more directive pattern. Instead, the proper orientation of metallic walls around the helical antenna can significantly help to improve the overall gain and bandwidth of the antenna. So the cavity which is basically a modified ground plane to the helical antenna is designed assuming 13.6GHz ± 1.4GHz as the critical range of frequency. The higher range of frequency is selected to achieve impedance matching of helical with the standard 50Ω excitation. Also this critical frequency leads to a minimum height of cavity wall with which efficient confinement of electric field is possible. So all the dimensions of cavity calculated here is critical wavelength dependent using eq.(1).

$$\lambda = c/f \qquad (1)$$

Where 'c' is the velocity of light and 'f' is critical frequency

The designed cavity has a height of 20mm and ground base as (24×24) mm. Now the cavity is actually acting as a resonator whose inductance and capacitance per axial inch can be calculated as;

$$L \approx 0.025 n^2 d^2 [1-(d/W)^2] \mu H \qquad (2)$$

$$C \approx \frac{0.75}{\log_{10}(W/d)} pF \qquad (3)$$

Where d- diameter ofhelix, W-width of ground base

It is important to note that the impedance matching cavity inner dimensions can also be calculated as;

$$W = \frac{d}{0.41} = 0.8\lambda \qquad (4)$$

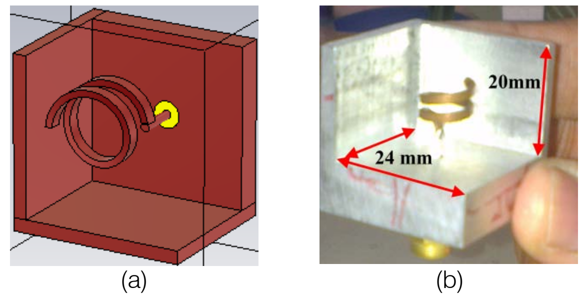


Figure 2 : (a) Perspective view of cavity backed helix, (b) Fabricated design

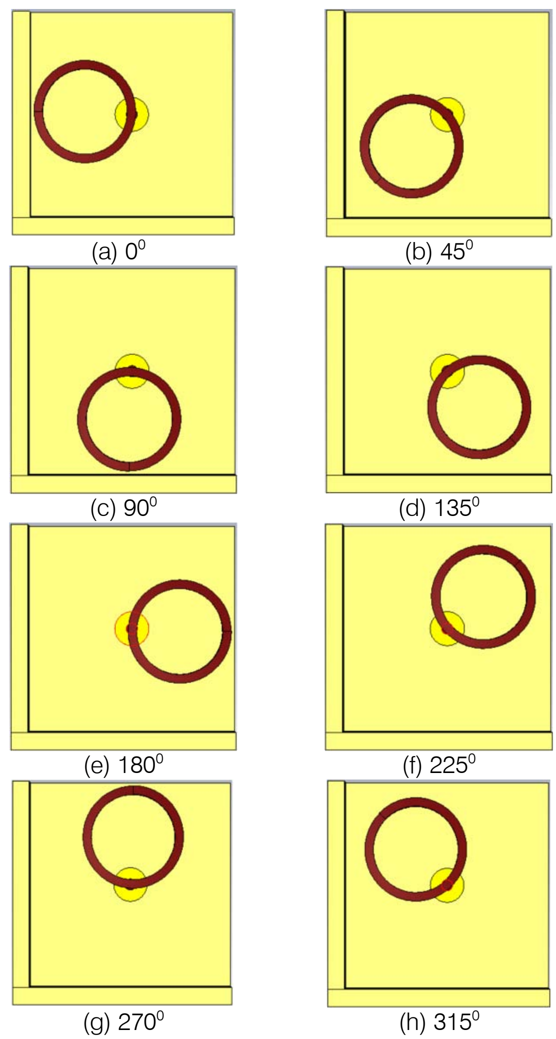


Figure 3 : Helix rotations inside the L-wall cavity

Next, it is important to find a suitable feed location of helix inside the L-wall cavity. So the helical antenna is placed with its feed pin at the center of the cavity from inner dimension. The orientation of helix with respect to the cavity walls is another potential parameter which will help to investigate the behavior of helical antenna in various directions inside the cavity. For this, the antenna is rotated with an offset angle of 45° in anticlockwise direction and thereby making the design reconfigurable in nature. Figure 3 shows the top view of helix rotation inside the L-wall partial cavity.

III. Result Analysis & Discussion

The simulation is performed in CST Microwave Studio Suite using time domain solver with accuracy set to -40dB. The boundary condition which plays an important role in the numerical analysis is kept as open space around the antenna. To investigate the effect of cavity and its corresponding enhancement in gain and bandwidth of helical antenna, initially a helix is simulated without the use of L-wall cavity so that a better comparative analysis can be made.

The analysis begins with the simulation of helical antenna only with a rectangular ground plane of (24×24) mm. Figure 4 shows the plot of reflection coefficient (S_{11}) in the frequency range of 5-15 GHz. It is observed that since the turns are too low, the result of S_{11} is not below -10dB. From Fig.5, it explains that theVSWR (voltage standing wave ratio) is not below 2 indicating that there is no impedance matching in helical antenna for higherrange of frequencies and the resonant modes are too weak. However these can be improved by loading the designed 1½ turn helical antenna in a specially design cavity.

The plots of reflection coefficient for L-wall cavity backed helical antenna at various rotation angles is shown in Fig.6. It is observed that at 0° position,a dual band is obtained from 7.3-8.4GHz and 13.49-15GHz with a bandwidth of 2.68GHz. This is the highest simulated bandwidth of helical antenna in this design because the spacing between helix and wall is less which results in more reflection of electric fields from the walls and also the helix end is pointing towards the corner of the L-wall. So the bandwidth should be higher at 45° position also, but this is not the case here because at 45° position the helix end starts orienting slightly outward from the L-wall. Therefore at 45° position instead of dual band only single band is resonated.Also it is noted that from 0° to 135°position, the bandwidth is eventually decreasing and dual band is only occurring at 0° and 90° position.At 90° position the helix end is outward the wall, but in 0° position the helix end is inwards the L-section of the wall, so the bandwidth at 0° position is high as compared to 90° position.Rest of the angles is with single frequency band only. Beyond 180° the bandwidth start increasing up to 270°, this is because the spacing of the helix from the cavity wall is decreasing.

It is observed that if the helix approaches closer to the walls, the bandwidth increases which can be seen in Table.1. At 135° the spacing between the helix and the base of L-wall is more, so the bandwidth is poor i.e. 0.41GHz only.

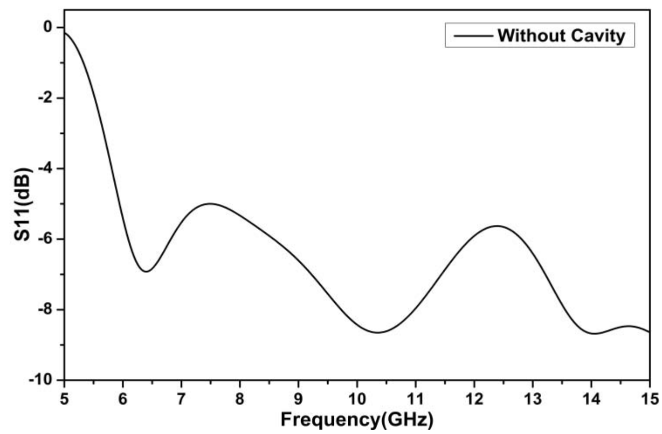


Figure 4 : Reflection coefficient (S_{11}) of helix without cavity

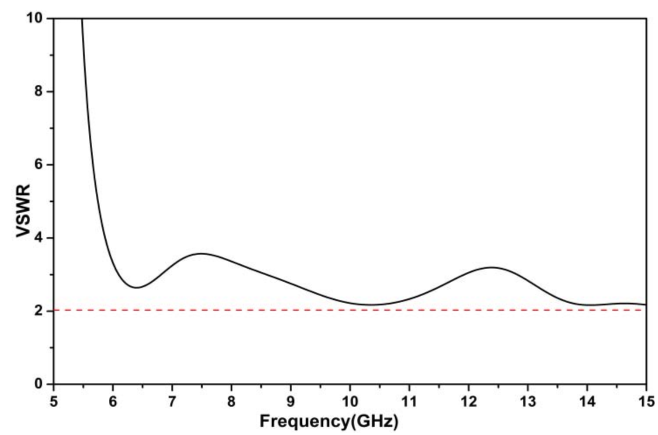
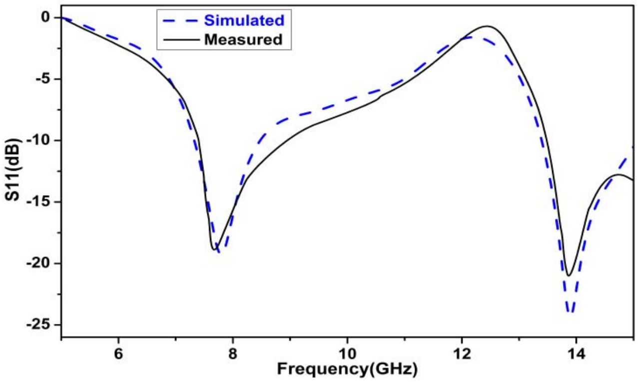


Figure 5 : Voltage standing wave ratio of helix without cavity

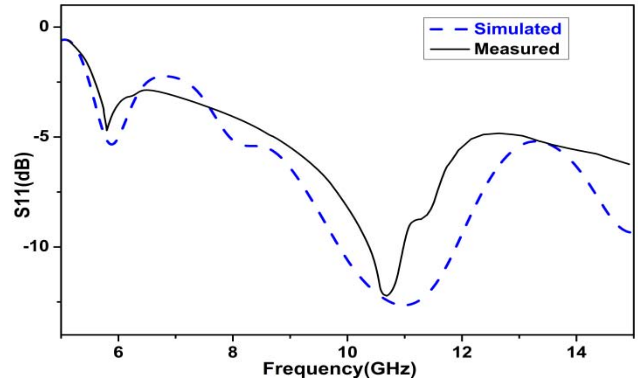
After the comparative analysis made for simulated and measured results of cavity backed helix, it is seen that there is an agreement in comparison made for majority of the helix rotation angle. However at positions like 90°, 180° and 225°, a slight shift and increase in the measured bandwidth is noticed. A detail explanation for this is illustrated in section IV.

The radiation pattern as shown in Fig.7 is simulated for each of the helix position inside the cavity at peak resonance for the respective orientations in E-plane. It is observed that due to the manual reconfiguration of helix orientation, both omnidirectional and directive nature of pattern is obtained which makes the antenna suitable for point to point and point to multipoint communication.

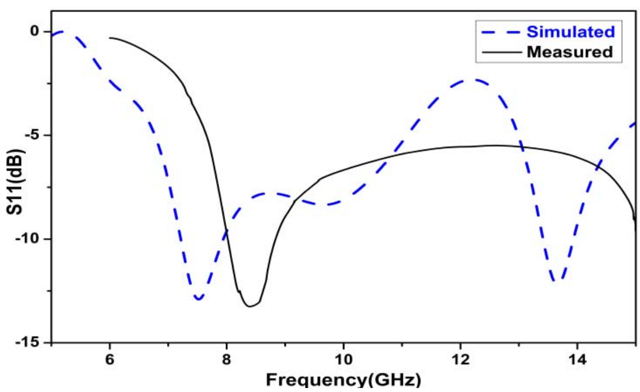
Global Journal of Researches in Engineering (F) Volume XIII Issue XVI Version I Year 2013



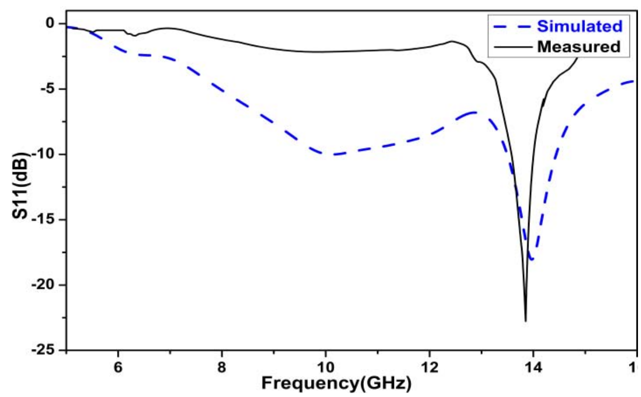
(a) 0^0 position



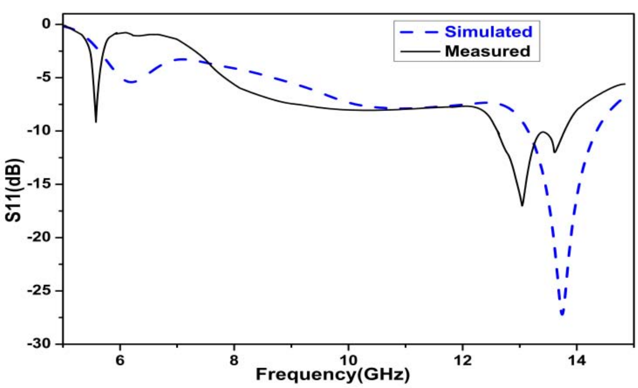
(b) 45^0 position



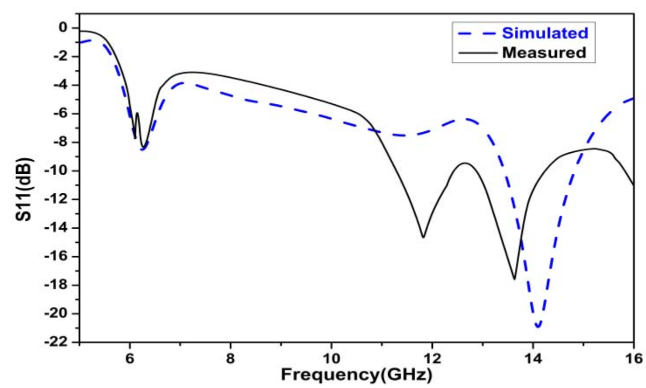
(c) 90^0 position



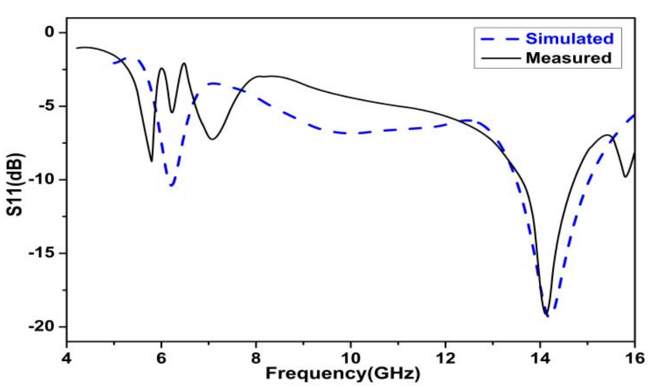
(d) 135^0 position



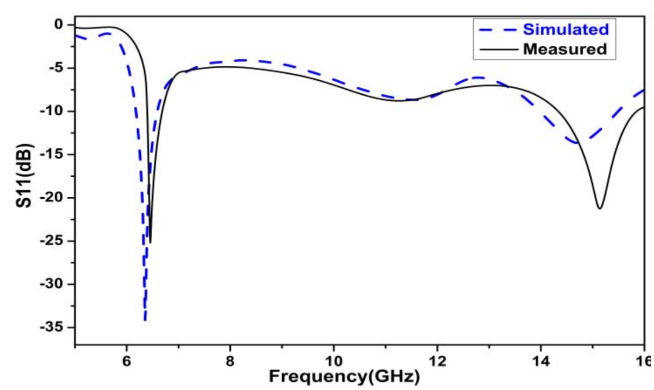
(e) 180^0 position



(f) 225^0 position

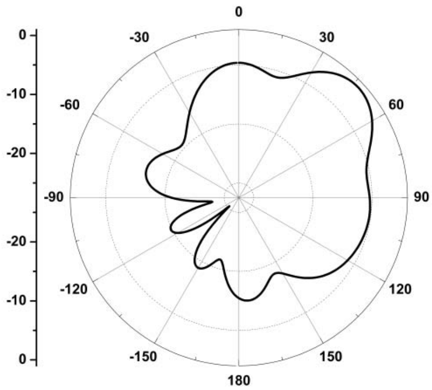


(g) 270^0 position

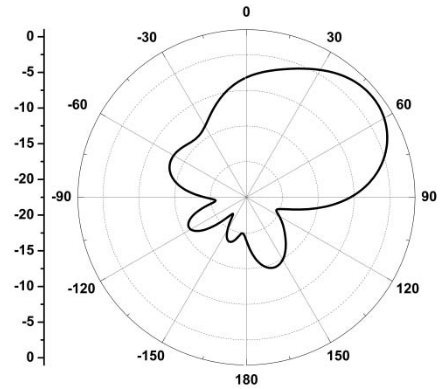


(h) 315^0 position

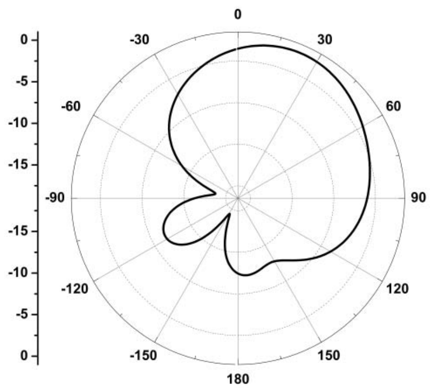
Figure 6 : Comparative simulated and measured results of cavity backed helix at various rotation angles



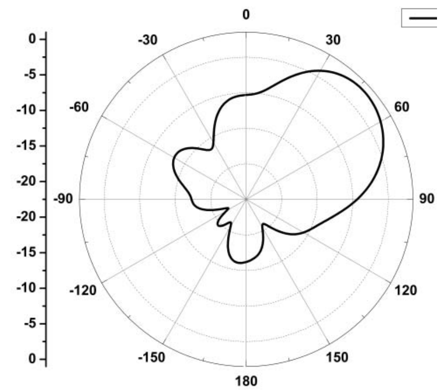
(a) 0^0 at 13.89GHz



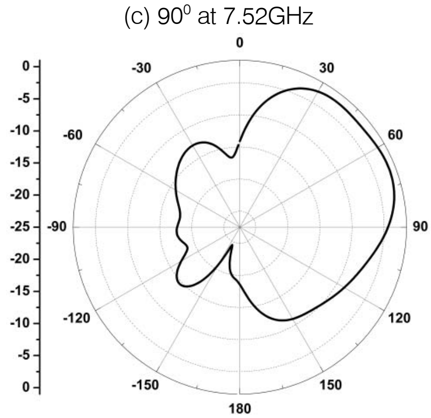
(b) 45^0 at 11GHz



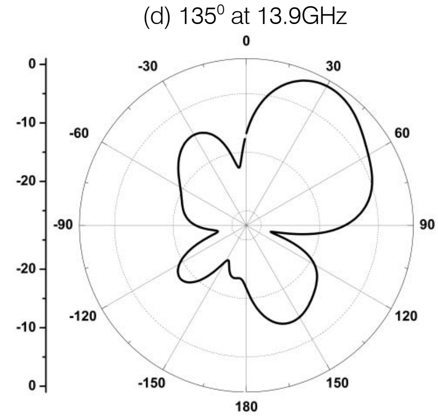
(c) 90^0 at 7.52GHz



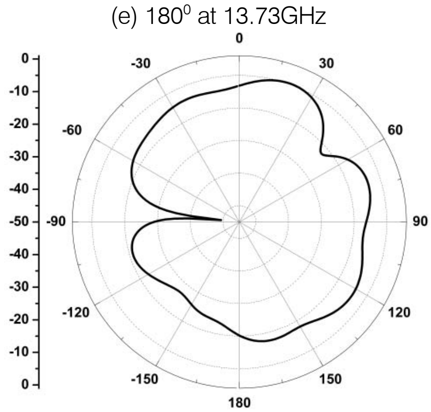
(d) 135^0 at 13.9GHz



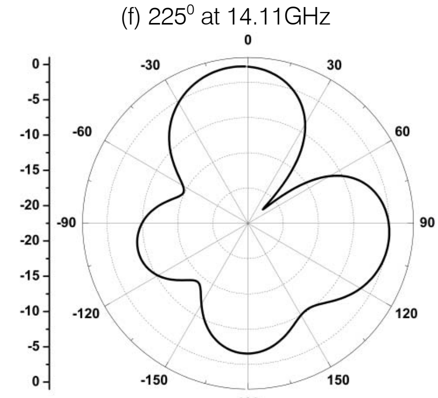
(e) 180^0 at 13.73GHz



(f) 225^0 at 14.11GHz



(g) 270^0 at 14.2GHz



(h) 315^0 at 6.35GHz

Figure 7 : Simulatedrelative power pattern of cavity backed helix in all rotation angles at the respective peak resonance

A comparative plot for investigated gain is shown in Fig. 8. The gain at 0° position is 11.28dB which is the highest gain in this design. A complete gain analysis has been illustrated in Table.2.

Table 1 : Frequency analysis of cavity backed helix

Helix Position	No. of Bands	Resonant Bands(GHz)	Bandwidth (GHz)
0^0	Dual	7.3-8.44 & 13.49-15	2.68
45^0	Single	9.58-11.91	2.33
90^0	Dual	7.21-7.93 & 13.42-13.93	1.22
135^0	Single	13.5-14.44	0.94
180^0	Single	13.15-14.33	1.18
225^0	Single	13.44-14.82	1.38
270^0	Single	3.49-15.03	1.54
315^0	Single	6.18-6.59	0.41

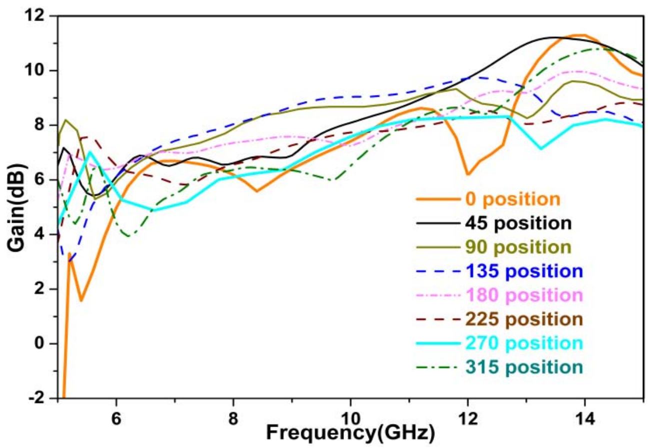


Figure 8 : Simulated gain for helix at various rotation angles

Next, to find the maximum power handling capacity of antenna, the intensity of near electric field vector is solved which is founds to be 7837 V/m as shown in Fig.9. Now assuming that breakdown threshold for helical antenna which is made of copper as 50 MV/m [11], the maximum power handling capacity comes out to be 40.67 MW.

Table 2 : Gain analysis of cavity backed helix

Helix Position	Peak Gain(dB)
0^0	11.28
45^0	11.2
90^0	10.7
135^0	9.7
180^0	10
225^0	8.8
270^0	8.2
315^0	10.7

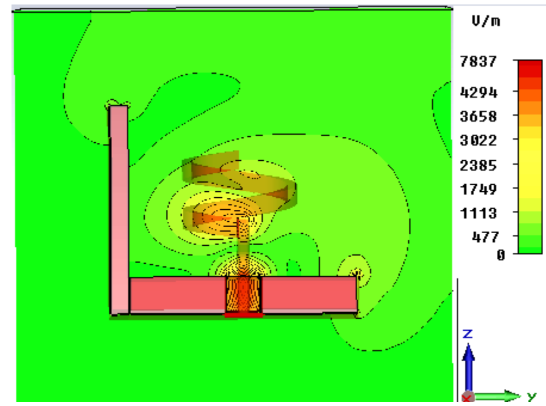


Figure 9 : Near E-field intensity

IV. Experimental Observations

In the fabricated design of cavity backed helical antenna, the helix which is made using copper and the impedance matching L-wall cavity which is fabricated using aluminum metal as shown in Fig.2b, it is found that the joint connection between the helix and feed pin plays an important in the distribution of current along the helical antenna. In the modeling of antenna in Computer Simulation Tool (CST), the joint connection between the helix and feed pin is abrupt however this has been improved in the practical implementation of helix as shown in Fig.10. The geometrical operation of lofting has been employed to enhance the flow of current from the feed along the helix. The lofting certainly improves the current distribution along the antenna and thereby increases the overall bandwidth of the antenna. The measured results of reflection coefficient show improvement in bandwidth over the simulated results at some of the rotation angles.

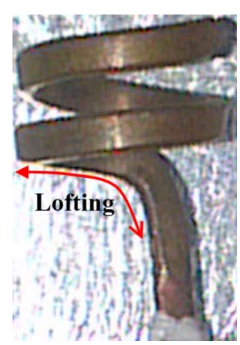


Figure 10 : Lofted helix

V. Conclusion

A compact and conformal helical antenna design has been demonstrated with a stable frequency response. It is found that modification of ground plane which is the L-wall cavity here in the design plays an important in confinement of near field electric vector. Also the orientation of helix inside the cavity should be appropriately adjusted to provide a multiple reflectionsof

Global Journal of Researches in Engineering (F) Volume XIII Issue XVI Version I Year 2013

electric field from the walls of cavity and thereby increasing the number of resonant bands.

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Analysis of Series Hybrid Electric Vehicle with Auxiliary Power Unit

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Abstract- Hybrid electric vehicles represent a promising future direction for the transportation sector in terms of decreasing the reliance on fossil fuels while simultaneously decreasing emissions. Energy used for driving is fully or partially shifted to electricity leading to lower emission rates.In this regard, the use of a power generator and motor as the primary power source for an automobile is very attractive. This thesis develops model of a series hybrid vehicle with a power generator as its Auxiliary Power Unit (APU). Simulation using the model helps to provide an understanding of the interaction and flow of power. Moreover, electrical power sharing between the APU and the Electrical Storage System (ESS) is shown. Conclusion is also discussed.

Keywords: traction motor, control strategy, tractive effort etc.

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ANALYSISOFSERIESHYBRIDELECTRICVEHICLEWITHAUXILIARYPOWERUNIT

Analysis of Series Hybrid Electric Vehicle with Auxiliary Power Unit

Avizit Basak [α], M. M. Israfil Shahin Seddiqe [σ], Md Sabbir Alam Chowdhury [ρ] & Md. Khairul Bashar [ω]

Abstract- Hybrid electric vehicles represent a promising future direction for the transportation sector in terms of decreasing the reliance on fossil fuels while simultaneously decreasing emissions. Energy used for driving is fully or partially shifted to electricity leading to lower emission rates.In this regard, the use of a power generator and motor as the primary power source for an automobile is very attractive. This thesis develops model of a series hybrid vehicle with a power generator as its Auxiliary Power Unit (APU). Simulation using the model helps to provide an understanding of the interaction and flow of power. Moreover, electrical power sharing between the APU and the Electrical Storage System (ESS) is shown. Conclusion is also discussed.

Keywords: traction motor, control strategy, tractive effort etc.

I. Introduction

A Hybrid Vehicle, as defined by Technical Committee 69 (Electric Road Vehicles) of International Electro Technical Commission, is one in which propulsion energy during specified operational missions is available from two or more kinds or types of energy stores, sources or converters with at least one store or converter onboard. A more specific definition of a hybrid electric vehicle is given as a hybrid vehicle in which at least one of the energy stores, sources or converters can deliver electric energy.

a) Hybrid Vehicle Architectures

The parallel configuration illustrated in figure 1.1 also represents a typical design, where both the ICE and the electric motor can provide torque to drive the wheels.

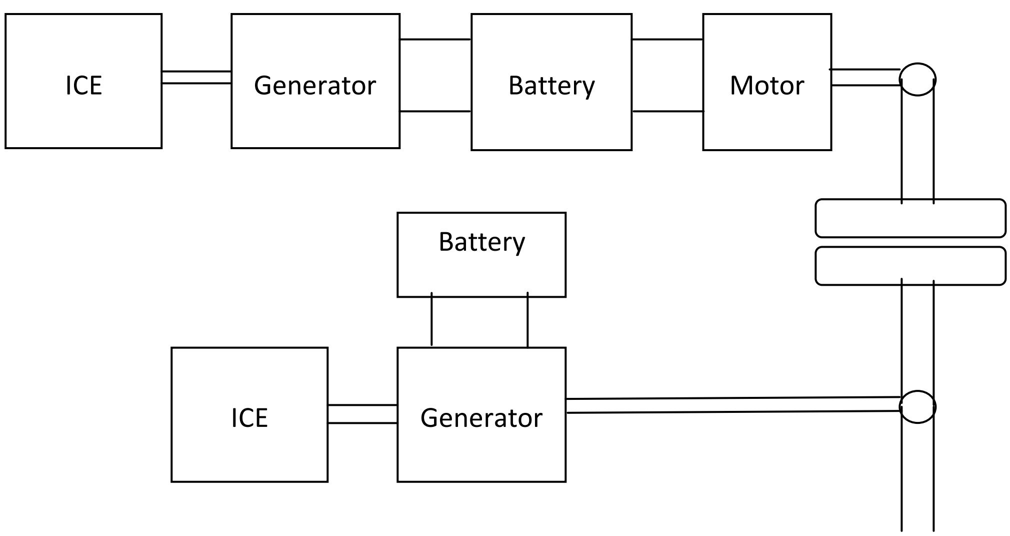

Figure 1.1 : Typical series and parallel hybrid vehicle architectures

II. Series Hybrid Drive Train

Although there are many possible configurations for a series hybrid drive train, a traction motor propels the vehicle. The motor delivers high torque at low speeds and low torque at high speeds. The motor gives a constant torque for variable speed up to the 'base speed' of the motor; beyond the base speed, the torque of the motor decreases with increase in the speed. The traction motor is powered by a battery pack and/or an engine generator unit. The engine/generator unit either helps the batteries to power the traction motor when load power demand is large, or charges the batteries when the load power demand is small. The motor controller is used to control the traction motor to produce the power required by the vehicle.

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a) Maximum State of Charge of Peaking Power Source Control Strategy

Consider Point A. The demanded power is more than what the engine/generator alone can meet (P_e/g). Hence the motor supplies the extra power to meet the load demand. (P_{pps}). At point B, the power required is less than the power produced by the engine /generator at its optimal operating point. In this case, this surplus power that is being produced by the ICE can either be used to charge the peaking power source else the engine is operated in its non- optimal region, to supply just the traction power. Point C has negative (braking power) which is more than the braking power that the motor can alone produce, hence hybrid braking is used. Here, the electric motor produces its maximum braking power and mechanical brakes are also applied in addition. Point D represents the commanded braking power that is less than the maximum braking power that the motor can produce.

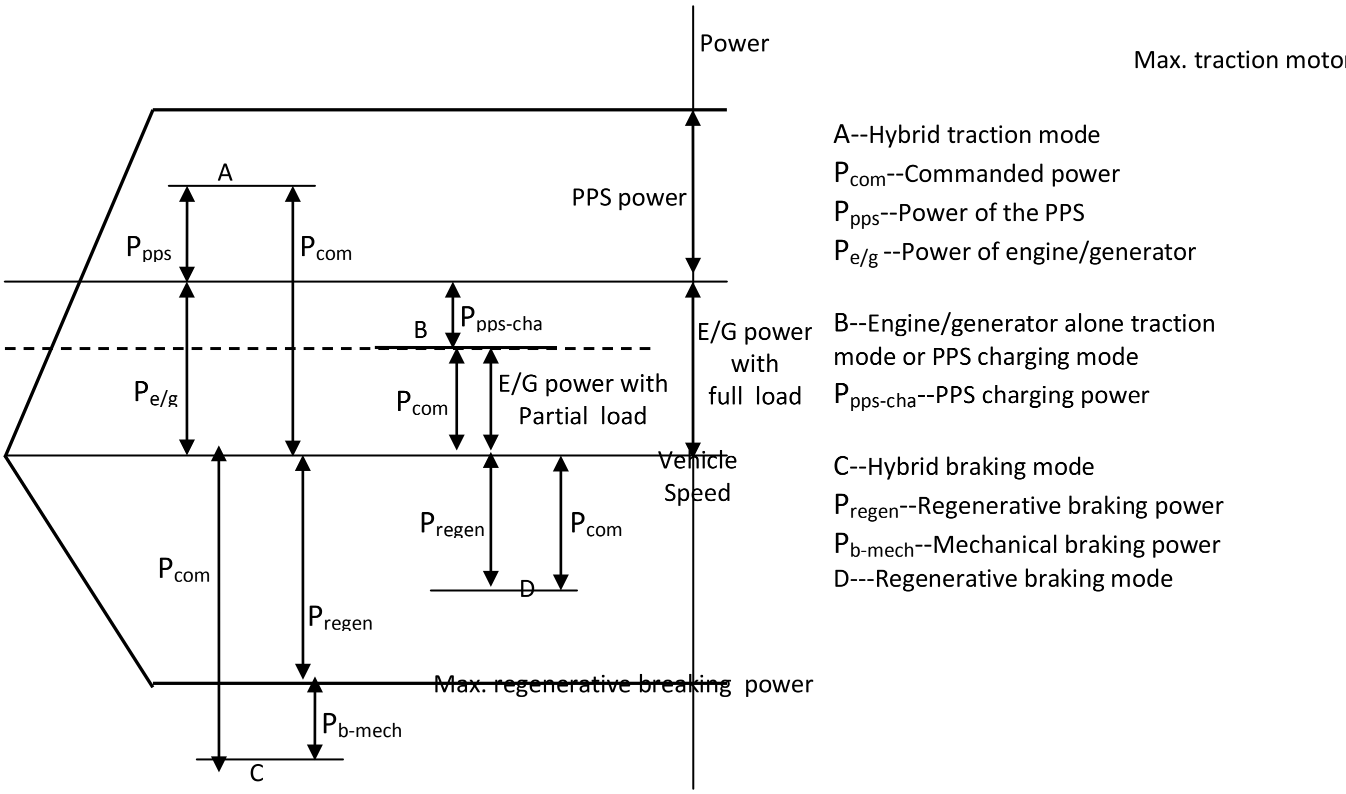


Figure 2.1 : Maximum SOC control strategy

III. Design

For designing the hybrid electric vehicle we need to consider vehicle maximum mass, front area, maximum velocity, acceleration time, trans-mission efficiency, traction motor efficiency, generator efficiency, aerodynamic drag coefficient,rolling resistance coefficient, tire radius and air density. For a four passenger carry able vehicle, normally the maximum mass is 1200-1500Kg.When a vehicle runs, then a resistance is created by air. This resistive force act against car speed is proportional to vehicle front area, aerodynamic drag co-efficient, air density and vehicle speed. To overcome from this resistive force, traction motor has to consume certain amount of its total consumed power.

Table 3.1 : Drag coefficients for some passenger vehicles[20]

Vehicle (class)	C_D	$C_D \times A_f$ (m^2)
VW Polo (class A)	0.37	0.636
Ford Escort (class B)	0.36	0.662
Open Vectra (class C)	0.29	0.547
BMW 520i (class D)	0.31	0.649
Mercedes 300SE (class E)	0.36	0.785

From this table, we can consider our vehicle's front area is $2m^2$ and hence drag co- efficient is approximately 0.3.

Table 3.2 : Air density at various temperatures[20]

T in °C	*ρ* in kg/m³(at 1 atm)	*T* in °C	*ρ* in kg/m³ (at 1 atm)
-25	1.423	5	1.269
-20	1.395	10	1.247
-15	1.368	15	1.225
-10	1.342	20	1.204
-5	1.316	25	1.184
0	1.293	30	1.164

We take temperature of air is normally 25°C and so air density 1.184 kg/m³ (at 1 atm).

Table 3.3 : Co efficient of rolling friction of tire[20]

Tire Type	Coefficient of Rolling Friction
Low rolling resistance car tire	0.006 - 0.01
Ordinary car tire	0.015
Truck tire	0.006 - 0.01
Train wheel	0.001

We consider our desired rolling co efficient is 0.01.As motors & generators efficiency are normally 80% to 90%, we consider motor efficiency as 85% and generator efficiency as 90%. Table 3.4: Various types of gear with their efficiency[20]

Name of gear	Efficiency	Name of gear	Efficiency
Spur Gears	90%	Helical Gears	80%
Sprocket Gears	80%	Bevel Gears	70%
Rack and Pinion	90%	Worm Gears	70%

Weight of the vehicle, M_V =1500Kg(with 4 passenger),Front area of the vehicle, A_f= 2.0 square meters, Transmission efficiency (η_t)=90%, Traction motor drive efficiency (η_m)= 85%,Generator efficiency (η_g)= 90%,Aerodynamic drag coefficient (C_D) = 0.3,Rolling resistance coefficient (f_r) = 0.01,Tire radius = 0.3 meters,Air density (ρ_a) = 1.184 kg/cubic meters,Acceleration time (from 0 to 100 km/h) = 10 Seconds,Grad ability more than 5% at 100 km/h.,Maximum speed = 160 km/h.

a) Design of Traction Motor

The power rating of the traction motor is determined by using the equation:

$$P_t = \frac{M_v}{2t_a}(V_f^2 + V_b^2) + \frac{2}{3}M_V\, g f_r V_f + \frac{1}{5}\rho_a\, C_D A_f\, v_f^3$$

In this case, we know that,M_V = Vehicle mass = 1500 kg.,t_a = Acceleration time in seconds = 10 seconds.V_f = Final Speed of the Vehicle in m/s = 160 km/h.V_b = Final speed corresponding to motor base speed.

The motor base speed and the maximum speed of the motor are related by a factor 'x'.

$$X = \frac{\text{Motor max .Velocity}}{\text{Motor base velocity}}$$

The factor 'x' is arbitrarily chosen to have a value of 4, the ratio between maximum vehicle velocity (V_f) and V_b will be 'x' = 4 The Motor power thus calculated will be 82.5 KW. Hence the value of V_b can be calculated. The values of C_D, A_f, f_r,ρ_a have already been specified. The motor maximum speed is chosen to be 5000 RPM. Correspondingly the motor base speed is 5000/4 that is 1250 RPM .Motor power =π 2× Motor base speed × Ratedmotor torque.The motor torque thus calculated is found out to be 630 Nm. Thus the specifications of the traction motor are as follows: Motor power = 82.5 KW. Motor rated torque = 630 Nm. Motor base Speed = 1250 RPM. Motor maximum Speed = 5000 RPM.

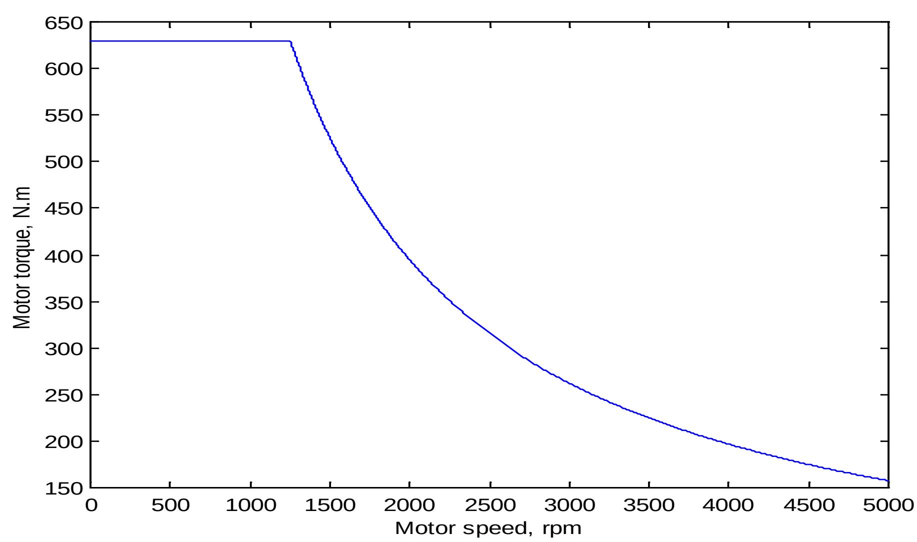


Figure 3.1 : Speed vs. Torque curve for the designed traction motor

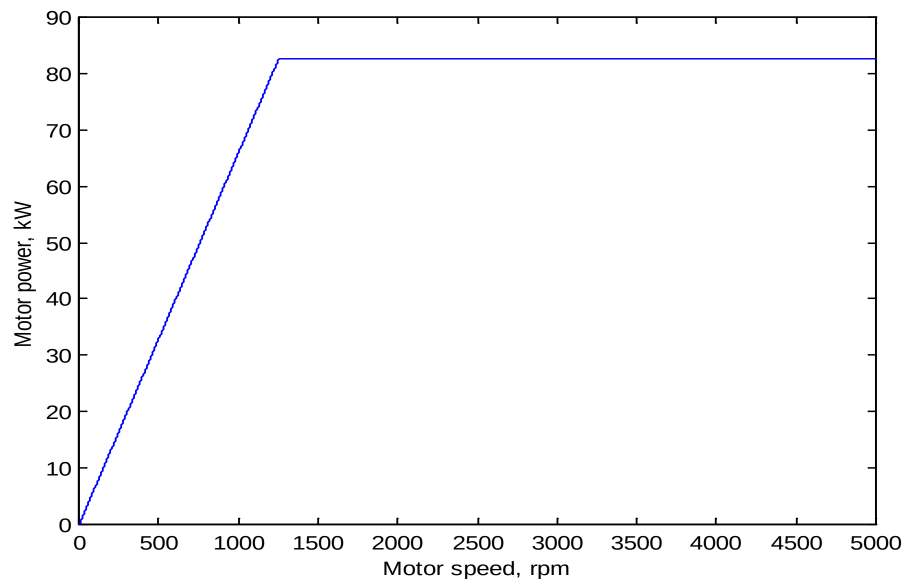


Figure 3.2 : Speed vs. Power curve for the designed traction motor

b) Design of Gear Ratio

Hence the gear ratio is designed such that the vehicle maximum speed corresponds to the motor maximumspeed

$$i_g = \frac{2\,\pi n_{m,max}\, r}{V_{max}}$$

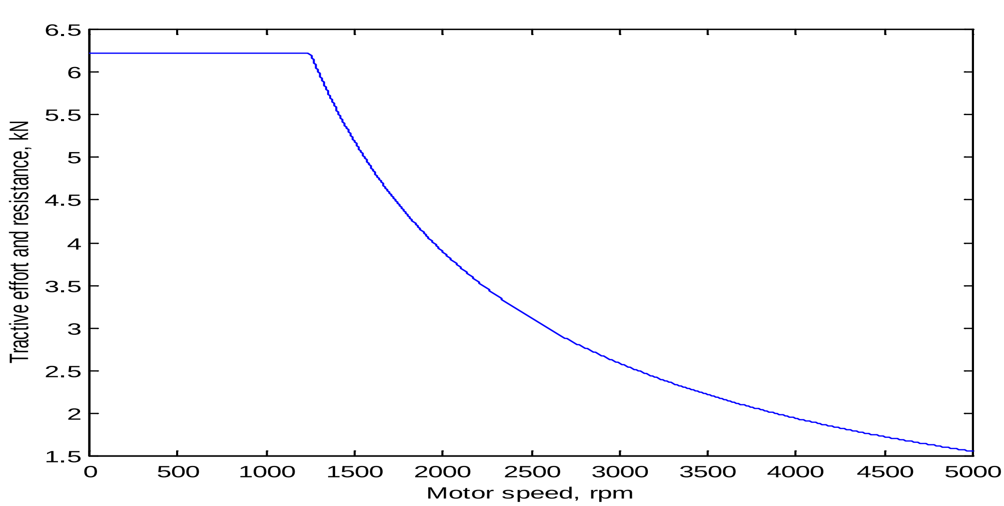
where$n_{m,max}$= Maximum motor speed = 5000 RPM. ,r = tire radius = 0.3 meters. ,V_{max} = 160 km/hr. The gear ratio thus calculated is 3.53.

c) Calculation of Tractive Effort

Tractive effort of the designed vehicle is calculated by following equation.

$F_t = \frac{T_p\, i_g\, \eta_t}{r}$,Here, motor rated torque, T_P = 630N-m

Gear ratio, i_g = 3.53,Transmission efficiency, η_t = 90%,Tire radius, r = 0.3m So, rated tractive effort will be 6.2 kN.To check if the motor is able to meet the gradability condition, the tractive effort of the vehicle is plotted with the vehicle resistance (aerodynamic drag + rolling resistance + the hill climbing).



. *Figure 3.3 :* Traction effort and resistance of vehicle versus vehicle speed *d) Design of Generator*

Considering a 5% grade, the engine power needed to support the vehicle at this speed, considering transmission efficiency to be 90%, motor drive efficiency to be 85% and the generatorefficiency to be 90%.$P_g = \frac{V}{1000\ \eta_t \eta_m}(M_v\, g\, f_r + 0.5\ \rho_a C_D A_f\ V^2)$kW.Using this eqh^n our desired generators power rating is 29KW.

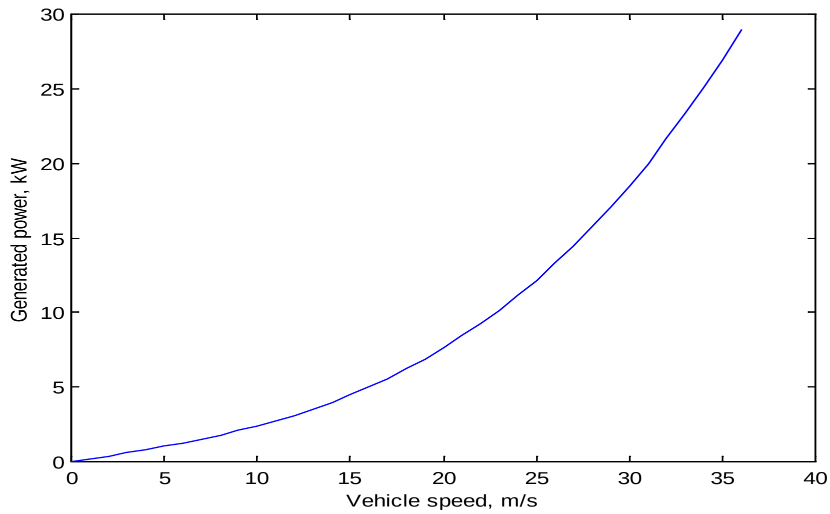


Figure 3.4 : Generated power versus vehicle speed

The load can be given by

$$P_{ave} = \frac{1}{T}\int_0^T \left(M_v g f_r + 0.5\ \rho_a C_D A_f V^2\right) V dt + \frac{1}{T}\int_0^T M_V \frac{dV}{dt} dt$$

Consider that drive cycle is about 16 hour. At this condition P_{ave} will be approximately 26.45kW.

e) Power Rating of Peaking Power Source

Since the power rating of the generator and the traction motor has been decided, the rating of the peaking power source can be easily calculated.

$$P_{PPS} = \frac{P_{motor}}{\eta_{motor}} - P_g = \frac{82.5}{0.85} - 29 = 68\ \text{kW}$$

f) Design of the Peaking Power Source Energy Capacity

The S.O.C is decided to vary from 0.6 to 0.4. Hence $\Delta SOC = SOC_{top} - SOC_{bott} = 0.2$. Also, the energy capacity of the PPS is decided to vary from 1.5 kWh to 1 kWh. Hence $\Delta Emax = 0.5$kWh. Having decided how much the state of charge as well as the energy rating of the peaking power source, its energy capacity can be calculated.

$$E_{PPS} = \frac{\Delta Emax}{\Delta SOC} = \frac{0.5}{0.2} = 2.5\ \text{kWh}$$

g) Design of the Vehicle Analytical Tool

The equations are listed below.

$$P_t = \frac{M_v}{2t_a}(V_f^2 + V_b^2) + \frac{2}{3}M_V\, g f_r V_f + \frac{1}{5}\rho_a C_D A_f\, v_f^3,$$

Motor power $= 2\pi \times$ Motor base speed $\times$ Rated motor torque. 3.$P_g = \frac{V}{1000\ \eta_t \eta_m}(M_v\ g\ f_r + 0.5\ \rho_a C_D A_f V^2)$kW4.$P_{ave} = \frac{1}{T}\int_0^T \left(M_v g f_r + 0.5\ \rho_a C_D A_f V^2\right) V dt + \frac{1}{T}\int_0^T M_V \frac{dV}{dt} dt$, 5. $F_t = \frac{T_p\, i_g \eta_t}{r}$ 6. $i_g = \frac{2\pi n_{m,max}\, r}{V_{max}}$, 7. $P_{PPS} = \frac{P_{motor}}{\eta_{motor}} - P_g$

Now text box of all input parameters are filled with a specified value. Here base factor is taken as X= 4.

Figure 3.5 : Window of the design tool with base actor X=4

By clicking DESIGN button we can get all our desired output parameters.Any one input parameters can be changed easily for various design condition. Here for example we change the base factor X=6 and again design tool window is shown with all the input-output parameters.

Figure 3.6 : Window of the design tool with base factor X=6

IV. Summary

In this chapter, a series hybrid electric vehicle was designed. By calculation we find that, our designed vehicle require a traction motor which takes a maximum power of 82.5 kW and the rated torque produced by it is 630Nm. Rated tractive effort of the vehicle that is the traction motor is approximately 6.2 kN. Maximum generation power by the generator is 29 kW is required in flat road and the average power generated in urban road is approximately 26.5 kW. Rest power needed for the traction motor is supplied by the PPS i.e, battery. Maximum power rating of the PPS is 68 kW and energy capacity of PPS is 2.5 kWh.

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A Critical Performance Evaluation of Classification Methods with Modified JPEG Decompressed Multiband Images

By Ch. Ramesh, Dr. N.B. Venkateswarlu & Dr. J.V.R. Murthy
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Abstract- Effective utilization of bandwidth andstorage space is important in imaging applicationsincluding remote sensing. Remote sensingapplications use multi-sensory, multi-band, multiresolution images. Usually, remote sensingapplications uses image classification results fortheir analysis and decision making. In this paper wepropose a new JPEG based image compressionalgorithm based on filters. Proposed algorithmperformance is evaluated in relation to conventionalJPEG algorithm. In order to envisage the effect ofcompression on classification performance, MaximumLikelihood, Mahalanobis and Euclidean distanceclassifiers performance is evaluated with originalimage data, conventional JPEG compressed data andthe compressed image data with the proposedmethod. Experiments are carried out with manymulti-band images. Our experiments supports thatthe classification accuracies of compressed imagesare at par with original image data.

Keywords: joint photo experts group (jpeg), filters, maximum likelihood, mahalanobis, euclidean, confusion matrix, kappa coefficient.

GJRE-F Classification : FOR Code: 090699

A Critical Performance Evaluation of Classification Methods with Modified JPEG Decompressed Multiband Images

Ch. Ramesh [α], Dr. N.B. Venkateswarlu [σ] & Dr. J.V.R. Murthy [ρ]

Abstract- Effective utilization of bandwidth andstorage space is important in imaging applicationsincluding remote sensing. Remote sensingapplications use multi-sensory, multi-band, multiresolution images. Usually, remote sensingapplications uses image classification results fortheir analysis and decision making. In this paper wepropose a new JPEG based image compressionalgorithm based on filters. Proposed algorithmperformance is evaluated in relation to conventionalJPEG algorithm. In order to envisage the effect ofcompression on classification performance, MaximumLikelihood, Mahalanobis and Euclidean distanceclassifiers performance is evaluated with originalimage data, conventional JPEG compressed data andthe compressed image data with the proposedmethod. Experiments are carried out with manymulti-band images. Our experiments supports thatthe classification accuracies of compressed imagesare at par with original image data.

Keywords: joint photo experts group (jpeg), filters, maximum likelihood, mahalanobis, euclidean, confusion matrix, kappa coefficient.

I. Introduction

In the recent years use of remote sensingsatellite data for urban planning, military,weather forecast, robotics, automatednavigation system, remote surveillance hasincreased by many fold in addition toconventional applications such as naturalresources management.

These applications involve acquisition, communication, storage and processing ofterrible number of images of earth surface.This situation is becoming more aggravatedbecause of increased pixel resolution, graylevel resolution, band resolutions and reducedrepetition cycle of satellite. All of these development demands more band width fordownlink lines of satellite in addition to moredisk space for storage.

In communications, data compression techniques under the name hood of imagecoding are widely used to reduce thecommunication bandwidth bottlenecks duringdata communication. For instance, JPEGstandard is used for still image compression [1], MPEG is used for video compression [2]. Also, while communicating data from satellites toground stations some compression methods areused [3].

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A typical image processing system isas shown in Figure 1 that is commonlyemployed for remote sensing applications. It isvery common that most of the applicationscientists using original image data for theirprocessing. In majority of remote sensing applications, results of classification are theultimate interest [4].

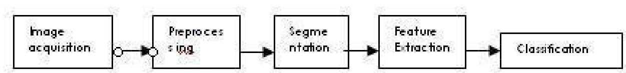

Figure 1 : A Topical Image Processing System

In this study, we propose to study howthe classification results will vary if we usecompressed image data instead of originalimage data. Usually applications such as landuse classifications assumes samples of a groupwill be having small random variations in theirpixel values while samples of different groupsto be having contrastingly different pixelvalues. Because of the increased pixel and graylevel resolutions, samples of a group may behaving similar pixel values. Moreover, they willbe having high level of spatial auto correlation.Evidently, majority of compression methods exploits this auto correlation to achieve highcompression ratios with acceptable PSNR (PeakSignal to Noise Ratio) values [5].

Our proposed Algorithm is based onfiltering concept [6]. In this Algorithm insteadof sending the original image, we send thefiltered image. In general, the number ofuseful DCT coefficients will become more if 8x8image blocks contain lot of variations in values,otherwise only few DCT coefficients will bemeaningful. If we apply filtering on image itgets smoothened, that is variation of the pixelvalues of a block reduces. It is attractive forpoint of view of compression as the number ofmeaningful DCT coefficients are going toreduce. Thus we are achieving compression benefit. We have compared the compression performance of our algorithm with conventional JPEG algorithm with variety ofmulti band images.

Also in this study, we evaluate theclassification performance of popularclassification algorithms like Maximum Likelihood, Mahalanobis and Euclidian distanceby taking original image data, conventional

JPEG compressed image data, compressed datathat is compressed by filter based JPEG imagecompression method.

Our paper work is organized as follows.Section II introduces the standard JPEGalgorithm. Section III explains proposedcompression algorithm. Section IV illustratesthe selected classification algorithms. Section Vincludes details about our experimentationsand results. Section VI contains conclusionsabout our research work

II. Brief Overview of JPEG Encoding/ Decoding System

JPEG is a well known standardized image compression technique. JPEG loses informationso the decompressed picture is not the same asthe original one. The main reason for use ofJPEG is to reduce the size of image files.Reducing image files is an important procedurefor transmitting files across networks orarchiving libraries. Usually JPEG can removethe less important data before thecompression; hence JPEG is able to compressimages meaningfully, which produces a hugedifference in the transmission time and the diskspace. Figure 2 shows the basic Architecture ofJPEG compression system. Here is a briefoverview of the JPEG compression system. [5]

The image is first subdivided into pixelblocks of size 8X8, which are processed left toright, top to bottom. As each 8X8 block or subimage is encountered, its 64 pixels are levelshifted by subtracting the quantity L/2, whereL is the Gray level resolution of the image . The2-D Forward Discrete Cosine Transform (FDCT)(Eq-1)[5]of the block is then computed,quantized using 64 corresponding step sizevalues from the quantization table in Figure 3[7]. After quantization the DCT coefficientsare rearranged in a zigzag sequence order as shown in the Figure 4. [7]

Since the one-dimensional reorderedarray generated under the zigzag pattern ofFigure 3 is qualitatively arranged according toincreasing spatial frequency, the JPEG codingprocedure is designed to take the advantage ofthe long runs of zeros that normally result fromthe reordering. In particular, the nonzero ACcoefficients (the term AC denotes all transformcoefficients with the exception of the zeroth orDC coefficient) are coded using a variablelengthcode that defines the coefficient's valueand number of preceding zeros. The DCcoefficient is difference coded relative to theDC coefficient of the previous sub image.

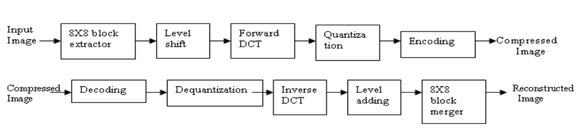

Figure 2 : Basic Architecture of JPEG Compression

The 2-D DCT is

$$C(u,v)=\alpha(u)\alpha(v)\sum_{x=0}^{N-1}\sum_{y=0}^{N-1}f(x,y)\cos\left[\frac{(2x+1)u\pi}{2N}\right]\cos\left[\frac{(2y+1)v\pi}{2N}\right] \quad (1)$$

for u, v = 0, 1, 2, ... , N -1

$$\alpha(u)=\begin{cases}\sqrt{1/N} & for \quad u=0\\ \sqrt{2/N} & for \quad u>0\end{cases} \quad (2)$$

$$\alpha(v)=\begin{cases}\sqrt{1/N} & for \quad v=0\\ \sqrt{2/N} & for \quad v>0\end{cases} \quad (3)$$

16	11	10	16	24	40	51	61
12	12	14	19	26	58	60	55
14	13	16	24	40	57	69	56
14	17	22	29	51	87	80	62
18	22	37	56	68	109	103	77
24	35	55	64	81	104	113	92
49	64	78	87	103	121	120	101
72	92	95	98	112	100	103	99

Figure 3 : Quantization Matrix [7]

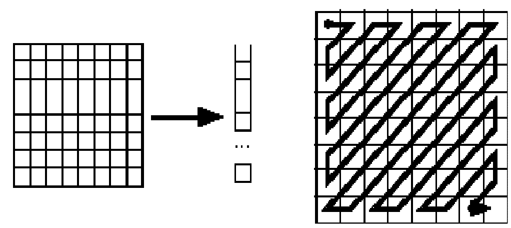

Figure 4 : Zigzag Séquencé [7]

The decompression process performs aninverse procedure. It decodes the Huffmancodes. Then, it makes the inversion of theQuantization step. In this stage, the decoderraises the small numbers by multiplying themby the quantization coefficients. The resultsare not accurate, but they are close to theoriginal numbers of the DCT coefficients. AnInverse Discrete Cosine Transform (IDCT) (Eq.4)[7] is performed on the data received from theprevious step. Finally add L/2 to each subimage. Place the sub images in their correctpositions.

$$\hat{f}(x,y)=\sum_{u=0}^{N-1}\sum_{v=0}^{N-1}\alpha(u)\alpha(v)C(u,v)\cos\left[\frac{(2x+1)u\pi}{2N}\right]\cos\left[\frac{(2y+1)v\pi}{2N}\right] \quad (4)$$

The error between the original imageand reconstructed image is calculated in termsof Peak signal to noise ratio (PSNR) = 10 log10

(L2/MSE) (5)

$$MSE=\frac{\sum_{x=0}^{m-1}\sum_{y=0}^{n-1}\left[\hat{f}(x,y)-f(x,y)\right]^2}{mXn} \quad (6)$$

MSE – Mean Squared Error

$\hat{f}(x,y)$ - Reconstructed Image

f (x, y) – Original Image

m x n – Size of the Image

III. New Mean, Median & Outlier based JPEG Algorithms

Mean filtering [8] is a simple, intuitiveand easy to implement method of imagesmoothing i.e. reducing the amount of variationbetween one pixel and the next or surroundingpixels. It is often used to reduce noise inimage. The idea of mean filtering is simply toreplace each pixel in an image with the meanvalue of its neighbors including itself. This hasthe effect of eliminating pixel values which areunrepresentative of their surroundings. Usually,3x3 neighborhoods of pixels are consideredwhile calculating mean filtered value of anypixel.

Median filter [9] is normally used to reducenoise in an image like the mean filter.However, it often does a better job than themean filter in preserving useful detail in theimage. Like the mean filter, the median filterconsiders each pixel in the image in turn andlooks at its neighbors to decide whether or notits representative of its surroundings. Insteadof simply replacing the pixel value with themean of neighboring pixel values, it replaces itwith the median of those values.

An outlier [10] is an observation that isnumerically distant from the rest of the data.In an image, a pixel value is very different fromits surrounding pixels, it can be called asoutlier.

From basic statistics, we know that apopulations sample values with someconfidence level can be given as mean ± C*P, where C is weighing factor (critical value) and P is standard deviation of the population. Table-1 shows the commonly used ConfidenceLevels and Corresponding Critical Values [11].In our outlier based algorithms, we take thesesimple confidence limits of normal distributionin deciding whether a pixel is outlier or not. Ifthe pixel is observed to be outlier with thegiven confidence level, we may retain else wemay take its mean filtered or median filtered value.

Table 1 : Confidence Levels Vs Critical values

Confidence Level	80%	90%	95%	98%	99%	99.8%	99.9%
Critical Values	1.28	1.645	1.96	2.33	2.58	3.08	3.27

In the following, we have listed thebasic Mean, Median and Outlier algorithms

a) MeanDCT Algorithm

- Apply mean filtering to the originalimage using 3x3 window
- Apply DCT on the mean filteredimages

b) MedianDCT Algorithm

- Apply median filtering to the original imageusing 3x3 window
- Apply DCT on the median filtered imagesOutlier

c) MeanDCT Algorithm

- Apply mean filtering with a little variation tothe given original image using 3x3 window. Foreach pixel, calculate average and standarddeviation of its neighboring 3x3 pixels. If apixels value is observed to be outlier (not inthe range of Mean ± C*P) then its value is takenas itself else mean is taken as its filtered value.
- Apply DCT on the outliermean filteredimage.

d) OutlierMedianDCT Algorithm

- Apply median filtering with a little variationto the given original image using 3x3 window.For each pixel, calculate median and standarddeviation of its neighboring 3x3 pixels. If apixels value is observed to be outlier (not inthe range of Median ± C*P) then its value istaken as itself else median is taken as itsfiltered value.
- Apply DCT on the outliermedian filteredimage.

IV. Popular Classification Algorithms

a) Maximum Likelihood Classifier

Let $w_1, w_2, \ldots, w_m$ denote m distinctpopulations (classes) with known d-dimensionalprobability density functions $p_1(X)$, $p_2(X)$, ... $p_m(X)$, respectively. The a priori probabilitiesthat an observation is selected frompopulations w_1, w_2, . . . ,w_m are denoted by q_l, q_2, ..., q_m, respectively[12]. According tothe Bayesian ML classification rule, assumingequal costs for misclassifications, a random ddimensional pixel vector X is classified as classw_k

$$q_k p_k(X) = max\{q_i P_i(X)\} \text{ for } i = 1, 2 \ldots, m. \quad (7)$$

Assuming equal a priori probabilities for all theclasses, decision rule (7) becomes:

$$p_k(X) = max\{p_i(X)\}, i = 1, 2, \ldots, m \quad (8)$$

In Equations (7) and (8), the probability density$p_k(X)$ will be given as:

$$p_k(X) = \frac{1}{(2\pi)^{d/2}\left|\sum_k\right|^{1/2}} \quad (9)$$

$$X \exp[-1/2.(X - M_k)^T \sum_k^{-1}(X - M_k)].$$

Here, and, are the mean vector andcovariance matrices of the k^{th}class, and arecalculated from the training data. is asymmetric positive definite matrix. −1,k kare the inverse and determinant of the covariance matrix.

b) Mahalanobis Classifier

According to this classifier a d-dimensionalrandom pixel vector (X) will be assigned to thegroup to which it is nearest [13]. Each group ischaracterized by its mean vector, which iscalculated from training data. Nearness isdetermined by the Mahalanobis distancebetween the group mean and X. Inmathematical terms, the same classificationrule can be represented as:

$$X \in w_i \tag{10}$$

where i = (1, 2, . . . C) groups if $d_i(X) < d_j(X)$ forall j U i where

$$d_i\,(X) = (X-M_i)^T\, \Sigma^{-1}(X-M_i \tag{11}$$

and M_i s mean vector of i^{th}group indicatesvector should be transposed. -1 is the inverseof the pooled covariance matrix.

c) Euclidian Distance Classifier

According to this classifier a random ddimensionalpixel vector (X) will be assigned tothe group to which it is nearest [14]. Eachgroup is characterized by its mean vector,which is calculated from training data.Nearness is determined by the Euclideandistance between the group mean and X. Inmathematical terms, the same classificationrule can be represented as:

$$X \in w_i \tag{12}$$

Where i = (1, 2, . . . C) groups if $d_i(X) < d_j(X)$ forall j U i where

$$d_i(X) = (X-M_i)^T(X-M_i \tag{13}$$

and M_i is mean vector of i^{th} group. T indicatesvector should be transposed

V. Experimentations and Results

For the purpose of experimental work,Landsat TM data from USGS data base“www.usgs.gov” is used. Experiments arecarried out under MS Windows XP version 2002,SP3 edition. The experimental system isequipped with Intel core 2 Duo 2.60 GHzprocessor with 1 GB RAM. Using ERDAS Imagine8.6 (copy rightsÓ1991-2002, Lieca Geo systems)Training sites are labeled. Programs are writtenin C language under Microsoft Visual Studio2005 version 8.0.

We have carried out extensivesimulations with the selected images andproposed algorithms. Table 2 shows theCompression Benefit and PSNR values ofMeanDCT algorithm VsOutlierMeanDCTalgorithm. With all the images we found thatMeanDCT and OutlierMeanDCT algorithms havebetter compression ratios as compared toconventional JPEG coding. The PSNR loss inMeanDCT and OutlierMeanDCT algorithms isnegligible as compared to conventional JPEGcoding. While comparing MeanDCT and thecorresponding Outlier DCT, CompressionBenefits are observed to beMeanDCT>OutlierMeanDCT (for C=1.28 to 2.58).As the value of C increases in the Outlier,Compression Benefit increases. For C=3.08 to3.27 Compression Benefit in MeanDCT andOutlierMeanDCT is almost same. PSNR in MeanDCT<OutlierMeanDCT(for C=1.28 to 2.58).As the value of C decreases in the Outlier, PSNRincreases. For C=3.08 to 3.27 PSNR in MeanDCTand OutlierMeanDCT is almost same. Fig5 Showsthe sample (Owensvalley) Original image, JPEGcompressed image, Proposed compresse dimage (Mean filtered approach).

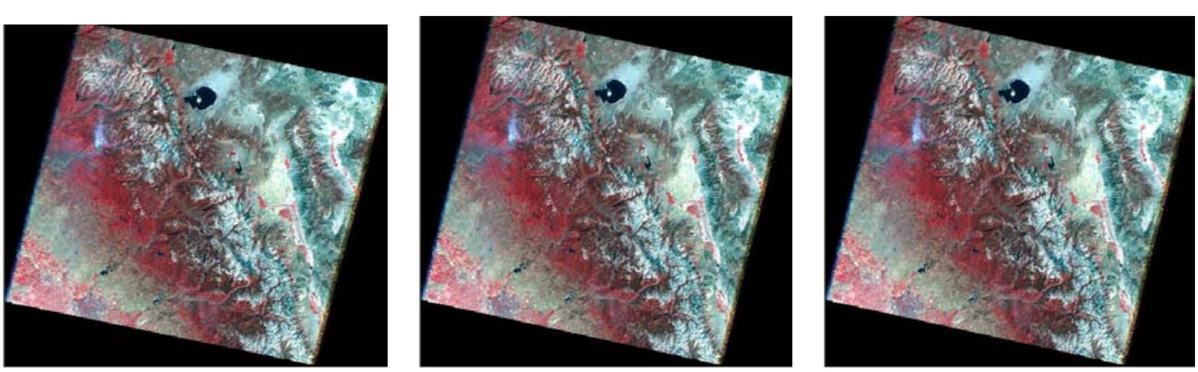

Figure 5 : Original Image JPEG Compressed Image Proposed Compressed Image (Mean filtered approach)

Table 2 : Compression benefit and PSNR loss of Mean & Outlier Mean DCT algorithm compared toconventional JPEG

Image		Conventional	Mean DCT	Outlier Mean DCT (C=3.27)	Outlier Mean DCT (C=3.08)	Outlier Mean DCT (C=2.58)	Outlier Mean DCT (C=2.33)	Outlier Mean DCT (C=1.96)	Outlier Mean DCT (C=1.645)	Outlier Mean DCT (C=1.28)
Bolivia1	No. of Bits	215085	172156	172144	172141	175585	178003	183439	19046	198835
	% of Saving	-	19.959	19.964	19.966	18.364	17.240	14.713	11.447	7.555
	PSNR	39.785	38.073	38.073	38.074	38.074	38.083	38.101	38.164	38.215
	% of Loss	-	4.303	4.303	4.300	4.300	4.277	4.232	4.074	3.946
Bolivia2	No. of Bits	275655	208384	208383	208394	212633	216319	225195	236059	250482
	% of Saving	-	24.404	24.404	24.400	22.862	21.525	18.305	14.364	9.132
	PSNR	37.939	36.872	36.872	36.872	36.88	36.89	36.914	36.971	37.064
	% of Loss	-	2.812	2.812	2.812	2.791	2.764	2.701	2.551	2.306
Bolivia3	No. of Bits	394036	274432	274432	274430	283304	291242	307235	325783	351372
	% of Saving	-	30.353	30.353	30.354	28.102	26.087	22.028	17.321	10.827
	PSNR	34.539	33.098	33.098	33.098	33.113	33.128	33.185	33.272	33.455
	% of Loss	-	4.172	4.172	4.172	4.128	4.085	3.920	3.668	3.138
Bolivia4	No. of Bits	623322	393045	393045	393045	398738	411789	442420	483673	526620
	% of Saving	-	36.943	36.943	36.943	36.030	33.936	29.022	22.403	15.513
	PSNR	30.959	29.219	29.219	29.219	29.225	29.247	29.283	29.373	29.652
	% of Loss	-	5.620	5.620	5.620	5.600	5.529	5.413	5.122	4.221
Bolivia5	No. of Bits	694304	429601	429601	429601	437597	451664	483706	525250	584315
	% of Saving	-	38.124	38.124	38.124	36.973	34.947	30.332	24.348	15.841
	PSNR	29.986	28.004	28.004	28.004	28.009	28.023	28.066	28.17	28.489
	% of Loss	-	6.609	6.609	6.609	6.593	6.546	6.402	6.056	4.992
Bolivia6	No. of Bits	321611	242123	242129	242127	243817	246467	252569	262095	277678
	% of Saving	-	24.715	24.713	24.714	24.188	23.364	21.467	18.505	13.660
	PSNR	37.221	33.598	33.598	33.598	33.598	33.597	33.600	33.612	33.654
	% of Loss	-	9.773	9.773	9.773	9.773	9.736	9.728	9.696	9.583

Bolivia7	No. of Bits	559107	357508	357508	357512	372414	386369	412008	441576	482908
	% of Saving	-	36.057	36.057	36.056	33.391	30.895	26.309	21.021	13.628
	PSNR	31.4	29.516	29.516	29.516	29.535	29.556	29.613	29.727	29.998
	% of Loss	-	6	6	6	5.939	5.872	5.691	5.328	4.464
Total	No. of Bits	3083120	2077249	2077242	2077250	2124088	2181853	2306572	2464900	2682210
	% of Saving	-	32.625	32.625	32.625	31.105	29.232	25.187	20.051	13.003
	PSNR	34.547	32.625	32.625	32.625	32.633	32.646	32.680	32.755	32.932
	% of Loss	-	5.563	5.563	5.563	5.540	5.502	5.404	5.187	4.674
Monolake1	No. of Bits	410486	329732	329729	329722	330006	331107	336165	344531	361041
	% of Saving	-	19.672	19.673	19.675	19.606	19.337	18.105	16.067	12.045
	PSNR	39.871	37.503	37.503	37.503	37.503	37.509	37.537	37.594	37.737
	% of Loss	-	5.939	5.939	5.939	5.939	5.924	5.853	5.710	5.352
Monolake2	No. of Bits	306006	257407	257409	257441	257713	258682	261126	266277	276333
	% of Saving	-	15.881	15.881	15.870	15.781	15.465	14.666	12.983	9.696
	PSNR	42.237	40.988	40.988	40.988	40.988	40.994	41.014	41.064	41.178
	% of Loss	-	2.957	2.957	2.957	2.957	2.942	2.895	2.777	2.507
Monolake3	No. of Bits	399635	324167	324170	324158	324460	325220	328846	335993	350594
	% of Saving	-	18.884	18.883	18.886	18.810	18.620	17.713	15.925	12.271
	PSNR	40.435	38.850	38.85	38.849	38.849	38.859	38.883	38.952	39.113
	% of Loss	-	3.919	3.919	3.922	3.922	3.897	3.838	3.667	3.269
Monolake4	No. of Bits	366063	300168	300130	300212	300264	300614	303531	309183	322696
	% of Saving	-	18.000	18.011	17.988	17.974	17.879	17.082	15.538	11.846
	PSNR	41.097	39.268	39.268	39.268	39.268	39.274	39.295	39.349	39.496
	% of Loss	-	4.450	4.450	4.450	4.450	4.435	4.384	4.253	3.895
Monolake5	No. of Bits	578965	451039	451032	451010	451400	452566	457120	468155	492798
	% of Saving	-	22.095	22.096	22.100	22.033	21.831	21.045	19.139	14.882
	PSNR	37.724	34.999	34.999	34.999	34.999	35.003	35.030	35.115	35.36
	% of Loss	-	7.223	7.223	7.223	7.223	7.212	7.141	6.916	6.266

Monolake6	No. of Bits	249582	232905	232911	232913	232925	233052	234078	234701	235876
	% of Saving	-	6.681	6.679	6.678	6.673	6.623	6.211	5.962	5.491
	PSNR	46.608	37.557	37.557	37.557	37.557	37.557	37.558	37.559	37.56
	% of Loss	-	19.419	19.419	19.419	19.419	19.419	19.417	19.415	19.412
Monolake7	No. of Bits	439079	352864	352873	352899	353207	354337	358195	365769	381841
	% of Saving	-	19.635	19.633	19.622	19.557	19.299	18.421	16.696	13.035
	PSNR	39.828	38.134	38.134	38.134	38.134	38.139	38.162	38.235	38.418
	% of Loss	-	4.253	4.253	4.253	4.253	4.240	4.182	3.999	3.540
Total	No. of Bits	2749816	2248277	2248254	2248355	2250035	2255578	2279061	2324609	2421179
	% of Saving	-	18.239	18.239	18.236	18.175	17.973	17.119	15.463	11.951
	PSNR	41.114	38.186	38.185	38.185	38.185	38.190	38.211	38.266	38.408
	% of Loss	-	7.121	7.124	7.124	7.124	7.111	7.060	6.927	6.581
Owensvalley1	No. of Bits	537518	360478	360483	360486	367990	378051	399052	423410	460890
	% of Saving	-	32.936	32.935	32.935	31.539	29.667	25.760	21.228	14.255
	PSNR	32.756	30.116	30.116	30.116	30.127	30.161	30.224	30.299	30.575
	% of Loss	-	8.059	8.059	8.059	8.026	7.922	7.729	7.500	6.698
Owensvalley2	No. of Bits	409426	288904	288897	288887	293676	299851	313895	331761	358355
	% of Saving	-	29.436	29.438	29.440	28.271	26.763	23.332	18.969	12.473
	PSNR	35.207	33.626	33.626	33.626	33.638	33.649	33.685	33.749	33.939
	% of Loss	-	4.490	4.490	4.490	4.456	4.425	4.323	4.141	3.601
Owensvalley3	No. of Bits	558702	371381	371378	371376	377700	388065	410282	438638	479219
	% of Saving	-	33.527	33.528	33.528	32.396	30.541	26.565	21.489	14.226
	PSNR	32.590	30.696	30.696	30.696	30.713	30.737	30.785	30.871	31.12
	% of Loss	-	5.811	5.811	5.811	5.759	5.685	5.538	5.274	4.510
Owensvalley4	No. of Bits	565589	374161	374168	374159	379834	390527	413718	443804	485971
	% of Saving	-	33.845	33.844	33.846	32.842	30.952	26.851	21.532	14.077
	PSNR	32.645	30.63	30.63	30.63	30.65	30.682	30.729	30.812	31.035
	% of Loss	-	6.172	6.172	6.172	6.111	6.013	5.869	5.614	4.931

Owensvalley5	No. of Bits	991131	583964	583964	583964	590799	606683	650116	708184	801412
	% of Saving	-	41.081	41.081	41.081	40.391	38.788	34.406	28.547	19.141
	PSNR	28.087	24.942	24.942	24.942	24.949	24.969	25.034	25.178	25.613
	% of Loss	-	11.197	11.197	11.197	11.172	11.101	10.869	10.357	8.808
Owensvalley6	No. of Bits	478658	346282	346277	346290	346905	348258	354345	370218	403209
	% of Saving	-	27.655	27.656	27.653	27.525	27.242	25.971	22.655	15.762
	PSNR	35.711	29.586	29.586	29.586	29.593	29.595	29.620	29.825	30.554
	% of Loss	-	17.151	17.151	17.151	17.131	17.126	17.056	16.482	14.440
Owensvalley7	No. of Bits	708596	449957	449957	449957	458283	470221	498865	536339	595087
	% of Saving	-	36.500	36.500	36.500	35.325	33.640	29.598	24.309	16.018
	PSNR	30.718	28.584	28.584	28.584	28.62	28.655	28.703	28.801	29.095
	% of Loss	-	6.947	6.947	6.947	6.829	6.715	6.559	6.240	5.283
Total	No. of Bits	4249620	2777127	2775122	2775119	2815187	2881656	3040273	3252354	3584143
	% of Saving	-	34.649	34.649	34.697	33.754	32.190	28.457	23.467	15.659
	PSNR	32.530	29.740	29.740	29.740	29.755	29.778	29.826	29.934	29.974
	% of Loss	-	8.576	8.576	8.576	8.530	8.459	8.312	7.980	7.857

Table 3 shows the Compression Benefit and PSNR values of Median DCT algorithm Vs Outlier Median DCT algorithm. With all the images we found that Median DCT and Outlier Median DCTalgorithms have better compression ratios as compared to conventional JPEG coding. The PSNR loss in Median DCT and OutlierMedianDCT algorithms is very less as compared to conventional JPEG coding. While comparing MedianDCT and the corresponding Outlier DCT, Compression Benefits are observed tobe MedianDCT>OutlierMedianDCT(for C=1.28 to 2.58). As the value of C increases in the Outlier,Compression Benefit increases. For C=3.08 to 3.27 Compression Benefit in MedianDCT andOutlierMedianDCT is same. PSNR in MedianDCT<OutlierMedianDCT(for C=1.28 to 2.58). As the value ofC decreases in the Outlier, PSNR increases. For C=3.08 to 3.27 PSNR in MedianDCT and OutlierMedianDCT is almost same.

Table 3 : Compression benefit and PSNR loss of Median & Outlier Median DCT algorithm compared toconventional JPEG

Bolivia1	No. of Bits	215085	178234	178240	178242	181353	183473	188038	194726	204035
	% of Saving	-	17.133	17.130	17.129	15.683	14.697	12.575	9.465	5.137
	PSNR	39.785	38.432	38.432	38.432	38.488	38.53	38.624	38.886	39.219
	% of Loss	-	3.400	3.400	3.400	3.260	3.154	2.918	2.259	1.422

Bolivia2	No. of Bits	275655	216504	216510	216502	220253	223670	232032	242533	257069
	% of Saving	-	21.458	21.456	21.459	20.098	18.858	15.825	12.015	6.742
	PSNR	37.939	36.860	36.860	36.860	36.914	36.963	37.094	37.307	37.562
	% of Loss	-	2.844	2.844	2.844	2.701	2.572	2.227	1.665	0.993
Bolivia3	No. of Bits	394036	283023	283023	283030	292258	300355	316259	334144	359377
	% of Saving	-	28.173	28.173	28.171	25.829	23.774	19.738	15.199	8.795
	PSNR	34.539	32.819	32.819	32.819	32.889	32.961	33.157	33.418	33.864
	% of Loss	-	4.979	4.979	4.979	4.777	4.568	4.001	3.245	1.954
Bolivia4	No. of Bits	623322	423592	423592	423592	428393	439439	467525	505592	556812
	% of Saving	-	32.042	32.042	32.042	31.272	29.500	24.994	18.887	10.670
	PSNR	30.959	29.228	29.228	29.228	29.247	29.298	29.412	29.635	30.093
	% of Loss	-	5.591	5.591	5.591	5.529	5.365	4.996	4.276	2.797
Bolivia5	No. of Bits	694304	469136	469136	469136	477077	490552	520174	558956	614893
	% of Saving	-	32.430	32.430	32.430	31.287	29.346	25.079	19.494	11.437
	PSNR	29.986	27.936	27.936	27.936	27.964	28.016	28.139	28.382	28.900
	% of Loss	-	6.836	6.836	6.836	6.743	6.569	6.159	5.349	3.621
Bolivia6	No. of Bits	321611	266018	266004	266014	267316	269347	274662	283086	297933
	% of Saving	-	17.285	17.290	17.287	16.882	16.250	14.598	11.978	7.362
	PSNR	37.221	35.806	35.806	35.806	35.818	35.833	35.868	35.934	36.136
	% of Loss	-	3.801	3.801	3.801	3.769	3.729	3.635	3.457	2.915
Bolivia7	No. of Bits	559107	375504	375504	375497	391368	405654	430574	460136	500472
	% of Saving	-	32.838	32.838	32.839	30.001	27.446	22.988	17.701	10.487
	PSNR	31.400	29.245	29.245	29.245	29.321	29.399	29.573	29.855	30.386
	% of Loss	-	6.863	6.863	6.863	6.621	6.372	5.818	4.920	3.229
Total	No. of Bits	3083120	2212011	2212009	2212013	2258018	2312490	2429264	2579173	2790591
	% of Saving	-	28.254	28.254	28.254	26.761	24.995	21.207	16.345	9.488
	PSNR	34.547	32.903	32.903	32.903	32.948	33	33.123	33.345	33.737
	% of Loss	-	4.758	4.758	4.758	4.628	4.477	4.121	3.479	2.344

Monolake1	No. of Bits	410486	350758	350767	350766	350935	351841	356379	364857	380685
	% of Saving	-	14.55	14.548	14.548	14.507	14.286	13.181	11.115	7.259
	PSNR	39.871	39.084	39.084	39.084	39.086	39.099	39.149	39.251	39.461
	% of Loss	-	1.973	1.973	1.973	1.968	1.936	1.810	1.555	1.028
Monolake2	No. of Bits	306006	270223	270260	270298	270633	271462	274155	274958	288663
	% of Saving	-	11.693	11.681	11.669	11.559	11.288	10.408	10.146	5.667
	PSNR	42.237	41.791	41.791	41.791	41.794	41.805	41.835	41.895	42.02
	% of Loss	-	1.055	1.055	1.055	1.048	1.022	0.951	0.809	0.513
Monolake3	No. of Bits	399635	343728	343749	343743	344127	345205	348596	355357	369757
	% of Saving	-	13.989	13.984	13.985	13.889	37.794	12.771	11.079	7.476
	PSNR	40.435	39.742	39.742	39.742	39.745	39.760	39.797	39.881	40.075
	% of Loss	-	1.713	1.713	1.713	1.706	1.669	1.577	1.370	0.890
Monolake4	No. of Bits	366063	318485	318461	318468	318653	319234	322400	328482	340987
	% of Saving	-	12.997	13.003	13.001	12.951	12.792	11.927	10.266	6.850
	PSNR	41.097	40.428	40.429	40.428	40.432	40.441	40.477	40.571	40.76
	% of Loss	-	1.627	1.625	1.627	1.618	1.596	1.508	1.279	0.820
Monolake5	No. of Bits	578965	483941	483935	483932	484197	485070	489545	501222	524503
	% of Saving	-	16.412	16.413	16.414	16.368	16.217	15.444	13.427	9.406
	PSNR	37.724	36.431	36.431	36.431	36.432	36.439	36.488	36.626	36.957
	% of Loss	-	3.427	3.427	3.427	3.424	3.4063	3.276	2.910	2.033
Monolake6	No. of Bits	249582	245642	245642	245642	245647	245771	246794	247364	248020
	% of Saving	-	1.578	1.578	1.578	1.578	1.526	1.117	0.8888	0.625
	PSNR	46.608	46.536	46.536	46.536	46.536	46.536	46.537	46.54	46.542
	% of Loss	-	0.154	0.154	0.154	0.154	0.154	0.152	0.145	0.141
Monolake7	No. of Bits	439079	376122	376122	376134	376452	377326	381171	388516	403764
	% of Saving	-	14.338	14.338	14.335	14.263	14.064	13.188	11.515	8.042
	PSNR	39.828	39.074	39.074	39.074	39.074	39.080	39.114	39.207	39.407
	% of Loss	-	1.893	1.893	1.893	1.893	1.878	1.792	1.559	1.057

Total	No. of Bits	2749816	2388899	2388936	2388983	2390644	2395909	2419040	2464756	2556379
	% of Saving	-	13.125	13.123	13.122	13.122	12.870	12.029	10.366	7.034
	PSNR	41.114	40.44	40.441	40.44	40.442	40.451	40.485	40.567	40.746
	% of Loss	-	1.639	1.636	1.639	1.634	1.612	1.529	1.330	0.895
Owensvalley1	No. of Bits	537518	392626	392626	392622	399523	409238	428771	451032	485562
	% of Saving	-	26.955	26.955	26.956	25.672	23.865	20.231	16.089	9.665
	PSNR	32.756	30.489	30.489	30.489	30.540	30.630	30.782	30.962	31.469
	% of Loss	-	6.920	6.920	6.920	6.765	6.490	6.026	5.476	3.929
Owensvalley2	No. of Bits	409426	310144	310145	310145	314136	319462	332498	348448	373454
	% of Saving	-	24.249	24.248	24.248	23.274	21.973	18.789	14.893	8.785
	PSNR	35.207	33.821	33.821	33.821	33.862	33.912	34.016	34.171	34.497
	% of Loss	-	3.936	3.936	3.936	3.820	3.678	3.382	2.942	2.016
Owensvalley3	No. of Bits	558702	403360	403360	403357	408933	417707	437272	463259	502047
	% of Saving	-	27.804	27.804	27.804	26.806	25.236	21.734	17.082	10.140
	PSNR	32.590	30.813	30.813	30.813	30.865	30.929	31.049	31.239	31.652
	% of Loss	-	5.452	5.452	5.452	5.293	5.096	4.728	4.145	2.878
Owensvalley4	No. of Bits	565589	405223	405223	405218	410226	420224	441258	468824	509673
	% of Saving	-	28.353	28.353	28.354	27.469	25.701	21.982	17.108	9.886
	PSNR	32.645	30.842	30.842	30.842	30.892	30.965	31.08	31.278	31.688
	% of Loss	-	5.523	5.523	5.523	5.369	5.146	4.793	4.187	2.931
Owensvalley5	No. of Bits	991131	650771	650771	650771	657617	672431	712566	768429	860138
	% of Saving	-	34.340	34.340	34.340	33.649	32.155	28.105	22.469	13.216
	PSNR	28.087	25.070	25.070	25.070	25.091	25.139	25.284	25.562	26.233
	% of Loss	-	10.741	10.741	10.741	10.666	10.495	9.979	8.989	6.600
Owensvalley6	No. of Bits	478658	377688	377690	377697	378455	379666	385816	404543	435834
	% of Saving	-	21.094	21.093	21.092	20.934	20.681	19.396	15.483	8.946
	PSNR	35.711	29.467	29.467	29.467	29.478	29.482	29.527	29.996	31.897
	% of Loss	-	17.484	17.484	17.484	17.454	17.442	17.316	16.003	10.680

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Owensvalley7	No. of Bits	708596	492900	492901	492901	501063	512030	537843	571450	626345
	% of Saving	-	30.439	30.439	30.439	29.287	27.740	24.097	19.354	11.607
	PSNR	30.718	28.639	28.639	28.639	28.723	28.790	28.917	29.132	29.595
	% of Loss	-	6.768	6.768	6.768	6.494	6.276	5.863	5.163	3.655
Total	No. of Bits	4249620	3032712	3032716	3032711	3069953	3130758	3276024	3475985	3793053
	% of Saving	-	28.635	28.635	28.635	27.759	26.328	22.910	18.204	10.743
	PSNR	32.530	29.877	29.877	29.877	29.922	29.978	30.094	30.334	31.004
	% of Loss	-	8.155	8.155	8.155	8.017	7.845	7.488	6.750	4.691

Confusion matrix [15] is used to assessthe accuracy of an image classification. Thestrength of a confusion matrix is that it identifiesthe nature of the classification errors, as well astheir quantities. In confusion matrix rowscorrespond to classes in the test set, columnscorrespond to classes in the classification result.The diagonal elements in the matrix representthe number of correctly classified pixels of eachclass. The off-diagonal elements representmisclassified pixels. The overall accuracy iscalculated as the total number of correctlyclassified pixels divided by the total number of test pixels.

Another measure which can be extractedfrom a confusion matrix is the kappa coefficient[16] which is a popular measure to estimateagreement in categorical data. The motivation ofthis measure is to extract from the correctlyclassified percentage the actual percentageexpected by chance. Thus, this coefficient iscalculated as

$$K = \frac{P_0 - P_e}{1 - P_e} \quad (14)$$

$$P_0 \text{ is observed agreement} = \frac{\text{Total number of correctly classified pixels (diagonal elements)}}{\text{Total number of test pixels}}$$

$$P_e \text{ is the Expected agreement} = \left[\frac{\frac{cm^1 x rm^1}{n} + \frac{cm^2 x rm^2}{n} + \dots\dots\dots \frac{cm^n x rm^n}{n}}{n} \right] \quad (15)$$

cm1,, cm2, ……… cmnare the column 1, 2 …………n marginals

rm^1 ,rm^2, ……… rm^n are the row 1, 2 --------- nmarginals

n is the total number of test pixels.

The higher the value of kappa, the betterthe classification performance. If all informationclasses are correctly identified, kappa takes thevalue 1. As the off-diagonal entries increase, thevalue of kappa decreases. For classification two data sets were used. Onewas a 1048 X 920 (Owensvalley image) LandsatTM with all 7 bands. The second data setcontained 500 samples of four ground types,Dense scrub, Rock, Forest and Open scrub of thesame scene. This second data set is used to observe the classification accuracy. All the 2000set patterns were classified simultaneously withthe Maximum Likelihood, Mahalanobis andMinimum distance classifiers. Classificationperformance of all the classifiers is displayed intables 4, 5 & 6. Figure 6 shows the Overallaccuracy of all the classifiers. It is observed thatclassification performance on proposedcompression images is almost same as JPEGstandard compression images and original images.

Table 4 : Confusion matrix for Maximum Likelihood classifier

Original Image						
Spectral Class	Correct Classification (%)	Number of Samples used	Classified as group			
			1	2	3	4
1. Dense scrub	99.9	500	499	1	0	0

2. Rock	100	500	0	500	0	0
3. Forest	94.4	500	0	28	472	0
4. Open scrub	100	500	0	0	0	500
Misclassification= 1.15 %	Overall accuracy= 98.55%		Kappa coefficient=0.9806			
Conventional JPEG Compression image						
Spectral Class	Correct Classification (%)	Number of Samples used	Classified as group			
			1	2	3	4
1. Dense scrub	97.6	500	488	12	0	
2. Rock	100	500	0	500	0	0
3. Forest	90.2	500	1	48	451	0
4. Open scrub	99.2	500	1	3	0	496
Misclassification= 3.25%	Overall accuracy= 96.75 %		Kappa coefficient=0.9567			
Proposed compressed image (Mean filtered approach)						
Spectral Class	Correct Classification (%)	Number of Samples used	Classified as group			
			1	2	3	4
1. Dense scrub	96.8	500	484	16	0	0
2. Rock	100	500	0	500	0	0
3. Forest	77	500	0	115	385	0
4. Open scrub	99.6	500	2	0	0	498
Misclassification= 6.65 %	Overall accuracy=93.35%		Kappa coefficient=0.9113			

Table 5 : Confusion matrix for Mahalanobis classifier

Original Image						
Spectral Class	Correct Classification (%)	Number of Samples used	Classified as group			
			1	2	3	4
1. Dense scrub	100	500	500	0	0	0
2. Rock	95.4	500	20	477	3	0
3. Forest	100	500	0	0	500	0
4. Open scrub	100	500	0	0	0	500
Misclassification= 1.15 %	Overall accuracy= 98.85 %		Kappa coefficient=0.9846			
Conventional JPEG Compression image						
Spectral Class	Correct Classification (%)	Number of Samples used	Classified as group			
			1	2	3	4
1. Dense scrub	98.2	500	491	6	3	0
2. Rock	93	500	23	465	12	0
3. Forest	96.8	500	8	8	484	0
4. Open scrub	99.8	500	1	0	0	499
Misclassification= 3.05 %	Overall accuracy=96.95%		Kappa coefficient=0.9593			
proposed compression image(Mean filtered approach)						
Spectral Class	Correct Classification (%)	Number of Samples used	Classified as group			
			1	2	3	4
1. Dense scrub	98.6	500	493	4	1	2
2. Rock	78.4	500	81	392	27	0
3. Forest	96.2	500	18	1	481	0
4. Open scrub	100	500	0	0	0	500
Misclassification= 6.7%	Overall accuracy= 93.3 %		Kappa coefficient=0.9106			

Table 6 : Confusion matrix for Minimum distance classifier

Original Image						
Spectral Class	Correct Classification (%)	Number of Samples used	Classified as group			
			1	2	3	4
1. Dense scrub	97.2	500	486	1	0	13
2. Rock	71.8	500	118	359	5	18
3. Forest	100	500	0	0	500	0
4. Open scrub	100	500	0	0	0	500
Misclassification= 7.75%	Overall accuracy=92.25%		Kappa coefficient=0.8966			
Conventional JPEG compression image						
Spectral Class	Correct Classification (%)	Number of Samples used	Classified as group			
			1	2	3	4
1. Dense scrub	93.6	500	468	4	5	23
2. Rock	51.2	500	101	256	69	74
3. Forest	98.6	500	7	0	493	0
4. Open scrub	100	500	0	0	0	500
Misclassification= 14.15%	Overall accuracy=85.85 %		Kappa coefficient=0.811			
proposed compression image(Mean filtered approach)						
Spectral Class	Correct Classification (%)	Number of Samples used	Classified as group			
			1	2	3	4
1. Dense scrub	91	500	455	5	6	34
2. Rock	48.8	500	79	244	90	87
3. Forest	96	500	18	2	480	0
4. Open scrub	99.6	500	2	0	0	498
Misclassification= 16.15%	Overall accuracy= 83.85 %		Kappa coefficient=0.784			

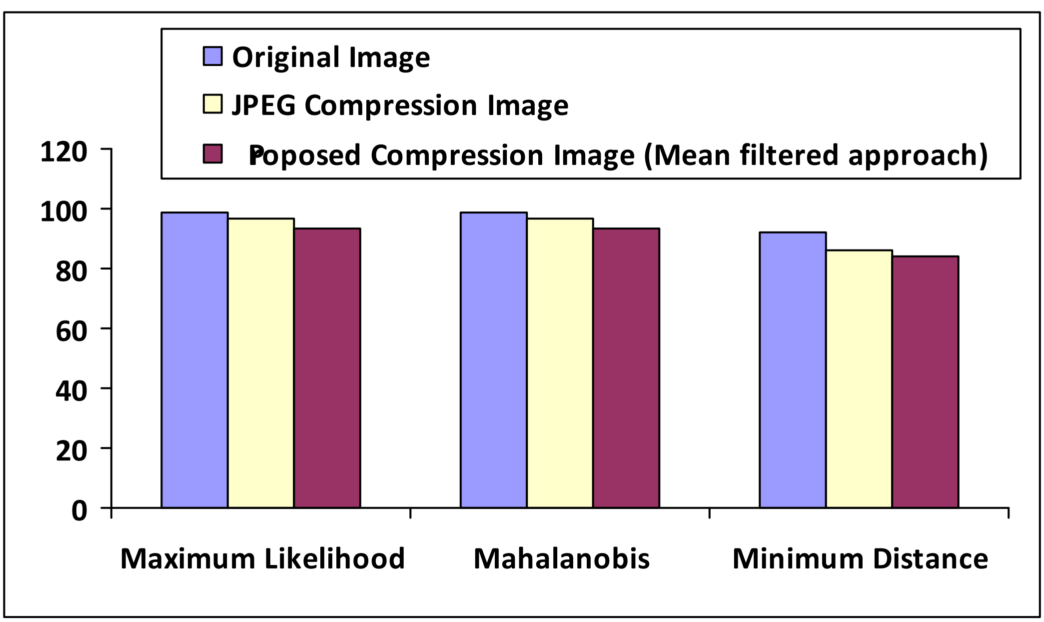

Figure 6 : Overall Accuracy of Classifiers

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VI. Conclusions

In this paper, a new filtering basedJPEG compression algorithm is proposed. Wehave compared our proposed algorithm withStandard JPEG compression. From ourexperiments it is evident that our approachgives better compression ratios compared toStandard JPEG. The PSNR resulting from ourapproach is slightly less than Standard JPEGapproach. Also the Classification accuracy oforiginal images, Conventional JPEGcompression images and proposed compression images are almost same.

If a typical satellite mission goal isclassification only, then we can sendcompressed images from satellite which savesbandwidth requirements of a satellite mission.Also, storage requirement reduces by manyfolds as we will be storing compressed imagesonly. This indirectly reduces powerrequirement needs of the storage system. Inaddition, loading and storing of images takesless time compared to original images, thus response times of imaging systems increases.

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Design of an Automated Car Parking System by using Microcontroller

By M. M. Israfil Shahin Seddiqe & Avizit Basak
Rajshahi University of Engineering & Technology (RUET), Bangladesh

Abstract- Now a days, with the growing number of vehicles and consequent shortage of parking space there is a haphazard and totally unregulated parking of vehicles all over, the station calls out for an automated parking system that not only regulates parking in a given area but also keeps the manual control to a bare minimum.

To cater to need here we present a minimum model of an automated car parking system that regulated the number of cars that can be parked in an area at any given time based on the parking space available. The entry and exit of vehicle are vacillated using to using to tally automated gate status signal indicates whether space is currently available in the parking lot and whether a car currently in the process of entering or leaving the parking space.

To avoid the manual dependent system a Microcontroller-Based system has been developed. The microcontroller has been interfaced with a simple hardware to a PC so that the program can be easily changed as our needs. So, no special arrangement is required to reprogram the microcontroller. The project is less expensive and works satisfactory.

Keywords: micro-controller, avr, stepper motor etc.

GJRE-F Classification : FOR Code: 290903p

DESIGNOFANAUTOMATEDCARPARKINGSYSTEMBYUSINGMICROCONTROLLER

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Keywords: micro-controller, avr, stepper motor etc.

I. Introduction

A gate has been provided at the entry of the parking space which opens on the arrival or departure of a car.A display section has been provided which consist of status signal and a display sowing the number of the number of the cars space available in the parking space at any point of time .after the maximum number cars have entered the parking space the gate is automatically disabled or closed for vehicles seeking entry into the parking lot. In this project Microcontroller ATtiny26 is used. The software for the microcontroller is written in BASCOM-AVR (a powerful basic complier) which is capable of creating a hex file. The hex file code can be burnt into the microcontroller using any commonly available programmer or kit or burner. The line LCD display, stepper motor, power supply also the key parameters of this project.

II. Description of a ATtiny26(l) Microcontroller & IRFZ44

The ATtiny26(L) is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle,the ATtiny26(L) achieves throughputs approaching 1 MIPS per MHz allowing the systemdesigner to optimize power consumption versus processing speed.The AVR core combines a rich instruction set with 32 general purpose working registers.All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in one single instruction executed in one clockcycle. The resulting architecture is more code efficient while achieving throughputs up toten times faster than conventional CISC microcontrollers. The ATtiny26(L) has a high precision ADC with up to 11 single ended channels and 8 differential channels. Sevendifferential channels have an optional gain of 20x. Four out of the seven differential channels, which have the optional gain, can be used at the same time. The ATtiny26(L)also has a high frequency 8-bit PWM module with two independent outputs. Two of the PWM outputs have inverted non-overlapping output pins ideal for synchronous rectification.The Universal Serial Interface of the ATtiny26(L) allows efficient softwareimplementation of TWI (Two-wire Serial Interface) or SM-bus interface. These featuresallow for highly integrated battery charger and lighting ballast applications, low-end thermostats,and fire detectors, among other applications.The ATtiny26(L) provides 2K bytes of Flash, 128 bytes EEPROM, 128 bytes SRAM, upto 16 general purpose I/O lines, 32 general purpose working registers, two 8-bitTimer/Counters, one with PWM outputs, internal and external Oscillators, internal andexternal interrupts, programmable Watchdog Timer, 11-channel, 10-bit Analog to DigitalConverter with two differential voltage input gain stages, and four software selectablepower saving modes. The Idle mode stops the CPU while allowing the Timer/Countersand interrupt system to continue functioning. The ATtiny26(L) also has a dedicated ADCNoise Reduction mode for reducing the noise in ADC conversion.

High-performance, Low-power AVR® 8-bit Microcontroller

RISC Architecture:

Powerful Instructions – Most Single Clock Cycle Execution

32 x 8 General Purpose Working Registers

Fully Static Operation

Authors α σ: B.Sc in Electrical & Electronics Engineering from Rajshahi University of Engineering & Technology (RUET), Rajshahi, Bangladesh. e-mails: mmisrafil@gmail.com, dhrubo_eee88@yahoo.com

Up to 16 MIPS Throughput at 16 MHz

Data and Non-volatile Program Memory:

2K Bytes of In-System Programmable Program Memory Flash

Endurance: 10,000 Write/Erase Cycles

128 Bytes of In-System Programmable EEPROM

Endurance: 100,000 Write/Erase Cycles

128 Bytes Internal SRAM

Programming Lock for Flash Program and EEPROM Data Security

Peripheral Features:

8-bit Timer/Counter with Separate Pre scaler

8-bit High-speed Timer with Separate Pre scaler

2 High Frequency PWM Outputs with Separate Output Compare Registers

Non-overlapping Inverted PWM Output Pins

Universal Serial Interface with Start Condition Detector

10-bit ADC

11 Single Ended Channels

8 Differential ADC Channels

7 Differential ADC Channel Pairs with Programmable Gain (1x, 20x)

On-chip Analog Comparator

External Interrupt

Pin Change Interrupt on 11 Pins

Programmable Watchdog Timer with Separate On-chip Oscillator

Special Microcontroller Features:

Low Power Idle, Noise Reduction, and Power-down Modes

Power-on Reset and Programmable Brown-out Detection

External and Internal Interrupt Sources

In-System Programmable via SPI Port

Internal Calibrated RC Oscillator

I/O and Packages:

20-lead PDIP/SOIC: 16 Programmable I/O Lines

32-lead QFN/MLF: 16 programmable I/O Lines

Operating Voltages:

2.7V - 5.5V for ATtiny26L

4.5V - 5.5V for ATtiny26

Speed Grades:

0 - 8 MHz for ATtiny26L

0 - 16 MHz for ATtiny26

Power Consumption at 1 MHz, 3V and 25°C for ATtiny26L

Active 16 MHz, 5V and 25°C: Typ 15 mA

Active 1 MHz, 3V and 25°C: 0.70 mA

Idle Mode 1 MHz, 3V and 25°C: 0.18 mA

Power-down Mode: < 1 μA

IRFZ44: N channel power MOSFET. Continuous Drain current 36A with V_{GS}=10V

III. Pin Descriptions

VCC Digital supply voltage pin.

GND Digital ground pin.

AVCC AVCC is the supply voltage pin for Port A and the A/D Converter (ADC). It should be externally connected to VCC, even if the ADC is not used. If the ADC is used, it should be connected to VCC through a low-pass filter.

Port A (PA7..PA0) Port A is an 8-bit general purpose I/O port. PA7..PA0 are all I/O pins that can provide internal pull-ups (selected for each bit). Port A has alternate functions as analog inputs for the ADC and analog comparator and pin change interrupt as described in “AlternatePort B (PB7..PB0) Port B is an 8-bit general purpose I/O port. PB6..0 are all I/O pins that can provide internal pull-ups (selected for each bit). PB7 is an I/O pin if not used as the reset. To use pin PB7 as an I/O pin, instead of RESET pin, program (“0”) RSTDISBL Fuse. Port B hasalternate functions for the ADC, clocking, timer counters, USI, SPI programming, and pin change interrupt. An External Reset is generated by a low level on the PB7/RESET pin. Reset pulses longer than 50 ns will generate a reset, even if the clock is not running. Shorter pulses are not guaranteed to generate a reset.

XTAL1 Input to the inverting oscillator amplifier and input to the internal clock operating circuit.

XTAL2 Output from the inverting oscillator amplifier.

IV. Stepper Motor

A stepper motor is an electromechanical device which converts electrical pulses into discrete mechanical movements. The shaft or spindle of a stepper motor rotates in discrete step increments when electrical command pulses are applied to it in the proper sequence. The motors rotation has several direct relationships to these applied input pulses. The sequence of the applied pulses is directly related to the direction of motor shafts rotation. The speed of the motor shafts rotation is directly related to the frequency of the input pulses and the length of rotation is directly related to the number of input pulses applied.

V. ATtiny26(L) Block Diagram

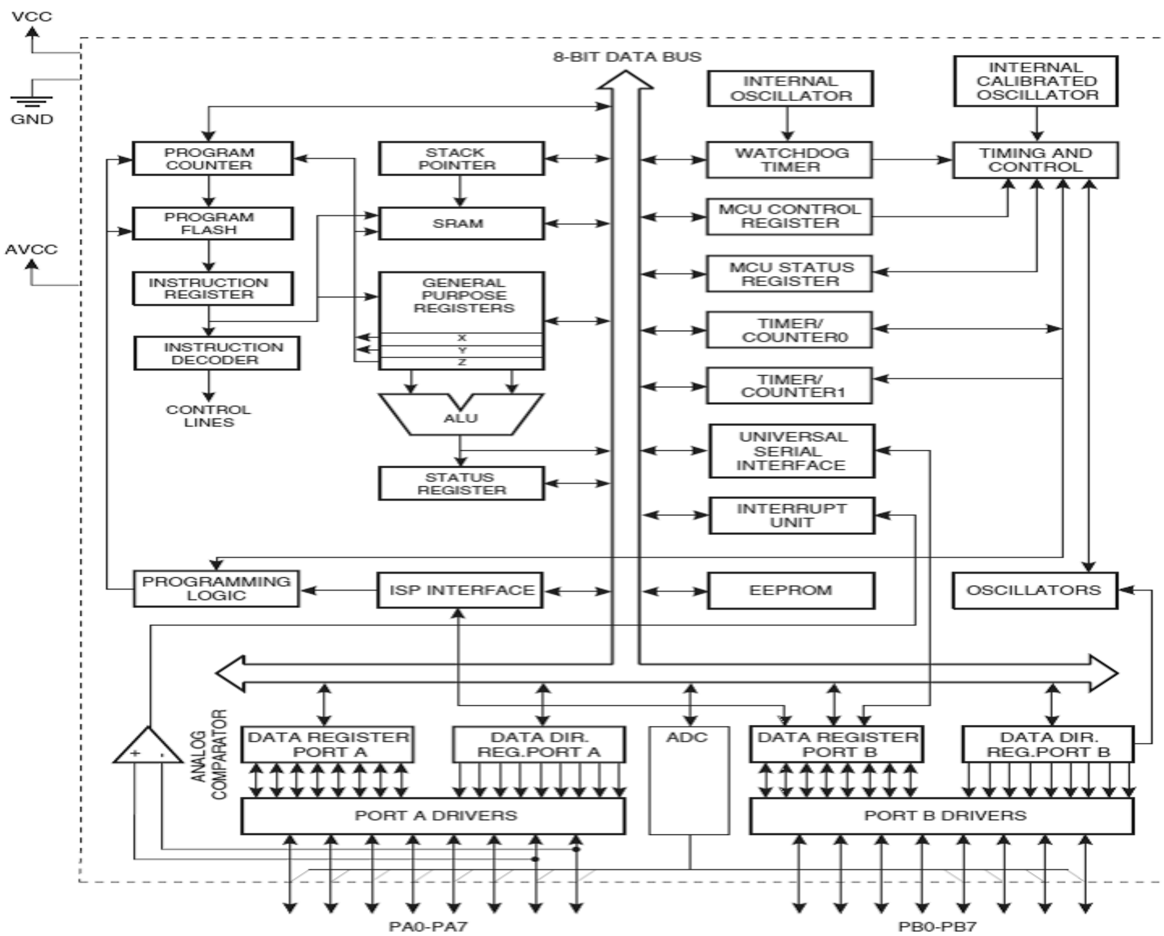

Figure 1 : ATtiny26 (L) Block Diagram

VI. Reason of using Mosfet

Discrete power MOSFETs employ semi-conductor processing techniques that are similar to those of today's VLSI circuits, although the device. The metal oxide semiconductor field effect transistor (MOSFET) is based on the original field-effect transistor introduced in the invention of the power MOSFET was partly driven by the limitations of bipolar power junction transistors (BJTs) which, until recently, was the device of choice in power electronics applications. Although it is not possible to define absolutely the operating boundaries of a power device, we will loosely refer to the power device as any device that can switch at least 1A. The bipolar power transistor is a current controlled device. A large base drive current as high as one-fifth of the collector current is required to keep the device in the ON state. Also, higher reverse base drive currents are required to obtain fast turn-off. Despite the very advanced state of manufacturability and lower costs of BJTs, these limitations have made the base drive circuit design more complicated and hence more expensive than the MOSFET.

VII. Block Diagram of Liquid Crystal Display

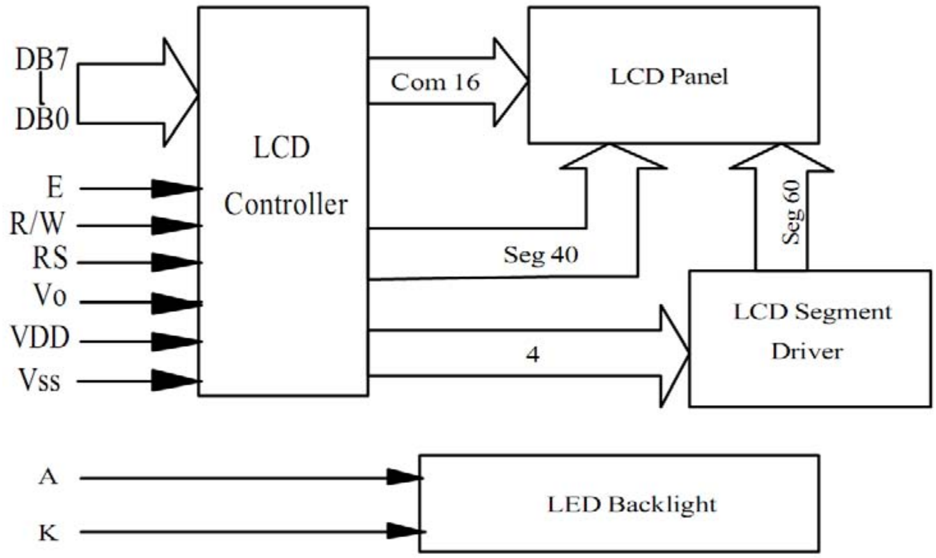

Figure 2 : Block diagram of LCD

Several types of LCD is available such as 16*2, 20*2, 20*4 etc. 16*2 represents that this LCD contains 16 character per line and total line is 2. LCD has 16 pin. From them 8 pins are data pin. For LED backlight 2 pins are reserved one is anode and other is cathode.

Vdd: Positive Supply.

Vss: Substrate Voltage (Reference level or Ground potential)

VO: Contrast selecting voltage. The contrast of the LCD is inversely proportional to the voltage at VO pin. If it set to ground potential the contrast will be maximum.

RS: Resister Select pin.

R/W: Read / Write select pin. Setting this pin to one state will configured LCD to read data from LCD and zero state will configured LCD to write data to LCD. As we will write data to LCD this pin will be connected to Vss.

E: Enable Pin.

D0-D7: Data pin. LCD operates in two mode – Pin mode and Bus mode. Pin mode uses only higher 4 bit and bus mode uses all the data bit.

LED+: LED Backlight anode pin.

LED-: LED Backlight cathode pin.

VIII. Circuit Diagram of 12V & 5VDC Supply

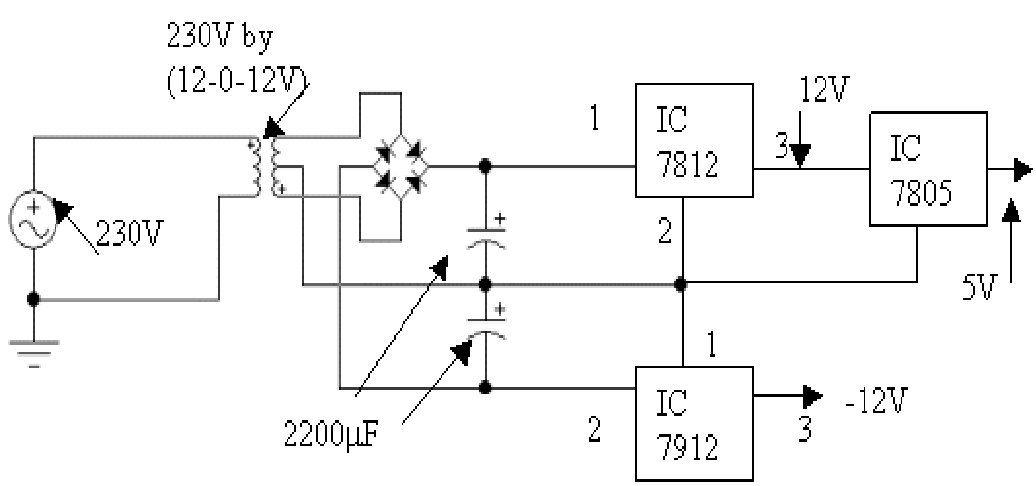

Figure 3 : Circuit Diagram of 12V & 5V DC Supply

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IX. Photoof the Project

Figure 4 : Project work

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Analysis and Design of Various Noval Microstrip Patch Antenna

By Deepak & Dhaynendra Parashar

S.R.G.I Jhansi, India

Abstract- In today's modern communication industry, antennas are the most important components required to create a communication link. Microstrip antennas are the most suited for aerospace and mobile applications because of their low profile, light weight and low power handling capacity. They can be designed in a variety of shapes in order to obtain enhanced gain and bandwidth, dual band and circular polarization to even ultra wideband operation. This paper provides a detailed study of the design of probe-fed Rectangular Microstrip Patch Antenna to facilitate effects of changing the feed point. By this paper we conclude that in the same patch we can take different feed points and same patch can be used for various applications. The main aim of this paper is to design various MSA for and analyze there results. For this first we simulate the results in IE3D and then we test these results practically after designing the hardware of the patch. In testing we find that our designed Microstrip antenna is very useful in Bluetooth technology for communication. The design parameters of the antenna have been calculated using the transmission line model and the cavity model. For the simulation process IE3D electromagnetic software which is based on method of moment (MOM) has been used.

Keywords: feed point, patch, return loss, bandwidth.

GJRE-F Classification : FOR Code: 291701, 090699

Analysis and Design of Various Noval Microstrip Patch Antenna

Deepak [α] & Dhaynendra Parashar [σ]

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Keywords: feed point, patch, return loss, bandwidth.

I. Introduction

Communication between humans was first by sound through voice. With the desire for slightly more distance communication came, devices such as drums, then, visual methods such as signal flags and smoke signals were used. These optical communication devices, of course, utilized the light portion of the electromagnetic spectrum. It has been only very recent in human history that the electromagnetic spectrum, outside the visible region, has been employed for communication, through the use of radio. One of humankind's greatest natural resources is the electromagnetic spectrum and the antenna has been instrumental in harnessing this resource.

Many wireless service providers have discussed the adoption of polarization, diversity and frequency diversity schemes in place of space diversity approach to take advantage of the limited frequency spectra available for communication [1-10]. Due to the rapid development in the field of satellite and wireless communication there has been a great demand for low cost minimal weight, compact low profile antennas that are capable of maintaining high performance over a large spectrum of frequencies. Through the years, microstrip antenna structures are the most common option used to realize millimeter wave monolithic integrated circuits for microwave, radar and communication purposes[11-35]. Compact microstrip antennas capable of dual polarized radiation are very suitable for applications in wireless communication systems that demand frequency reuse and polarization diversity.

a) Aim and Objective

The main aim of this paper to provide the very efficient bandwidth and return loss. For achieving this we designed many Microstrip antenna and obtained good results. If bandwidth is good then it can be used to any type of application. In here my work defines that at different feed points [41, 42] we can get a useful bandwidth where we can use the different devices. The performance comparison is based on, return loss, and bandwidth at all four different feed points in first MSA. In second patch we have simulate the patch at 4GHz, 5GHz, and 6GHz frequency and we find wideband width. And in third patch [37, 39] describe the phenomena of dual band.

II. Dimensions Calculation of 1st Proposed Antenna

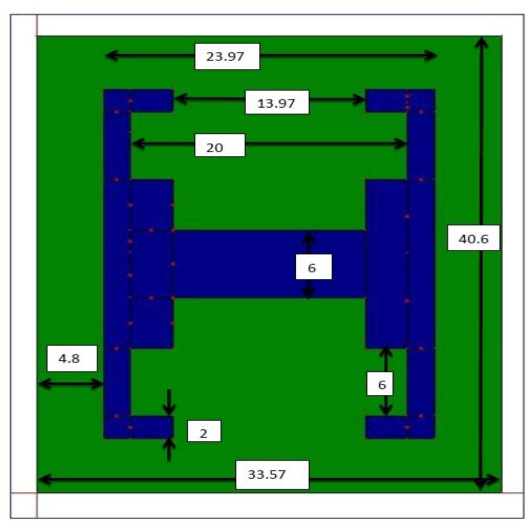

Figure 1 : Top view of Proposed Microstrip Patch Antenna

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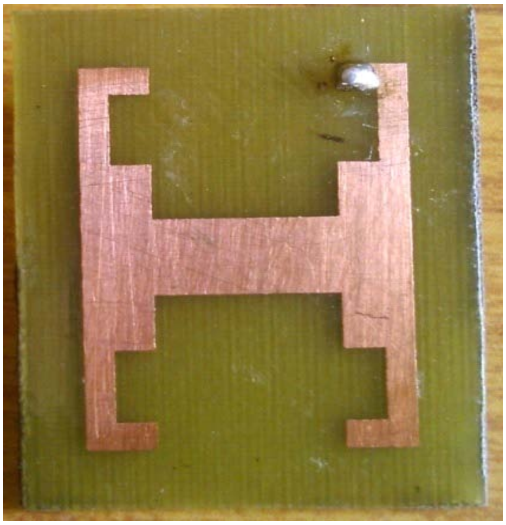

Figure 2 : Hardware of Proposed Microstrip Pa Antenna

a) Calculation of the Width (W)

The width of the Microstrip patch antenna [36] is given by equation (1) as:

$$W = \frac{c}{2f_r\sqrt{\frac{\varepsilon_r+1}{2}}} \quad (1)$$

Substituting c = 3e8 m/s, ε_r = 4.2 and f_r = 3 GHz, we get:

W = 0.03100 m = 31.00 mm

b) Calculation of Effective dielectric constant (ε_{reff})

Equation (2) gives the effective dielectric constant as:

$$\varepsilon_{reff} = \frac{\epsilon_r+1}{2} + \frac{\frac{\epsilon_r-1}{2}}{\sqrt{\left[1+12\frac{h}{w}\right]}} \quad (2)$$

Substituting ε_r = 4.2, W = 31.0 mm and h = 1.6 mm we get:

ε_{reff} = 3.86

c) Calculation of the Effective length (L eff)

Equation (3) gives the effective length as:

$$L_{eff} = \frac{c}{2f_r\sqrt{\varepsilon_{reff}}} \quad (3)$$

Substituting ε_{reff}=3.86, c = 3e8 m/s and f_r = 3 GHz we get:

L_{eff} = 25.44mm

d) Calculation of the length extension (ΔL)

Equation (4) gives the length extension

$$\text{as:}\Delta L = 0.412h\frac{(\varepsilon_{reff}+0.3)(\frac{W}{h}+0.264)}{(\varepsilon_{reff}-0.258)(\frac{W}{h}+0.8)} \quad (4)$$

Substituting ε_{reff} = 3.86, W = 31.0 mm and h = 1.6 mm we get

ΔL = .7421 = 7.421mm

e) Calculation of actual length of patch (L)

The actual length is obtained by re-writing equation (5) as:

$$L = L_{eff} - 2\Delta L \quad (5)$$

Substituting L_{eff} = 25.44 mm and ΔL = 7.421 mm we get:

L = 23.97 mm

f) Calculation of the ground plane dimensions (L_g and W_g)

The transmission line model is applicable to infinite ground planes only. However, for practical considerations, it is essential to have a finite ground plane. It has been shown by [9] that similar results for finite and infinite ground plane can be obtained if the size of the ground plane is greater than the patch dimensions by approximately six times the substrate thickness all around the periphery. Hence, for this design, the ground plane dimensions would be given as:

$$L_g = 6h + L = 6(1.6) + 23.97 = 33.57\text{mm} \quad (6)$$

$$W_g = 6h + L = 6(1.6) + 31 = 40.6\text{mm} \quad (7)$$

g) Result of 1st Proposed Antenna by Simulation

The software used to model and simulate the microstrip patch antenna is ZelandInc's IE3D software. IE3D is a full-wave electromagnetic simulator based on the method of moments. It analyzes 3D and multilayer structures of general shapes. It has been widely used in the design of MICs, RFICs, patch antennas, wire antennas, and other RF/wireless antennas. It can be used to calculate and plot the S_{11}parameters, VSWR, current distributions as well as the radiation patterns. An evaluation version of the software was used to obtain the results for this thesis. For simplicity, the length and the width of the patch and the ground plane have been rounded off to the following values: L = 23.97 mm, W = 31 mm, L_g = 33.57 mm, W_g = 40.6 mm

Now when we take the first feed point at X=25.575 Y= 35.075 then we found the simulation result given below.

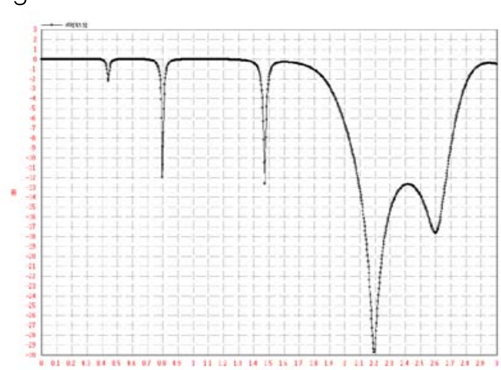

Figure 3 : Return Loss V Frequency Result at 1st FeedPoint

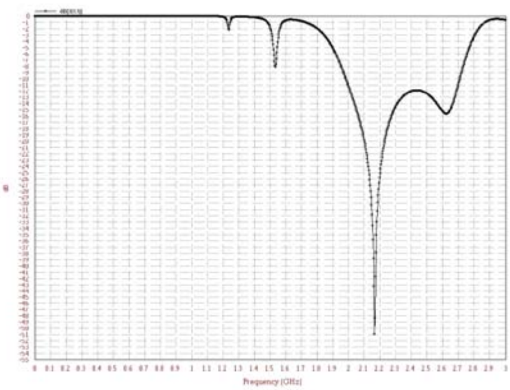

Figure 4 : Return Loss V Frequency Result at 2nd Feed Point

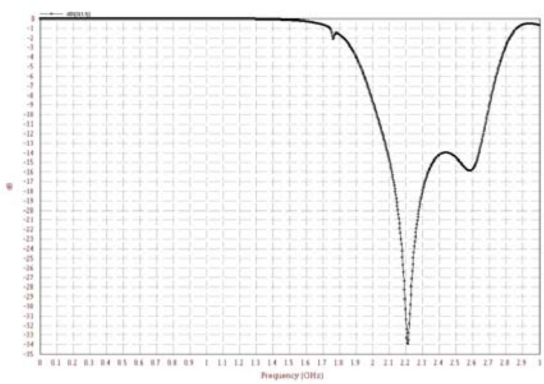

Figure 5 : Return Loss V Frequency Result at 3rd Feed Point

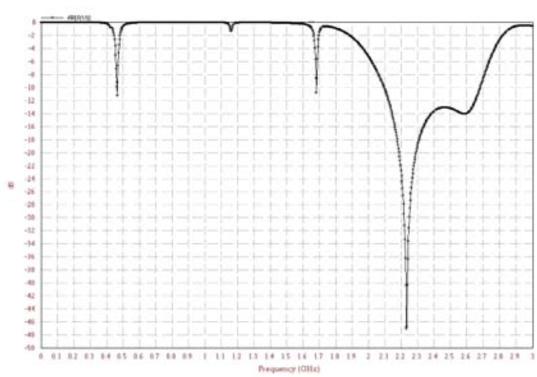

Figure 6 : Return Loss V Frequency Result at 4th Feed Point

From the simulation results of 1st feed point we are shown that return loss is below –10 db is maximum at frequency 2.2GHz is -30db.We can calculate the bandwidth for this patch at 1st feed point by given equation

$$B.W(\%) = 100\frac{F_{max} - F_{min}}{\frac{F_{max} + F_{min}}{2}} \quad (8)$$

F_{max} and F_{min} are frequency is maximum and minimum frequency at below -10db .In here F_{max}= 2.691GHz F_{min} = 2.054 we get B(%) = 26.84%.

Similarly for each feed point we can calculate the bandwidth of the patch.

Now form the above results we conclude that the proposed antenna give the various results at different feed points ,and all the results are useful for communication field without changing any other parameter we have found the useful results at all the feed points.

Table 1 : Performance table at different feed point

Feed points	1	2	3	4
X	24.575	7.75	8.525	24.875
Y	35.075	35.25	5.875	5.875
Return Loss	30	51	34	47
Bandwidth	26.84%	31.25%	28.69%	25%

At the 2nd feed point we have getting the best results in all others the feed points.

i. *Testing Result of 1st Proposed Antenna*

At the above 2.1 we have seen the simulated result of the patch using IE3D software. Now in this section we are shown the actual tested results of patch. Due to various losses and effects simulated results and actual testing results have some variations.

Figure 7 : Setup for Testing of a Patch

Figure 8 : Results at 2nd feed point

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From the above given table we can see that return loss is goes below -10 db at frequency 2.10GHzand the maximum return Loss is obtained at frequency 2.32GHz is-41db. Return loss again goes above -10db at frequency 2.65GHz.

So from here we can calculate the bandwidth of patch at second feed point, because we test these patch at second feed point.

$$\text{Band width (\%)} = \frac{2.65-2.10}{\frac{2.65+2.10}{2}} \times 100 = 23.15\%$$

In the simulation we have find out these bandwidth is 31.25% between frequency 1.979 GHz to 2.71GHz and return loss is -51db.But as we already consider that due to various effects these results can be vary. But if we optimized then we can get more effective results.

In the given table comparison is shown between simulated and actual testing results

Table 2 : Comparisons between Simulated and Testing Results

Specifications	Testing Results	Simulation results
Return Loss	-41	-51
Band width (%)	23.15	31.25

h) Inverted T Shape Microstrip Antenna[43,44,45]

As we know the main drawback of microstrip patch antenna is its narrow bandwidth but it can be improved by various techniques. In here we are taking a patch and we simulate it 4GHz, 5GHz and 6GHz frequency and we observe that when we goes to higher frequency its bandwidth is improved. And at 6GHz we also obtained dual bandwidth. So our main work in here to improve the bandwidth of the patch by allocating the feed point at same location.

From the above formulas in we can calculate the W and L of the patch for different frequencies, table 4.4 are given below for the W and L.

Table 3

	4Ghz	5Ghz	6Ghz
W_g(mm)	32.856	28.205	25.104
L_g (mm)	27.404	23.686	21.197
W_e(mm)	23.256	18.605	15.504
L_e(mm)	17.804	14.085	11.597

In this work we are having the three same type of patch, but for each patch W and L are change because frequency for each patch are change. But in here we are shown the entire patch at 4GHz, 5GHz and 6GHz

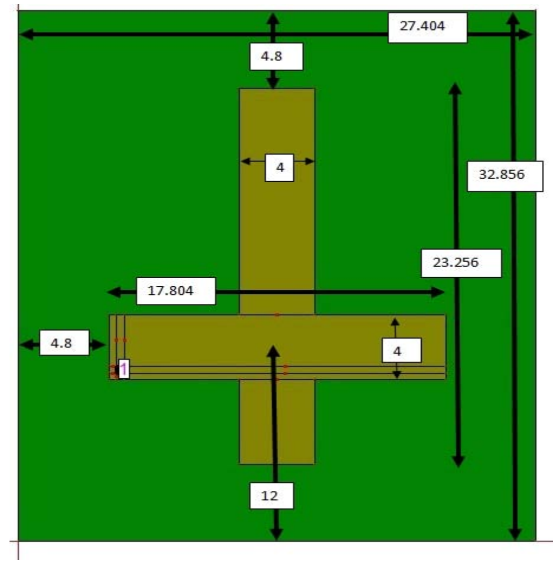


Figure 9 : Proposed patch at 4GHz

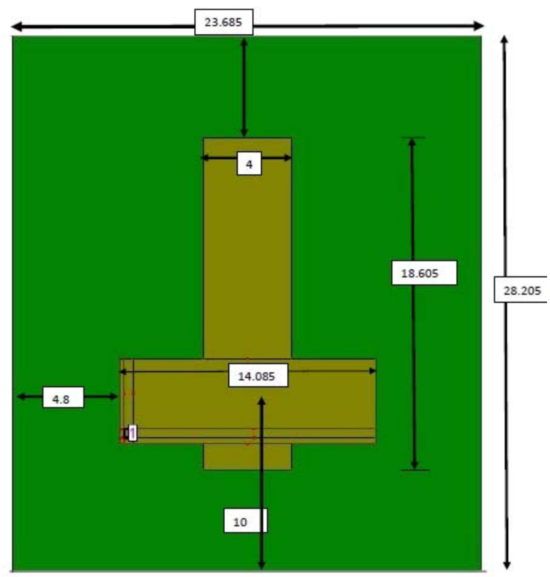


Figure 10 : Proposed patch at 5GHz

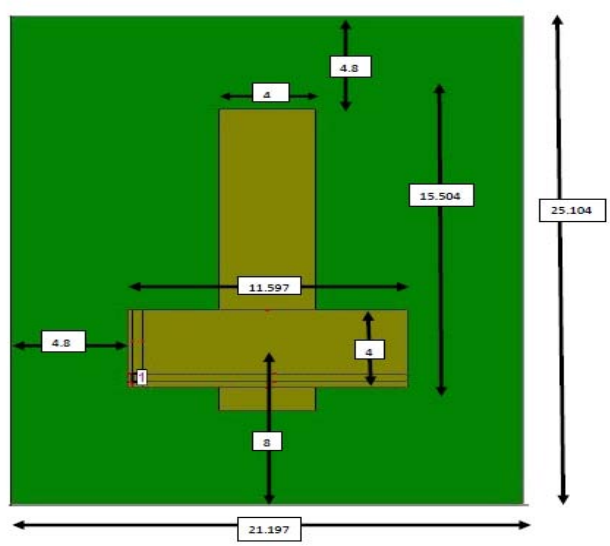


Figure 11 : Proposed patch at 6GHz

Figure 12 : Hardware of Proposed MSA

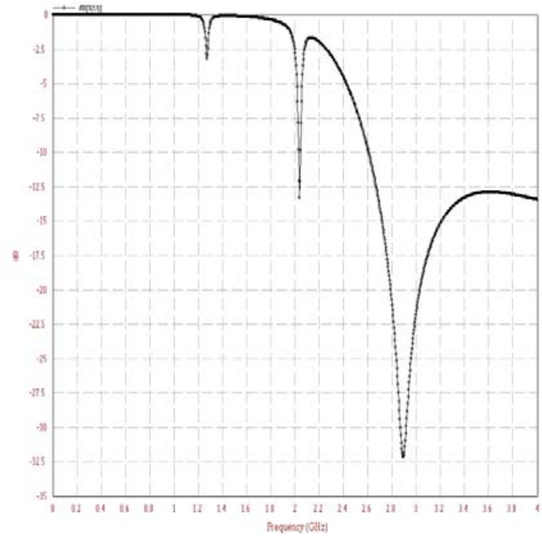


Figure 13 : Results at 4GHzFig.13 Results at 4GHz

i. *Results of Inverted T Shape Microstrip Antenna*

A proposed inverted T shapes patch is analyzed with a 4GHz, 5GHz, and 6GHz. This is found that by varying the operating frequency the size of patch changed [table.4.4] and a result is also changed [table.]. At 4GHz, 5GHz, 6GHz frequencies antenna parameters return loss, bandwidth are measured and compared.

At 4GHz frequency we take a feed point at X= 5.425 and Y= 10.625, in here we are using a coaxial probe feed. From the results we conclude that the return loss is maximum at 4GHz And the minimum, return loss is at 6GHz.When we conclude the bandwidth of the patch then maximum bandwidth is 50%, obtained at 5GHz and minimum bandwidth is 42.42% at 4GHz (accept 1st band at 6GHz).The main important result in here is dual bandwidth is obtained at 6GHz, which can be used in various application.

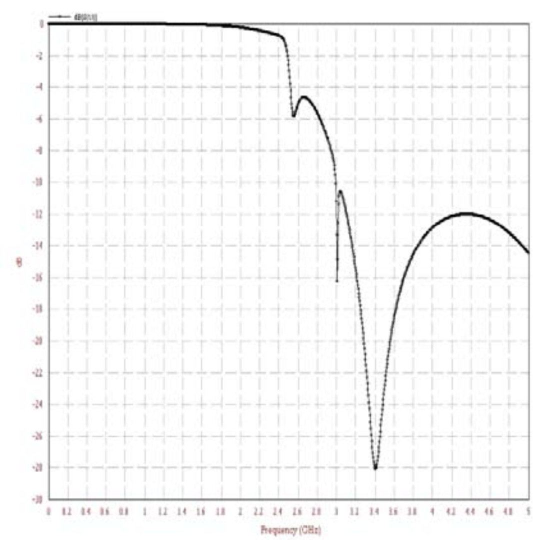


Figure 14 : Results at 5GHz

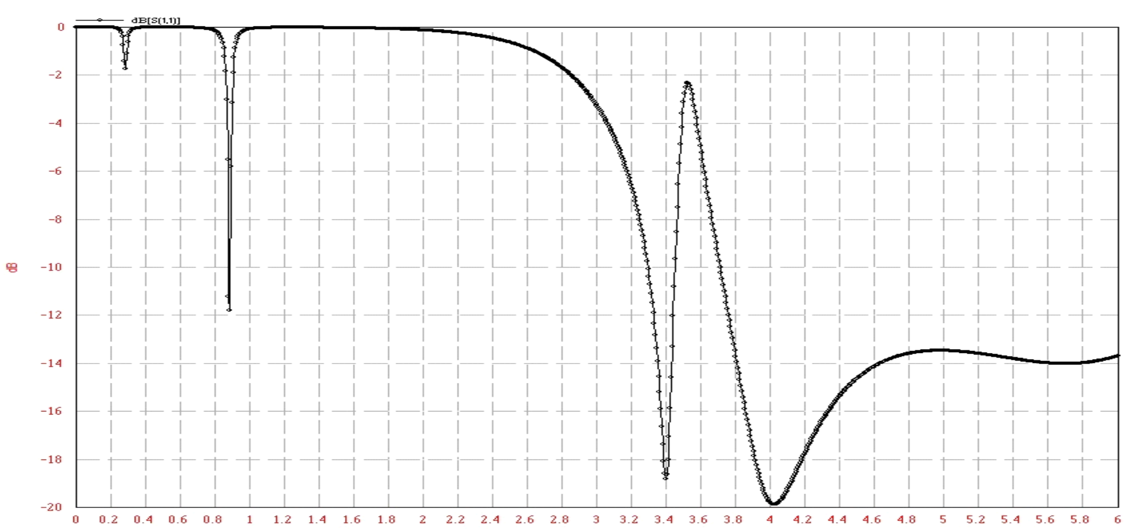


Figure 15 : Results at 6GHz

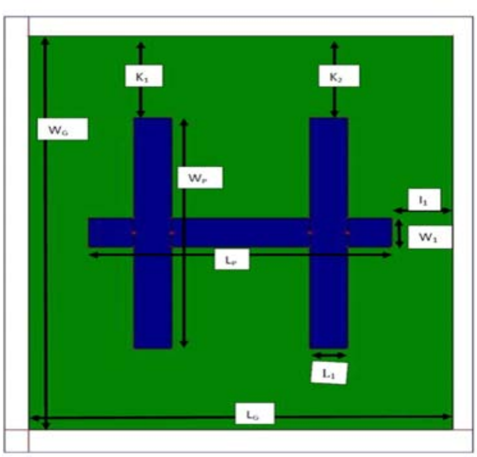
Investigated results of return loss, and bandwidth for patch with different operating frequencies are shown in Table 4.

Specifications	4GHz	5GHz	6GHz
X(mm)	5.425	5.375	5.225
Y(mm)	10.625	8.65	6.5
Band	Single	Single	Dual
Band Width (%)	42.42	50	4.74 (1st Band)
			47 (2nd Band)
Return Loss	-32	-28	-19
			-20

In the above work we have found that by changing the operating frequency and keeping feed point area constant, it is seen that as bandwidth is improves. We are getting single band at 4GHz and5 GHz while as at 6GHz we obtained dual band of 4.74% and 47%. It suggests that the microstrip antenna performance can be upgraded by using the proposed inverted T shaped patch antenna. The main focus is our work, that we are not changing the feed point area. By our work compactness of microstrip patch antenna can be achieved.

i) H Shape Micro strip Patch Antenna

Now in this section we are designing Partially H Shape Dual Band Micro strip Patch Antenna .A single feed compact micro strip antenna for dual -band is presented in this paper. For the proposed antenna two resonant frequencies are obtained at 1.87GHz and 2.3 GHz respectively. The design and simulation of the proposed antenna is carried out using IE3D software. An extensive analysis of the return loss, Radiation pattern, gain, VSWR of the proposed antenna is presented. The simple configuration of the proposed antenna makes it suitable for the applications in various communication systems. The return losses of this dual band antenna are -26dB at 1.95GHz, and -20dB at 3GHz. The proposed antenna offers 10.63% bandwidth at 1.87-2.08GHz and 26.41% bandwidth at 2.3- 3 GHz.



Proposed 16 : Figure Antenna

Figure 17 : Hardware of Proposed MSA

All the dimensions are calculated as per given formulas in section 2.4.1. The calculated dimensions are given below in table.

Table 5 : Design Parameters of Proposed Antenna

Antenna Parameters	Dimension in mm
h	1.6
W_g	40.6
L_g	33.57
W_p	23.8
L_p	23.97
K_1& K_2	8.445
L_1	3
W_1	3
l_1	4.8

i. *Simulating and Testing Results of H Shape Micro strip Patch Antenna*

A prototype of the antenna has been tested by IE3D simulator, with the above given geometrical dimensions of the patch. The simulation returns loss of this antenna is presented in figure for two different distances.

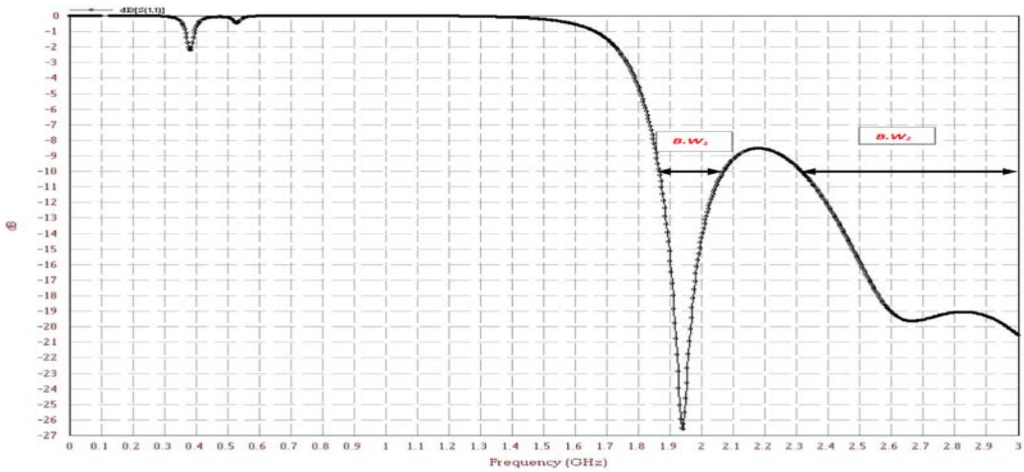


Figure 18 : Simulated Return Loss and Bandwidth of the Dual Band H shape Rectangular patch antenna

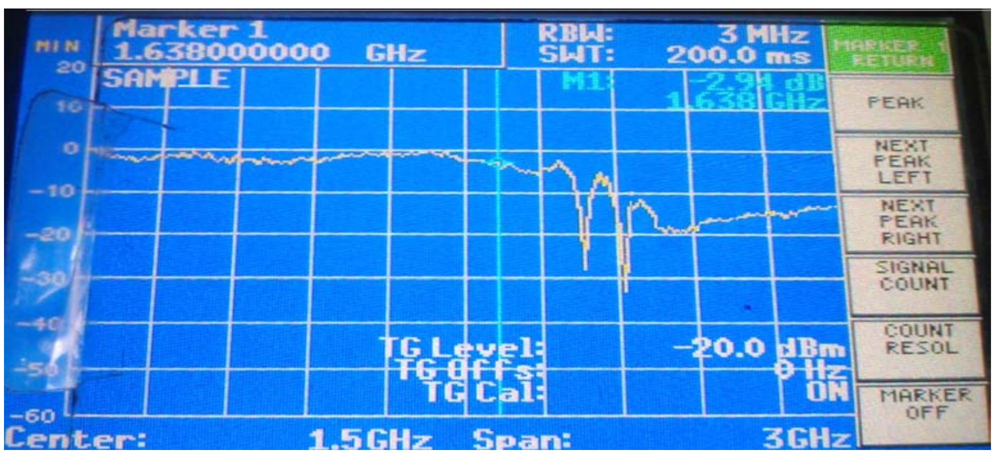


Figure 19 : Testing Results of Proposed MSA

Return loss is a measure of the reflected energy from a transmitted signal which is commonly expressed in positive dB. The larger the value the lesser is the energy that is reflected. From the figure we can see that dual band width is obtained. The first Band at frequency between 1.87GHz -2.08GHz, and the maximum return loss at here is –26db. From this band we can find out the 10.63% bandwidth by using fallowing equation.

The second band of this microstrip antenna, we are obtain at frequency range 2.3GHz- 3.0GHz and maximum return loss is here -20db and the bandwidth is 26.41%.The return loss should be -10db is satisfactory for this patch to provide better results.

But when we actually test this patch then we obtain some changes in results. The return loss of first band is obtained same as simulation but return loss of second band is goes to -32db.s

III. Conclusion

We have designed various novel wideband microstrip patch antennas. The characteristics of proposed antennas have been investigated through different parametric studies using IE3D simulation software. The proposed antennas have achieved good impedance matching, stable radiation patterns, and high gain. The work in this paper primarily focuses on the study of various results on the same patch which give the useful results, and the bandwidth can be used in various applications.

IV. Suggestions for Future Works

The proposed patch is simulated at 3GHz frequency and we seen that at all the feed points the return loss is below -10bd. At all the feed point we have obtain the bandwidth. This patch is simulated only on 3GHz, but if simulation is done at higher frequency then it may be possible theata wide bandwidth obtain and if this is possible then we can use the proposed antenna at any feed point. From this work we can prove that a single patch antenna can be used at much application.

From second patch it may be possible that feed point location is not changed but results can be improved when we goes toward higher frequency. In future if we design a patch at low frequency and bandwidth is satisfactory for applications then we can also attained satisfactory results at higher frequency at same feed point location .but due to limitations of testing in here we are only simulated results obtained from IE3D.

From last H shape patch we attained a dual bandwidth, we have seen that second band of result is goes below -10db at frequency 2.3GHz to 3 GHz. And this bandwidth can be improved if we simulate same H patch at higher frequency above to 3GHz. The bandwidth of this band can be improve in future, but due to limitations in testing for patch above 3GHz we are goes on above 3GHz.

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Improvement of Power System Stability by using SVC with Cascade PID Controller

By Pranoy Kumar Singha Roy, G.K.M. Hasanuzzaman & Md. Moniruzzaman
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Abstract- In power system, one most crucial problem is maintaining system stability. The main reasons for occurring stability problem in the system is due to the fault occurs in the system. In this paper the effect of SVC on voltage stability is investigates using cascade Proportional Integral Differential controller.SVC is a shunt type FACTS device which is used in power system primarily for the purpose of voltage and reactive power control. The cascade PID controller parameters has been selected by using Tyreus-Luyben settings method for primary loop controller and modified Ziegler-Nichols method for secondary loop controller. Cascade control is mainly used to achieve fast rejection of disturbance before it propagates to the other parts of the plant.PID controller in cascade architecture is the best choice compared to conventional single loop control system for controlling nonlinear processs. The primary controller is used to calculate the setpoint for the secondrary controller. The effect of fault on line with SVC and SVC with supplementary controller is also investigates.

Keywords: SVC, voltage regulator, cascade propotional integral differential controller, matlab simulink.

GJRE-F Classification : FOR Code: 090607

IMPROVEMENTOFPOWERSYSTEMSTABILITYBYUSINGSVCWITHCASCADEPIDCONTROLLER

Strictly as per the compliance and regulations of :

Improvement of Power System Stability by using SVC with Cascade PID Controller

Pranoy Kumar Singha Roy [α], G.K.M. Hasanuzzaman [σ] & Md. Moniruzzaman [ρ]

Abstract- In power system, one most crucial problem is maintaining system stability. The main reasons for occurring stability problem in the system is due to the fault occurs in the system. In this paper the effect of SVC on voltage stability is investigates using cascade Proportional Integral Differential controller.SVC is a shunt type FACTS device which is used in power system primarily for the purpose of voltage and reactive power control. The cascade PID controller parameters has been selected by using Tyreus-Luyben settings method for primary loop controller and modified Ziegler-Nichols method for secondary loop controller. Cascade control is mainly used to achieve fast rejection of disturbance before it propagates to the other parts of the plant.PID controller in cascade architecture is the best choice compared to conventional single loop control system for controlling nonlinear processs. The primary controller is used to calculate the setpoint for the secondray controller. The effect of fault on line with SVC and SVC with supplementary controller is also investigates. In this paper, A power system network is considered which is simulated in the phasor simulation method & the network is simulated in three steps; without SVC , With SVC but no externally controlled, SVC with cascade PID. The result of the Simulation shows that SVC with cascade PID controllers are more effective to enhance the voltage stability and increases power transmission capacity of a power system .The power system oscillations is also reduced with controllers in compared to that of without controllers. So with cascade PID controllers the system performance is greatly enhanced.

Keywords: SVC, voltage regulator, cascade propotional integral differential controller, matlab simulink.

I. Introduction

The challenge facing power system engineers today is to use the existing transmission facilities to greater effect[1]. Power system should retain its synchronism during and after all these kind of disturbances. Therefore the transient stability is an important security in power system design. So FACTS has come to help the power system engineer [2-3]. The SVC is one of the important FACTS devices whose effectiveness for voltage control is well known. The AC power transmission system has diverse limits, classified as static limits and dynamic limits[4-5].Traditionally, fixed or mechanically switched shunt and series capacitors, reactors and synchronous generators were being used to enhance same types of stability augmentation[6]. For many reasons desired perfor-mance was being unable to achieve effectively. A static VAR compensator (SVC) is an electrical device for providing fast-acting reactive power compensation on high voltage transmission networks and it can contribute to improve the voltage profiles in the transient state and therefore, it can improve the qualities and performances of the electric services[6]. An SVC can be controlled externally by using properly designed different types of controllers which can improve voltage stability of a large scale power system[7]. However, in this study, With a view to get better performance, A new PID has been designed & proposed for SVC to injects V_{qref} externally for the improvement of power system stability. The dynamic nature of the SVC lies in the use of thyristor devices (e.g. GTO, IGCT)[6]. Therefore, thyristor based SVC with PID controllers has been used to improve the performance of 2-machine power system.

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II. Control Concept of SVC

An SVC is a controlled shunt susceptance(B) which inject reactive power (Q_{net}) into thereby increasing the bus voltage back to its net desired voltage level. If bus voltage increases, the SVC will inject less (or TCR will absorb more) reactive power, and the result will be to achieve the desired bus voltage[Fig.1]. Here, $+Q_{cap}$ is a fixed capacitance value, therefore the magnitude of reactive power injected into the system, Q_{net}, is controlled by the magnitude of $-Q_{ind}$ reactive power absorbed by the TCR. The basis of the thyristor controlled reactor (TCR) which conduct on alternate half-cycles of the supply frequency. If the thyristors are gated into conduction precisely at the peaks of the supply voltage, full conduction results in the reactor, and the current is the same as though the thyristor controller were short circuited. SVC based control system is shown in Fig.1[6]

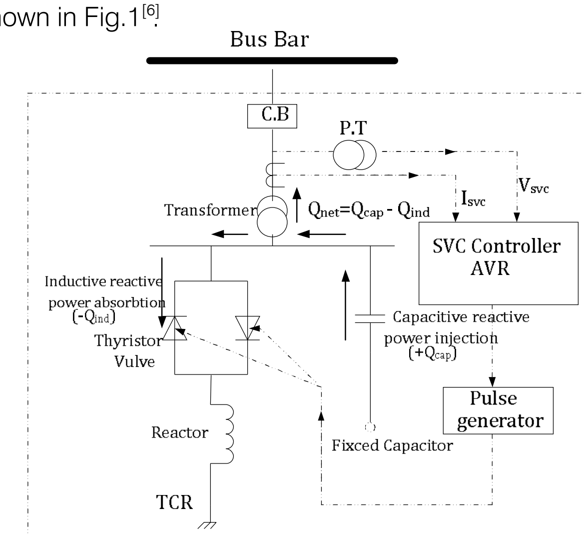

Figure 1 : SVC based control system

III. SVC V-I Characteristics

a) The SVC can be operated in two different modes

In voltage regulation mode (the voltage is regulated within limits as explained below). b). In VAR control mode (the SVC susceptance is kept constant).

From V-I curve of SVC, From Fig.2[3].

$V=V_{ref}+X_s.I$,: In regulation range($-Bc_{max}<B<Bc_{max}$)
$V=I/Bc_{max}$, , : SVC is fully Capacitive($B=Bc_{max}$)
$V=1/BI_{max}$, : SVC is fully inductive($B=BI_{max}$)

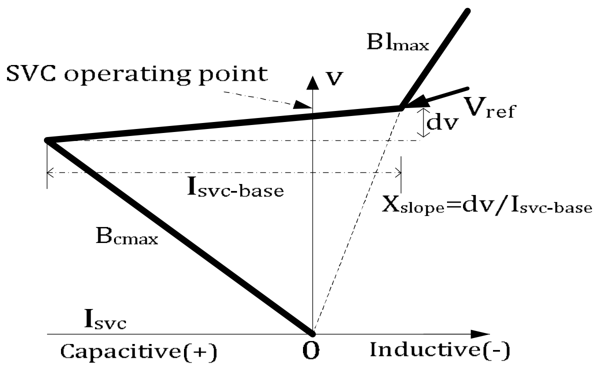

Figure 2 : Steady state(V-I) characteristic of a SVC

IV. Power System Model

This example described in this section illustrates modelling of a simple transmission system containing 2- hydraulic power plants[Fig.3]. SVC has been used to improve transient stability and power system oscillations damping. The phasor simulation method can be used. A single line diagram represents a simple 500 kV transmission system is shown in Fig.3[9].

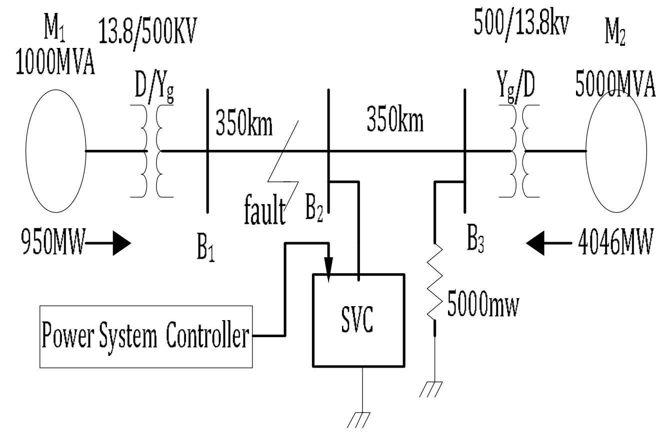

Figure 3 : Single line diagram of 2-machine power system

A 1000 MW hydraulic generation plant (M1) is connected to a load centre through a long 500 kV, total 700km transmission line. A 5000 MW of resistive load is modelled as the load centre. The remote 1000 MVA plant and a local generation of 5000 MVA (plant M2) feed the load. A load flow has been performed on this system with plant M1 generating 950 MW so that plant M2 produces4046 MW. The line carries 944 MW which isclose to its surge impedance loading (SIL = 977 MW).To maintain system stability after faults, the Transmissi online is shunt compensated at its centre by a 200MVAR Static VAR Compensator (SVC).

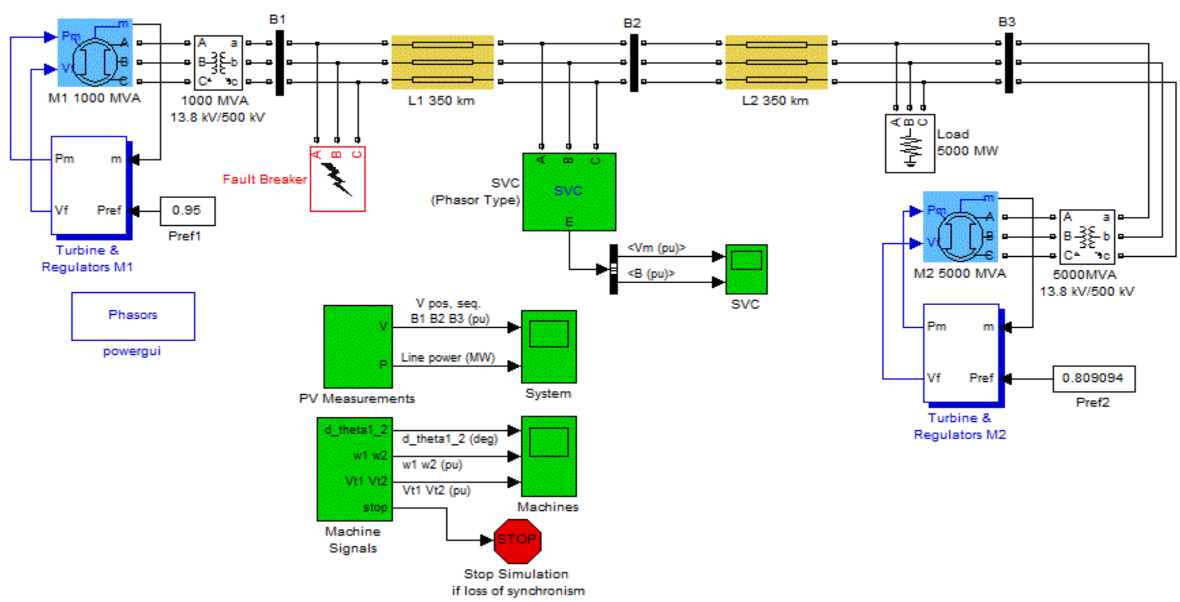

Figure 4 : Complete simulink model of 2-machine power system

The SVC does not have any controller unit. Machine & SVC parameters has been taken from reference[9].The complete simulink model of SVC with PID controller is shown in Fig.4. To maintain system stability after faults, the transmissionline is shunt compensated at its centre by a 200MVAR Static VAR Compensator (SVC) with PID controller. The two machines are equipped with a hydraulic turbine and governor (HTG), excitation system, and PID controller. Another machine is swing generator.PID is used in the model to add damping to the rotor oscillations of the synchronous machine by controlling its excitation current[5]. Any disturbances that occur in power systems due to fault, can result in inducing electromechanical oscillations of the electrical generators. Such oscillating swings must be effectively damped to maintain the system stability and reduce the risk of stepping out of synchronism.

V. Simulation Results

The load flow solution of the above system is calculated and the simulation results are shown below. Two types of faults: A. single line to ground fault & B. Three phase fault have been considered.

a) Single line to ground fault

Consider a 1-phase fault occurred at 0.1s & circuit breaker is opened at 0.2s (4-cycle fault), Without SVC, the system voltage, power & machines oscillates goes on unstable[Fig.(5,7,9)]. But if SVC(without controller) is applied then voltage becomes stable within 3s [Fig.6], power becomes within 3s[Fig.8] & machines oscillation becomes stable within 4.5s [Fig.10]. All results has been summarized in table-III

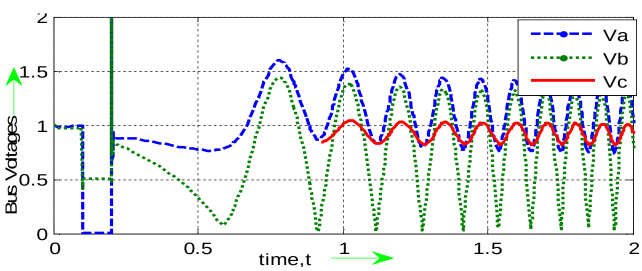

Figure 5 : Bus voltages in p.u for 1-phase fault(without SVC)

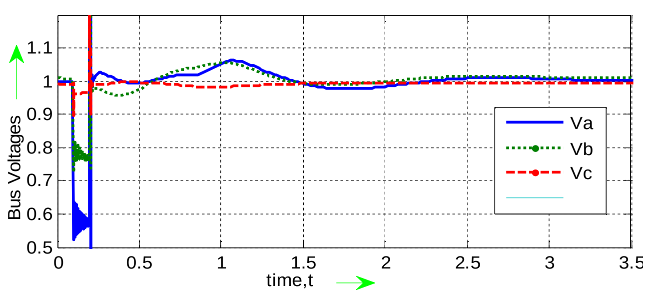

Figure 6 : Bus Voltages in p.u for 1-phase fault (with SVC)

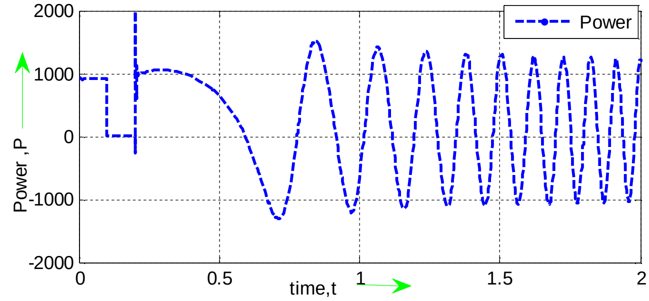

Figure 7 : Bus power, P in MW during fault (Without SVC)

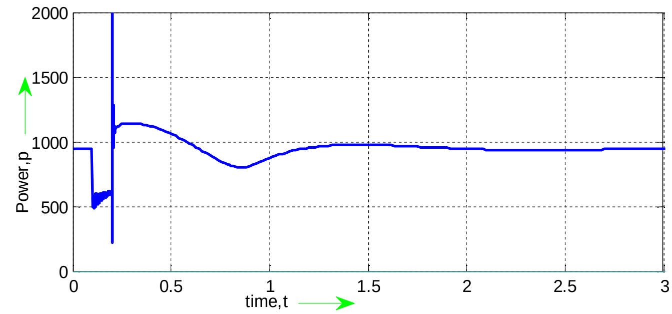

Figure 8 : Bus Power(P)in MW for 1-Ø faults(with SVC)

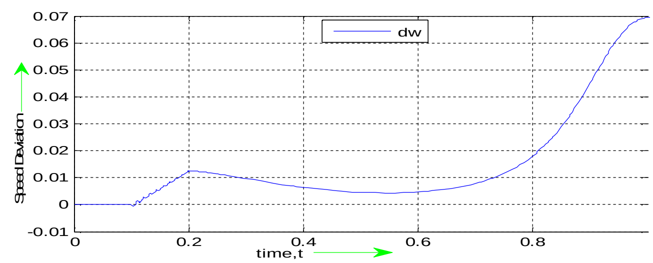

Figure 9 : Speed deviation for 1- phase fault(without SVC)

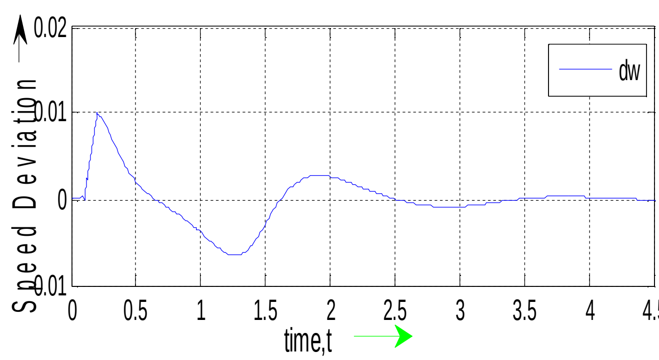

Figure 10 : Speed oscillations for 1- phase fault(with SVC)

b) Three phase fault

During 3-phase faults, If no SVC is applied then system voltage & machines speed deviations becomes unstable But when SVC(without controller) is applied then the system voltage becomes stable within 5s [Fig.11] & machines speed deviation becomes stable within 5s [Fig.12].

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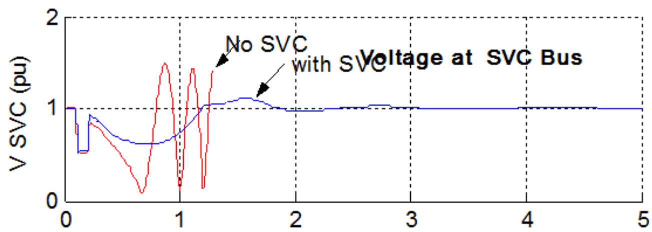

Figure 11 : Bus Voltage(Va) in p.u for L-L phase fault

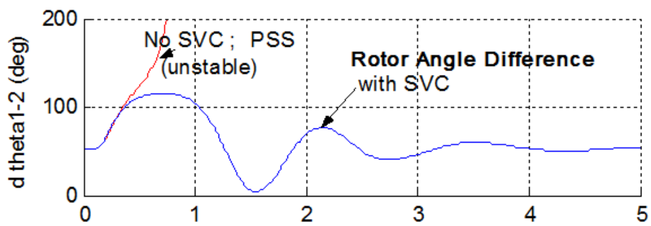

Figure 12 : Machines speed deviation for L-L fault

VI. Designe of Cascade Propotional Integral Differtional Controller (PID)

The Tyreus- Luyben procedure is quite similar to the Ziegler-Nichols method but the final controller settings are different. Tyreus-Luyben PID Controller, the values of delay time, rise time, and settling time are better in comparison with Modified Ziegler-Nichols method. Also this method only proposes settings for PI and PID controllers. These settings that are based on ultimate gain and period are given in table 1.

Table 1 : Tyreus-Luyben settings

Controller	Kp	Ti	Td
PI	Kcr/3.2	2.2Pcr	
PID	Kcr/3.2	2.2Pcr	Pcr/6.3

For some control loops the measure of oscillation, provide by ¼ decay ratio and the corresponding large overshoots for set point changes are undesirable therefore more conservative methods are often preferable such as modified Z-N settings

Table 2 : Modified Ziegler-Nichols settings

Controller	Kp	Ti	Td
PI	0.2Kcr	Pcr/2	
PID	0.2Kcr	Pcr/2	Pcr/3

a) Designed of PID Controller

PID controller is tuned by the proposed both Tyreus-Luyben tuning and modified Ziegler- Nichols methods. The PID controller has three term control signal

$$u(t) = K_p e(t) + \frac{K_p}{T_i}\int e(t)dt + K_p T_d \frac{de(t)}{dt}$$

$$\frac{U(s)}{E(s)} = K_p\left(1 + \frac{1}{T_i S} + T_d S\right)$$

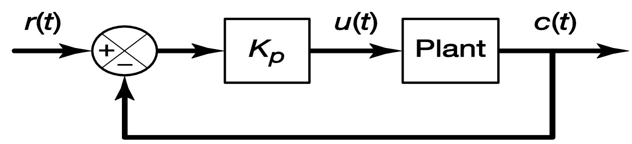

Figure 13 : PID controller is in proportional action

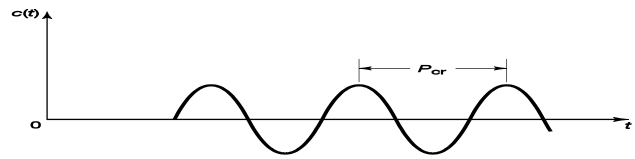

Figure 14 : Determination of sustained oscillation (P_{cr})

For selecting the proper controller parameters, Tyreus-Luyben Tuning Method is described below. In this method, the parameter is selected as $T_i=\infty, T_d=0$. Using the proportional controller action[Fig.14]only increase K_p from 0 to a critical value K_{cr}. At which the output first exhibits sustained oscillations [Fig.14]. Thus the critical gain K_{cr} & the corresponding period P_{cr} are experimentally determined.It is suggested that the values of the parameters K_p T_i T_d should set according to the following formula

$$K_p=0.3125K_{cr}\ ,\ T_i=2.2P_{cr}\ ,\ T_d=0.159P_{cr}$$

Notice that the PID controller tuned by proposed Tyreus-Luyben tuning methods rules as follows

$$Gc(s)=Kp\left(1+\frac{1}{T_i S}+T_d S\right)$$

$$Gc(s)=0.3125Kcr\left(1+\frac{1}{2.2PcrS}+0.159PcrS\right)$$

It's found that, P_{cr}=0.2s & K_{cr}=200[Fig.5]. So,

$$Gc(s)=\frac{1.98}{S} * (S^2 + 31.5S + 71.6)$$

For selecting the proper controller parameters, Modified Ziegler-Nichols Tuning Method is described below.

In this method, the parameter is selected as $T_i=\infty, T_d=0$. Using the proportional controller Action Fig.14]only increase K_p from 0 to a critical value K_{cr}. At which the output first exhibits sustained oscillations[Fig.14]. Thus the critical gain K_{cr} & the corresponding period P_{cr} are experimentally determined. It is suggested that the values of the parameters K_p T_i T_d should set according to the following formula .

$$K_p=0.2K_{cr}\ ,\ T_i=0.5P_{cr}\ ,\ T_d=0.33P_{cr}$$

Notice that the PID controller tuned by proposed Ziegler-Nichols tuning methods rules as follows,

$$Gc(s)=Kp(1+\frac{1}{T_i S}+T_d S)$$

$$Gc(s)=0.2Kcr(1+\frac{1}{0.5PcrS}+0.33PcrS)$$

It's found that, P_{cr}=0.2s & K_{cr}=200[Fig.5]. So,

$$Gc(s)=\frac{2.67}{S}*(S^2+15S+150)$$

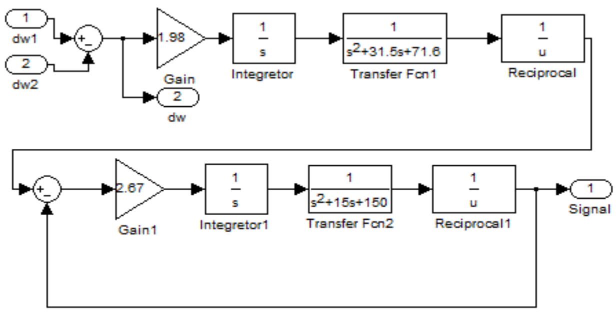

Figure 15 : Internal Structure of cascade PID controller with d ω input

VII. Simulation Results

The network remains same [Fig.4],just simple SVC is replaced by cascade PID controlled SVC. During fault ,machines speed deviation(d ω) always monitored by cascade PID controller & taking input of this oscillation, after processing this signal reaches as Vref in SVC . it reduces damping of power system oscillation& helps SVC to improve stability. Two types of faults has been considered:

A. Single line to ground fault and B. Three phase L-L fault

a) Single line to ground fault

During 1-phase faults, if cascade PID is used with SVC controller then, the system voltage becomes stable within 1.5s with 0% damping [Fig.16] &Power (P,Q) becomes stable within 1.2s& 1s [Fig.17,18] & Machine speed deviationt d ω becomes stable at 2.8s[Fig.19].

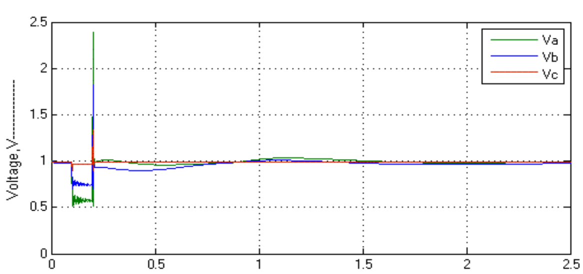

Figure 16 : Bus voltage in p.u for 1-Ø fault (with cascade PID)

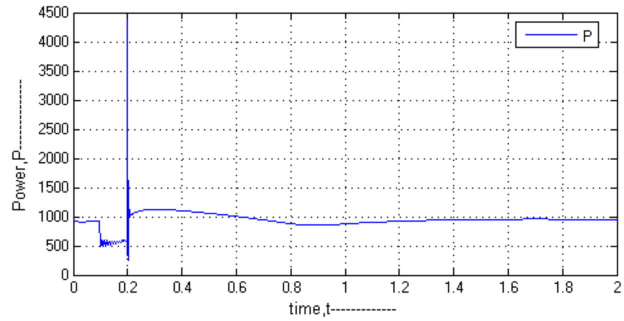

Figure 17 : Bus power,P in MW for 1-Ø fault (with cascade PID)

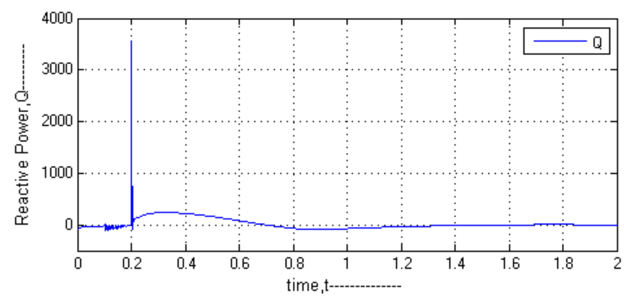

Figure 18 : Bus Power,Q for 1-Ø fault in MW(with cascade PID)

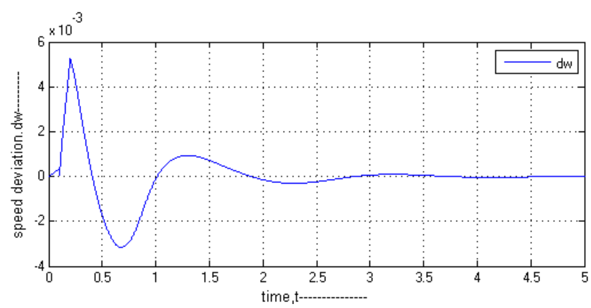

Figure 19 : Machines speed deviation for 1-Ø fault(with cascade PID)

b) Three phase fault

During 3-phase faults, If cascade PID is used with SVC controller then, the system voltage becomes stable within 2.5s [Fig.20] & Both power (P,Q) becomes stable within 1.8s [Fig.21,22].Machine speed deviation d ω becomes stable at 3.3s[Fig.23].

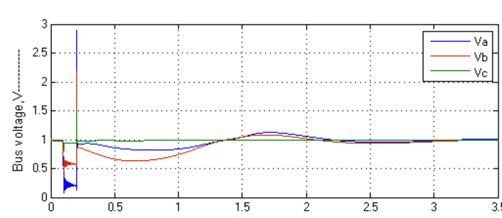

Figure 20 : Bus voltages in p.u for L-L fault (with cascade PID)

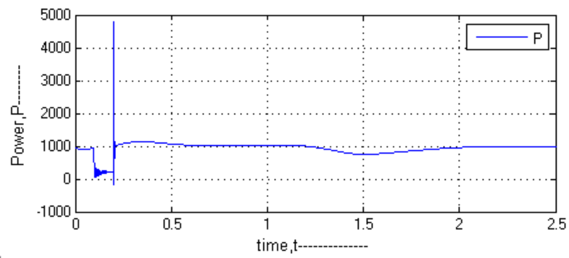

Figure 21 : Bus power, P in MW for L-L fault (with cascade PID)

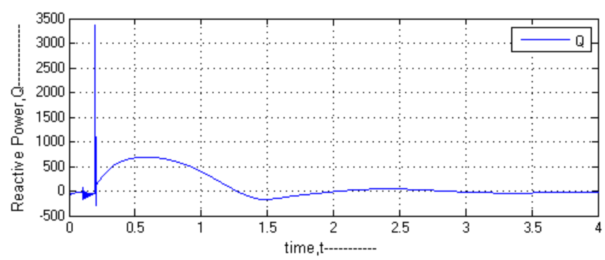

Figure 22 : Bus power, Q in MVAR for L-L fault (with cascade PID)

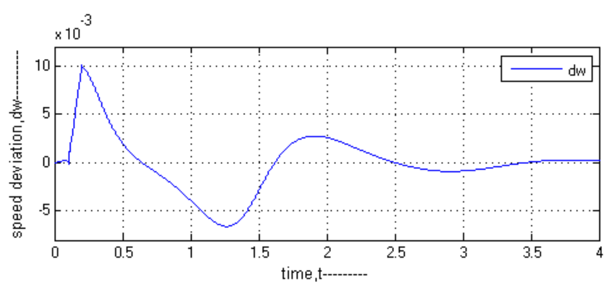

Figure 23 : Machines speed deviation for L-L fault(with cascade PID)

VIII. Results & Discussions

The performance of the proposed PID Controller with SVC has been summarized in the table III. In table-III, α (infinite time) means the system is unstable, SVC rating in MVA. The network is simulated in three steps; without SVC, With SVC, SVC with proposed CASCADE PID Controller.

Table 3 : Performance of proposed cascade PID

		1-Øfault (Stability time)			L-L fault (Stability time)		
Controller	SVC Rating	Volt	P,Q	dω	Volt	P, Q	dω
No SVC	200 MVA	α	α	α	α	α	α
SVC	200 MVA	3s	3s	4.5s	5s	5s	5s
SVC +Cascade PID	20 MVA	1.5s	1.2s ,1s	2.8s	2.5 s	1.8 s	3.3 s

IX. Conclusion

The obtained results of the conducted investigations along with the associated simulation demonstrated clearly that the proposed (desinged) cascade PID controller enhanced significantly the effectiveness of the integrated SVC in the examined power controller because of shorter stability time, simple designed system. In cascade PID Controller may be highly suitable as a SVC, low cost & highly efficient controller. The proposed cascade PID for SVC is proved to be very effective of robust power system within very shortest possible time for both steady state & dynamic conditions. These proposed cascade PID Controller can be applied for any interconnected multi-machine power system network for stability improvement.

These controller can be applied to another FACTS devices namely SSSC, STATCOM, UPFC whose controllers may be controlled externally by designing different types of controllers which also may be tuned by using different algorithm i.e. Fazzy logic,ANN, Genetic algorithm, FSO etc. for both transient and steady state stability improvement of a power system.

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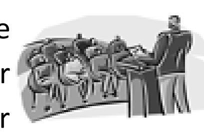

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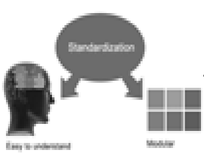

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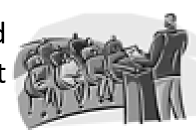

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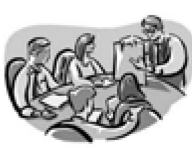

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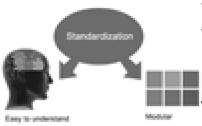

After nomination of your institution as "Institutional Fellow" and constantly functioning successfully for one year, we can consider giving recognition to your institute to function as Regional/Zonal office on our behalf.
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Note :

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4. Manuscript’s Category,

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Informal Guidelines of Research Paper Writing

Key points to remember:

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

Final Points:

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

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

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

General style:

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

To make a paper clear

· Adhere to recommended page limits

Mistakes to evade

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

In every sections of your document

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

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

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

· Align the primary line of each section

· Present your points in sound order

· Use present tense to report well accepted

· Use past tense to describe specific results

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

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

Title Page:

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

Abstract:

The summary should be two hundred words or less. It should briefly and clearly explain the key findings reported in the manuscript--must have precise statistics. It should not have abnormal acronyms or abbreviations. It should be logical in itself. Shun citing references at this point.

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

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

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

Approach:

- Single section, and succinct
- As a outline of job done, it is always written in past tense
- A conceptual should situate on its own, and not submit to any other part of the paper such as a form or table
- Center on shortening results - bound background information to a verdict or two, if completely necessary
- What you account in an conceptual must be regular with what you reported in the manuscript
- Exact spelling, clearness of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else

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.
- 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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Please carefully note down following rules and regulation before submitting your Research Paper to Global Journals Inc. (US):

Segment Draft and Final Research Paper: You have to strictly follow the template of research paper. If it is not done your paper may get rejected.

- The **major constraint** is that you must independently make all content, tables, graphs, and facts that are offered in the paper. You must write each part of the paper wholly on your own. The Peer-reviewers need to identify your own perceptive of the concepts in your own terms. NEVER extract straight from any foundation, and never rephrase someone else's analysis.
- Do not give permission to anyone else to "PROOFREAD" your manuscript.
- Methods to avoid Plagiarism is applied by us on every paper, if found guilty, you will be blacklisted by all of our collaborated research groups, your institution will be informed for this and strict legal actions will be taken immediately.)
- To guard yourself and others from possible illegal use please do not permit anyone right to use to your paper and files.

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Topics	Grades		
	A-B	**C-D**	**E-F**
Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

Index

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