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# Journal of Electronic and Optical Communication

## Aims and Scope

Journal of Electronic and Optical Communication is a journal that publishes original research papers in the fields of Electrical and Electronic Engineering and in related disciplines. Areas included (but not limited to) are electronics and communications engineering, electric energy, automation, control and instrumentation, computer and Advanced technology, and the electrical engineering aspects of building services and aerospace engineering, Journal publishes research articles and reviews within the whole field of electrical and electronic engineering, new teaching methods, curriculum design, assessment, validation and the impact of new technologies and it will continue to provide information on the latest trends and developments in this ever expanding subject.

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# Energy Consumption Based Evaluation Of AODV By Detecting Sleep Deprivation Attackover Manet

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## ABSTRACT

*A Mobile Ad hoc network (MANET) is configured by different mobile nodes. Its drawback is that it lacks in fix infrastructure like Wi-Fi devices or base stations. In MANET nodes communicate with each other without taking any help from centralized authority. The characteristics of MANET such as wireless medium, dynamic topology, etc. Various types of attacks are available on MANET but Sleep Deprivation Attack is also one of them. Our objective of this is to design a system that removes sleep deprivation attack based on danger theory. Energy constrained networks place the nodes into sleeping node in ordered to increase the network lifetime. Due to Sleep Deprivation Attack there is a big threat to lifetime of sensor network because it prevents the node from going into sleep node. To do this we designed algorithm classify and analyse the selfish node. After this we have to update or delete selfish node to increase the throughput.*

***Keywords***—*Sensor network, Denial, Sleep Deprivation Attack.*

## 1. Introduction

MANET stands for "Mobile Ad-hoc Network" that can be configured by itself and can also change its location itsself also use wireless networks to connect with each other, they use medium such as cellular or satellite transmission. Ad-hoc on demand distance vector is a routing protocol for ad-hoc networks for large numbers of mobile nodes. Routes create in this protocol only when the routes requested by source nodes, giving the permission to the node to enter and leave the networks. In this protocol route will remain active upto the time when packets not reached the destination, at the time when source stop sending the packet it stops the route. It supports both unicast and multicast routing. Sleep Deprivation attack is distributed DOS attack, sleeping node connect with the MANET node as the network node, after this the malicious not start broadcasting the packet to the another nodes that it consumes energy and decrease the throughput. The malicious node in wireless network dramatically decrease the performance of the mobile nodes during their data transmission, if the malicious node increases in the networks it start consumption of energy to large extend due to the same network performance degrade with increase in the malicious node. In manet the data transmit between host and destination node

according to the theory of the protocols design , these protocols are capable to find the path and route to send the packet to the destinations. Sometimes there may be the failure in the link between the communications nodes, due to the same reason the nodes choose another link to send the data , due to same there may the loss of energy occur. Above given figure no. 1 shows that communication between the nodes, are executed by using the gateway [1].


**Different Kinds Of Attacks On WSN**

The different kinds of attacks on sensor networks are [4]:

**"Black Hole Attack"** back drop packet in which router suppose to the packet during transmission instead of discarding the packet when denial of service attack occur. In this attack the router become a malicious router due to same behaviour its start dropping the packets to large extent, to overcome this problem we have to replace the malicious router with new one.

**"Grey Whole Attack"**In the AODV protocol every mobile node creates its own routing table in which it stores the path of the destination node, if the path exist in the routing table it send the packet through this path, if the path not exist then every mobile node send the RREQ REQUEST to all the neighbour nodes, if all the mobiles node does not have any path then every mobile node send s the RREQ request to their neighbour node, if this happen the intermediate node increment the routing table for reverse route to the sorce node. Then by doing this the AODV protocols intercepts the route to send the packet to destination and also it loss the packet through this interception route , so it is very difficult to identify the Grey hole attack.

**"Warm Hole Attack"**In wormhole attack, a malicious node takes packets from one location and place at another location. And create a tunnel between these two locations this tunnel is known as wormhole. It could be established between two clouding attacker through wireless and wired network. The attacker may create a tunnel even for packets node address to itself due to its broadcast nature. If proper mechanism are not used to protect wormhole attack then wireless and adhoc network are not able to find their routes.

**"Routing Table Attack"**In routing table attack every node has its own routing table, the same helps to draw network topology for each node. When selfish node attack on this table then attacks nodes are not able to find any route. The reason for this attack by fabricating new control message and called fabricating attack.

**"DoS Attack"** The DoS attack is to flood packets to finish the services provided by intermediate nodes. Due to same network no longer available those attack can be launched against any layer of the network protocol stacks.

**"Sleep Deprivation Attack":** Sleep deprivation Attack introduced by starjno. This attack is victim of battery powered computing device such as node which try to remain in a sleep mode. The attacker deploys this attack by interacting with a node to keep in out of power by conserving sleep mode, and used to reduce the lifetime of the victim. Further this attack difficult to detect.

**"SYN Flooding":** In this attack, a misbehaving node sends SYN packets in large amount to a victim node due to the same spoofing the return addresses of the SYN packets occur.

**Distributed DoS:** Distributed DoS attack try to prevent legitimate users from accessing the services offered by the network.

**Energy Consumptions In WSN**

Sleep Deprivation attack is distributed DOS attack, sleeping node connect with the MANET node as the network node., but its purpose is to consume the energy by going into sleeping mode. in a sleep deprivation attack, an malicious node send an huge amount of packets to another nodes to consume computation and memory resources

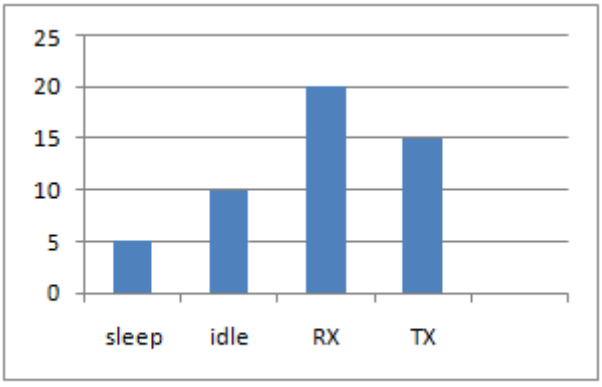



Fig.2 Energy Consumption

Fig. 2 the above figure shows that the energy consume is less when in the manet in AODV protocols not sending any packet to the destination it indicates it's better to keep node in sleeping node when the source not send any packet to the destination. But when the source is sending packets to the destination at that time if the node is sleeping then it consumes more energy.

**The Application Of Sleep Deprivation Attack Over AODV Routing Protocol**

AODV is used as a large scale routing protocol. AODV may be affected by different attacks. This section is explaining Sleep Deprivation Attacks over MANET.As shown in figure 1 the source node sends the request (RREQ) with the help of MANET node and set the timer to wait for the reply. Every intermediate node checks the RREQ packets that are a fresh route to the destination. If yes then it sends the RREP packet to source node else the RREQ packet waits until it reach the destination. As shown in figure 2.

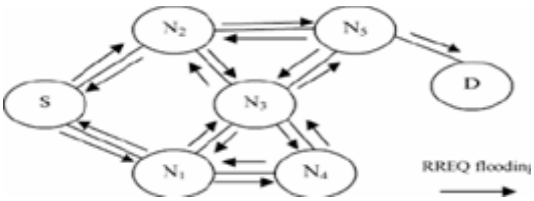



**Figure 1: Propagation of RREQ packet**

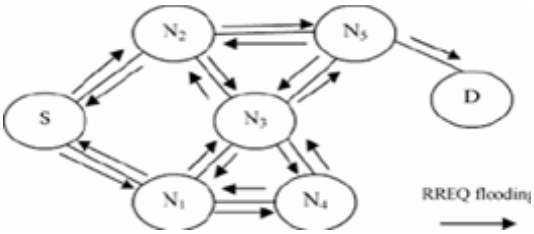



**Figure 2: Path RREP packet**

The figure 3 shows how Sleep Deprivation Attack disturbs the route discovery process in AODV. By broadcasting RREQ packet it consume resources of energy, bandwidth and memory. The figure 4 shows how attacker keeps on sending RREQ packets when MANET links already had been congested with malicious node. That interrupts the services of the network.

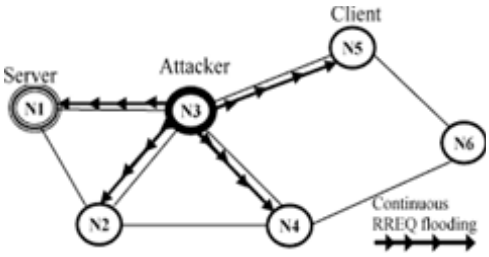



**Figure3: RREQ broadcasted by sleep deprivation attacker**

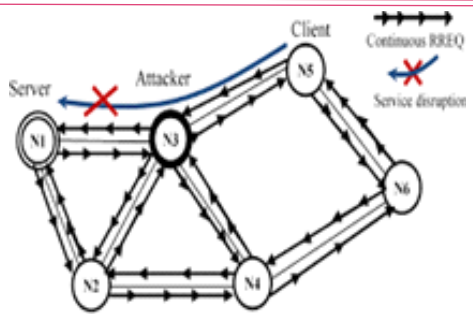



**Figure4: RREQ packets flooding by sleep deprivation attacker**

**Danger Theory Based Aiss**

This paper tells about the danger theory algorithm the danger theory algorithm tells that how to behave with the nodes when they are become the selfish nodes,Sleep Deprivation attack is distributed DOS attack, sleeping node connect with the MANET node as the network node., but its purpose is to consume the energy by going into sleeping mode.in a sleep deprivation attack, an malicious node send an huge amount of packets to another nodes to consume computation and memory resources. To overcome this problem in our danger theory algorithm we have to update the node which is sleeping node try to convert the specification of the node into the active nodes, if we are not able to get the node into the active node we have to change the route of the path in the end if everything fails we have to delete the node, when we deleteted the selfish node then the new path will be created to send the packet to the destination by using this the energy consumption will be less and it also decrease the packet delivery ratio and increase the through put.[10].

**Detection Of Selfish Node**

The credit risk [13] can be de-scribed by the following equation expected value of risk, if it is greater less than the expected risk then the node will mark as non selfish node else the node is selfish node, then node waits for replica allocation to be done. And if node is non selfish then for each connected node it replicates the replica of the node its share memory space and shared data item, else it does not replicate the shared data item and the shared memory space. And in algorithm 2, it updates the selfish node during route discovery, if any new node comes in the network then first it will treat as a non selfish node and in route discovery if it serves the query then according to algorithm the shared data item added into the network and also shared memory size added into the network. If new node does not serves the query then increase the expected risk value of the node and remove the shared data item and memory size.

- **Algorithm 1: Detection of malicious node**

During every relocation time
/* $N_j$ used to detect malicious node */
Detect () {
For (every connected node $N_p$)
{

$$nCR_i^k \prec \delta$$
$$N_p$$

IF ( ) $N_p$ marked as non-malicious node
ELSE market this as malicious node ;}
Look for next relocation period;
For ($for\ each\ connect\ node\ N_P$ ) {
IF ($N_j$ has allocate replica to $N_p$ ) {
$ND_i^k$ = replica allocated;
$SS_i^k$= size of the replica;
}

ELSE {
$ND_i^k = 01$;
$SS_i^k$ =Data Item size;
}}}

- **Algorithm 2: UPDATING THE SELFISH NODE**

During query processing time

/* at time when $N_j$ issues a query */
Modify () {
WHILE (at predefined time w) {
IF (special node serves the query)
Reduce $P_i^k$ ;
IF (the special node $N_j$ evaluates the query)
{
In mathematical form it can be written
To detect selfish node at relocation period, node Ni detects maliciousnodes}}
$ND_i^j = +1$;
$SS_i^j = +$ (data item size);
Credit Risk = $\frac{\text{Expected Risk}}{\text{Expected Value}}$

Algo 2 judge the value at query processing time according to algo2.According to 1 first node will check the credit risk value by}}

If (a selected node $N_p$ does not evaluate the query) {

$P_i^k$

$ND_i^k$

$SS_i^k$

Increase;

$ND_i^k = -1;$

$SS_i^k = -$ (Data item size);

$$nCR_i = \frac{P_i}{\alpha * SS_i^k + (1-\alpha) * ND_i^k}$$

**Deletion Algorithm:**

The proposed MDCA pseudo code

**Used to store "Input Packet ID" in Queue**

**WHILE**

Queue packet! =NULL then receive packet ID, Now Checking of"Packet ID" in memory

**IF** (packet ID exists)

Underline the List

**ELSE**

Discard the list and delete the packet detail from the routing table

**Then**

Start sending beep message

**Else If**

Packed ID exist in beeped message list

**Then**

Discard packet

Delete information of route

**Else**

Extract Packet foreign substance and transfer

Packet foreign substance to foreign substance Store

Extract signal and transfer

Signal to Signal Buffer and Call DCA

**IF**

Foreign Substance is begin

**Then**

Receive the packet and start the Danger Theory algorithm

**ELSE**

Discard the packet and delete the routing information

And broadcast the beep message and store the packet ID in beep message list

**End If End If**

**End While**

Simulation scenario that I have used to calculate Residual Energy (E) as given in equation 5.1, Packet Delivery Ratio (PDR) given in equation 5.2 and Average throughput given in equation 5.3 of protocols such as AODV (Before deleting selfish node) and AODV (After deleting selfish node). Node value is varied from 50 to 300 in scenario. Scenario is presented in Table 5.1 below.

| S.No. | Parameter | Value |
|---|---|---|
| 1 | No of Nodes | 50-300 |
| 2 | Traffic Load(kbps) | 5 |
| 3 | Simulation time | 400 seconds |
| 4 | Data Pattern | Node-UDP |
| 5 | Routing Protocols | AODV |
| 6 | MAC type | MAC 802.11 |
| 7 | Simulator | NS-2.35 |
| 8 | Speed | 0.5 m/s to 1.5 m/s |
| 9 | Antenna Type | Omni Directional |

The results of the simulation are as follows in Table 5.2

**Table 5.2: Energy Consumption Result**

| NODES | AODV(Before) | AODV(After) |
|---|---|---|
| 50 | 89.51 | 85.07 |
| 100 | 85.72 | 88.55 |
| 150 | 93.17 | 89.87 |
| 200 | 88.11 | 91.49 |
| 250 | 83.47 | 87.13 |
| 300 | 80.92 | 78.39 |

Figure 5.1Energy Consumption vs. Nodes used for AODV based upon results given in the Table 5.2

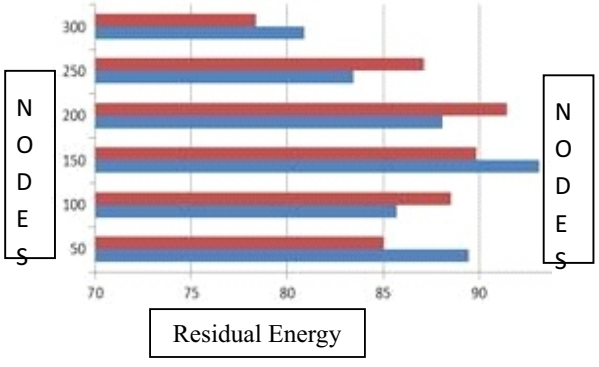



**Figure 5.1: Energy Consumed verus Nodes**

In the above Figure 5.1, Energy Consumed for AODV Protocol before and after detecting selfish node. It is clearly observed from figure that in case of lower number of nodes AODV (After deleting selfish Node) is more energy efficient than AODV(Before deletion of selfish node) and consumes less energy at 300 number of node value.

### 5.3.2 Packet Delivery Ratio vs. Number of Nodes

**Table 5.3: The Result for PDR (Packet Delivery Ratio)**

| NODES | AODV(AFTER) | AODV(BEFORE) |
|---|---|---|
| 50 | 162.33 | 158.1 |
| 100 | 112.67 | 108.31 |
| 150 | 93.17 | 90.37 |
| 200 | 80.66 | 74.84 |
| 250 | 69.43 | 64.38 |
| 300 | 63.32 | 54.43 |

| NODES | AODV(BEFORE) | AODV(AFTER) |
|---|---|---|
| 50 | 0.9954 | 0.9695 |
| 100 | 0.984 | 0.9448 |
| 150 | 0.9834 | 0.9582 |
| 200 | 0.9631 | 0.9073 |
| 250 | 0.9343 | 0.8688 |
| 300 | 0.9123 | 0.7951 |

Figure 5.2showsthe graph for Packet Delivery Ratio for AODV before deletion of selfish nodes and AODV after deletion of selfish node, based on the simulation results given in Table 5.3.

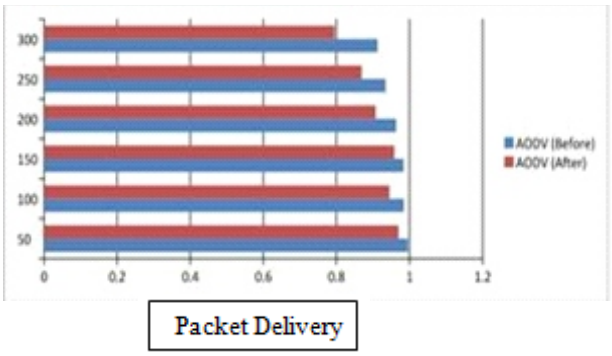



**Figure 5.2: Packet Delivery Ratio versus Number of Nodes**

It is clearly observed that PDR value of AODV (after deletion of selfish node) is similar for lower number of nodes. But AODV (after deletion of selfish node) performs well for higher number of nodes.

### 5.3.3 Average Throughput vs. Number of Nodes

Results are given below in Table 5.4

**Table 5.4: Results for Throughput**

In Table 5.4 we have observed that with increase in number of nodes the value of Average Throughput decreases because of higher congestion and higher computation requirements.

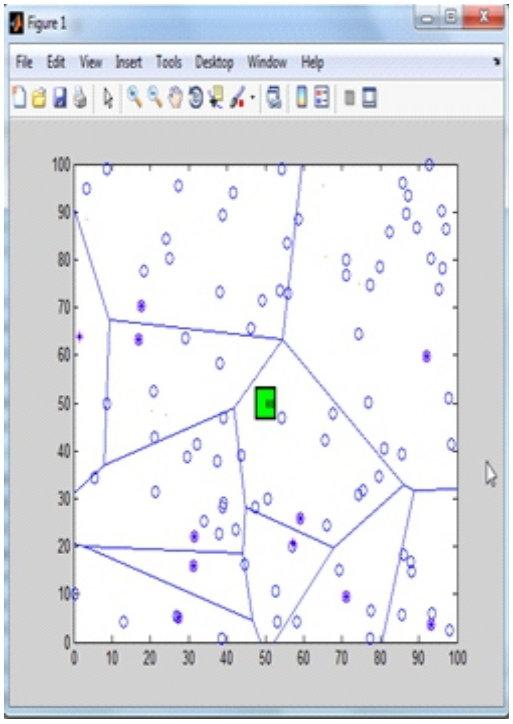
**Result & Discussion**

This section examines the performance of the proposed algorithm. It also provides a performance comparison between proposed algorithms with the existing one.

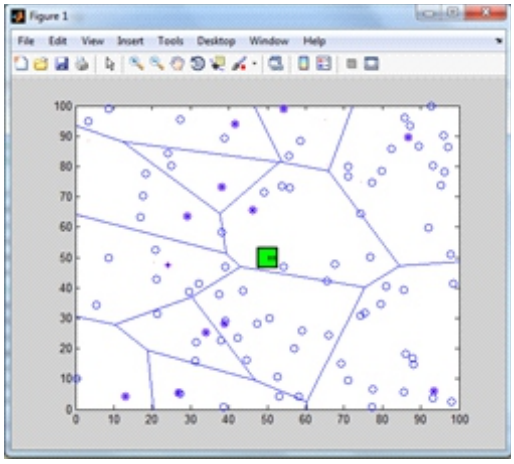
A. Experimental Setup

B. The experimental setup is done to detect the attack

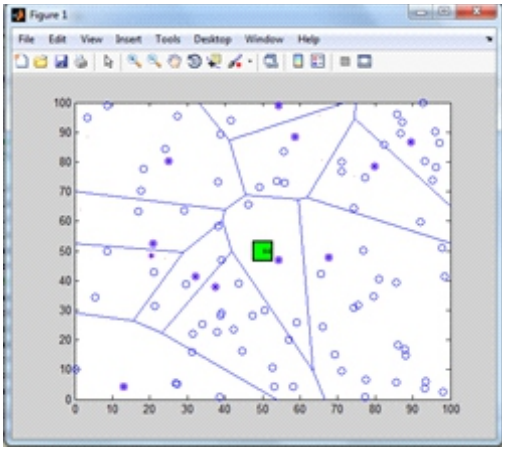
of the hacker, if found any then with the help of AOSEDV algorithm IP address is changed and finally path changed. These results are setup with the value of Base Station (BS) in the centre of the routing protocol and packets has to be send. The system is set for the number of iterations. With the change of iterations the simulation can be shown as figure 4.1 (a) to 4.1 (d), some of the random path for the intrusion detection system from the iteration set of 7 0.



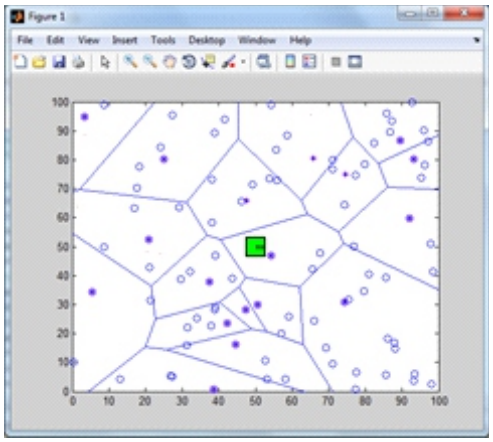

4.1 (a)




4.1 (b)




4.1 (c)




4.1 (d)

**Figure 4.1(a)-(d): Sleep Deprivation Attack detection system**

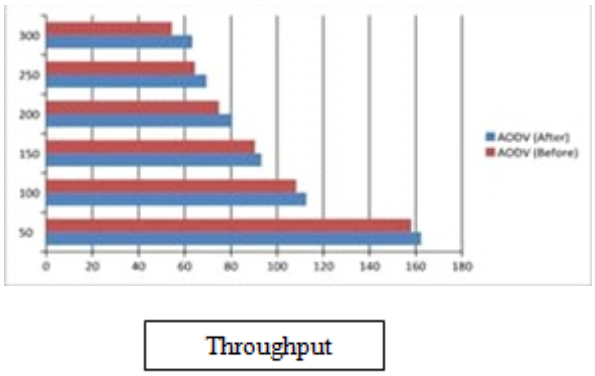
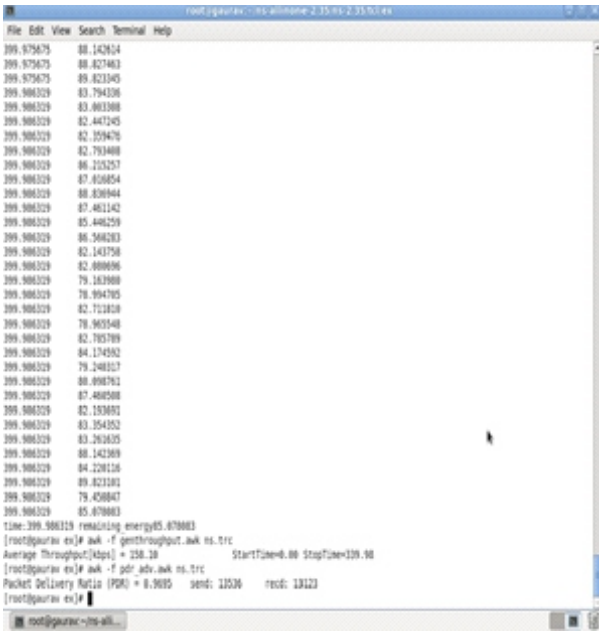



**Figure 5.3: Graph Representing Average Throughput Versus Number Of Nodes**

As shown in Figure 5.3 the graph of protocols is almost overlapping for lower number of nodes for example number of nodes below 150. AODV (after deletion of selfish node) is performing better than AODV (before detecting selfish node) with higher number of average throughput because of efficient routing paradigm which leads to comparatively higher packet transfer. Here are some of the screenshots of research work.

**Screenshot: Showing the Result of AODV protocol using 50 nodes network& 400 simulation time**




## Conclusion And Future Scope

The most import issue in the wireless sensor network designing is the Security and energy efficiency, because wireless sensor networks are affected due to different types of network attacks and intrusion. The purpose of the thesis is to detect the malicious node and identify the attacker. We term this problem the malicious node problem. “Danger Theory based on AIS” algorithm to detect the Energy Consumption based Evaluation of AODV to increase the throughput over MANET. This thesis

Sleep Deprivation Attack, the hacker keep sending the route request packet in order to include every node continuously and due to same try to observe energy bandwidth and memory. The attacker starts overflowing the network with a route request. Due to the same attack the link has been congested with the malicious packet due to the same service of server isolated by the attacker. To avoid this be used "Danger Theory based on AIS." So, my thesis is used for better energy consumption after detecting malicious node for the performance parameter like energy, PDR (Packet Delivery Ratio) and throughput is improved. After detecting malicious node.

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# Review On Prediction Of Epileptic Seizure From EEG Signal By DWT And ANN Technique

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## A B S T R A C T

*Epilepsy is the most common neurological disorder which is characterized by sudden and recurrent neuronal firing in the brain. It can be detected by analyzing EEG of the subject. Electroencephalograms (EEG) are signal records of electrical activity of brain neurons. It can easily display wave patterns like alpha, beta, delta, etc according to human behavior. Prediction of EEG signals has core issues on EEG based brain mapping analysis. EEG, which is a compulsive tool, used for diagnosing neurological diseases such as epilepsy, besides of techniques such as magnetic resonance and brain tomography (BT) that are used for diagnosing structural brain disorders.EG input signals are in stationary and non stationary form. It is very difficult to predict it. Various comparison and classification techniques are used to measure irregularities present in the EEG signals. This paper describes a novel approach for forecasting epileptic seizure activity, by classifying these EEG signals. The decision making consists of two stages; initially the signal features are extracted by applying wavelet transform (WT) and then an artificial neural network (ANN) model, which is a supervised learning-based algorithm classifier, used for signal classification.[3]*

*Wavelet transform is the effective method for time frequency representation signal analysis. The classification of EEG signals has been performed using features extracted from EEG signals. The performance of the Artificial neural network is used for signal classification and tests carried out by hidden layer.*

***Keywords***—*Electroencephalography, EEG signal, Dwt , ANN Feature Analysis, Prediction of EEG*

### 1. Introduction

EEG is the most useful and cost effective and successful tool in neuroscience to diagnose diseases and neurological disorders which is caused due to the electrical activity within brain. Epilepsy is one of the most serious neurological disorders. About 50 million people world-wide are suffering from epilepsy and each year, 2.4million new cases are estimated to occur globally. In most of the adult patients, it occurs in the mesial temporal structures such as hippocampus, amygdale, and parahippocampal gyrus. It is characterized by recurrent seizures, transient impairments of sensation, thinking, and motor control, caused by sudden excessive electrical discharges in a group of brain cells.

The electrical activity of active nerve cells in the brain produces currents spreading. These currents reach the scalp surface, and resulting voltage differences on the scalp can be recorded as the

electroencephalogram. Thus it is the recording of electrical activity along the scalp produced by the firing of neurons within the brain. The EEG records can easily display these electrical discharges as a rapid change in potential differences. Thus, neurologists invariably use EEG records to investigate suspected seizure phenomena.[7]

Epileptic seizures are sudden abnormal function of the body, with loss of consciousness, an increase in muscular activity or an abnormal sensation. There is use of wavelet based features for the classification between normal and seizure EEG signals.

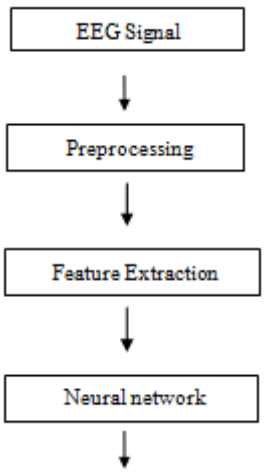
Thus neurologists invariably use EEG records to investigate suspected seizure phenomena ejection of a seizure attack. EEG input signals are in stationary and non stationary form. There are various comparison and classification techniques are used to measure irregularities present to predict EEG signals. The detection of epilepsy is possible by analyzing EEG signals. [4]

## II. Data Description

Data collection is a process of gathering information from a variety of sources. In this paper data from EEG signal of approximately 40 to 50 patients is collected and used to train Ann network model. Each EEG signal consists of 309000 data points. This data points are further divided with set of 154 each contains 2000 data points. The energy is extracted from these data packets for further analysis.

## Methodology

Signals originated due to muscle movements are another artifact. The first step is to preprocess the data to remove artifact slow and high frequency components. The next step is to process the filtered signal and extract features that represent or describe the status and conditions of the system. Such features are expected to distinguish between normal and seizure.



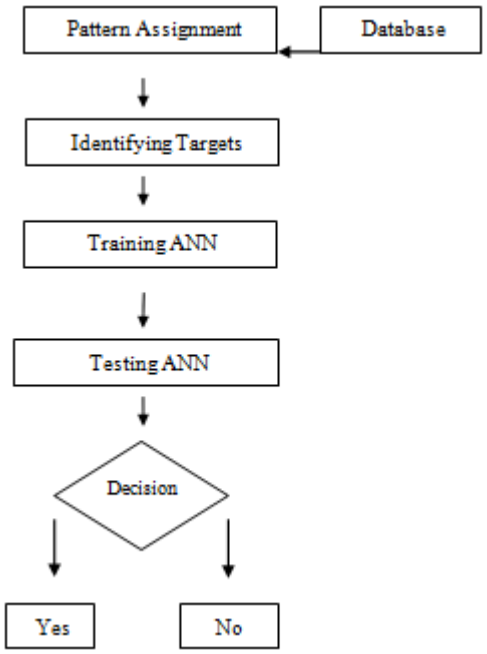



**Fig 1 : Functional Modulus of EEG Preprocessing System**

**Preprocessing:**

Data preprocessing transforms the data into a format that will be more easily and effectively processed for the purpose of the user. There are a number of different tools and methods used for preprocessing such as sampling, de-noising, filtration, normalization etc. In this stage detailed frequency content is obtained by NFFT (Nyquist Fast Fourier Transform) which is considered in EEG Signal. The high frequency components are removed from the EEG signal and low frequency signals are allowed to pass. The Low Pass Filter is designed according to the Specification and Parameters. At the end of preprocessing stage we obtained new filtered signals.

## III. Design And Implementation Wavelet Transform (WT)

The wavelet transform (WT) is designed to address the problem of non-stationary signals. The main advantage of the WT is that it has a varying window size, being broad at low frequencies and narrow at high frequencies.

Spike parameters extracted from the EEG signal, such as slope and sharpness, are presented to the ANNs for training and testing. The selection of the parameters is very important task for success of such types of system. The EEG signals, consisting of many data points, can be compressed into a few features by performing spectral analysis of the signals with the WT. These features characterize the behavior of the EEG signals. Using a smaller number of features to represent the EEG signals is particularly important for recognition and diagnostic purposes. The window size of 20 points (100 ms) produced successful results [8- 10]. Later, this window was extended to 30 points (150 ms) for further improving detection accuracy.[4]

**Feature Extraction**

Feature extraction is the process of defining a set of features, or image characteristics, which will most efficiently or represent the information that is important for analysis and classification. The last step is the classification and diagnostics. In this step, all the extracted features are submitted to a classifier that distinguishes among different classes of samples, for example, normal and abnormal. In the seizure detection problem this step is the classification between normal and seizure EEG signals.

Selection of appropriate wavelet and the number of decomposition levels is very important in analysis of signals using the WT. The number of decomposition levels is chosen based on the dominant frequency components of the signal. Thus, the EEG signals were decomposed into details D1–D4 and one final approximation, A4. The smoothing feature of the Daubechies wavelet of order 6 made it more suitable to detect changes of the EEG signals [2].Therefore, the wavelet coefficients were computed using DB 6.

The computed detail and approximation wavelet Coefficients of the EEG signals were used as the feature vectors representing the signals. The EEG signals were decomposed into time–frequency representations using discrete wavelet transform and statistical features were calculated[4].

In this stage filtered signal is Selected for feature extraction and DB6 level, applied to extract the feature on selected signal. Wavelet Energy is recorded after summing of detail coefficients. Then we can plot three subplots for detail, approximate and moving window number.

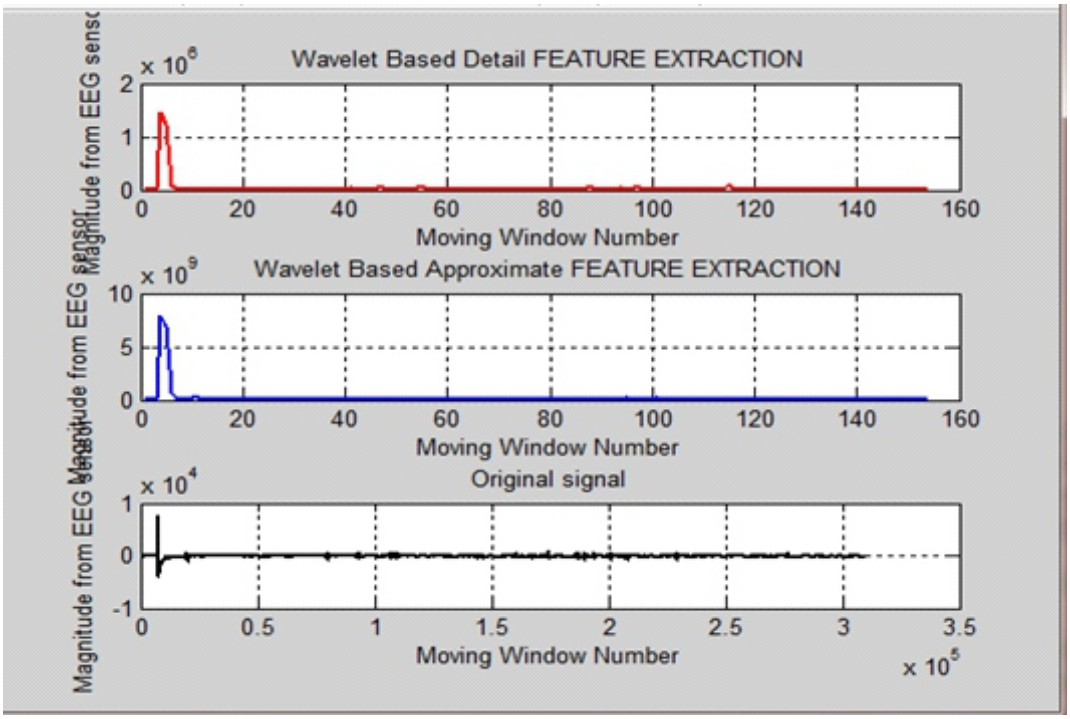



**Fig 2 : Detail and approximate feature extraction.**

**Artificial Neural Network :**

A neural network consists of an interconnected group of artificial neurons, and it processes information using a connectionist approach to computation. Neural networks are used for modeling complex relationships between inputs and outputs or to find patterns in data.

In this ANN approach the neural network is prepared Artificially by training it through giving various Inputs of EEG pattern such as Normal patients, Brain death, slow wave and Epilepsy etc. Neural Network gets trained for these various types of Inputs according to feature extraction, wave pattern and energy values. The trained model is checked tested for its efficiency up to acceptable level and then the completed Model is now can be used for actual testing and reorganization of unknown patients EEG pattern for different types o diseases as mentioned above.[4]

## IV. Result

| Target Pattern to the ANN model | | | Answer given by the ANN model at trained stage | | | Answer as per algorithmic absolute value | | | Error | | | Display Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.00 | 0 | 0 | 0.9593 | -0.0189 | 0.0616 | 1 | 0 | 0 | 0 | 0 | 0 | Normal |
| 0 | 1.00 | 0 | -0.0210 | 0.9763 | 0.0452 | 0 | 1 | 0 | 0 | 0 | 0 | Brain Death |
| 0 | 0 | 1.00 | 0.0415 | 0.0187 | 0.9371 | 0 | 0 | 1 | 0 | 0 | 0 | General Epilepsy |

**Table 1: Result of ANN trained data pattern(Classification and Training stage)**

| Accuracy of Algorithm for Brain death Disease (a) | Accuracy of Algorithm for Normal(b) | Accuracy of Algorithm for General Epilepsy(c) | Accuracy of Algorithm for Slow wave (d) | Accuracy of Algorithm for Focal Epilepsy(e) | Calculated Avg. Accuracy ( = $\frac{a+b+c+d+e}{5}$ ) |
|---|---|---|---|---|---|
| 100 % | 100 % | 90 % | 100 % | 100 % | 98.00 % |

**Table 2 : Summery of Result / Accuracy of ANN Algorithm**

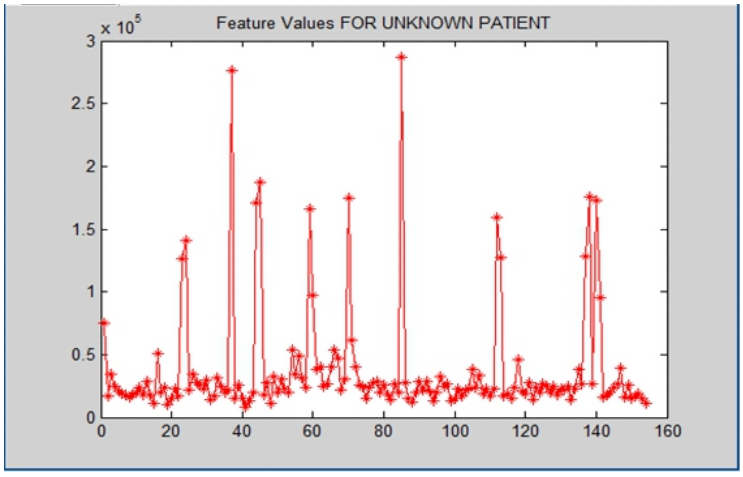



**Fig 3 : Energy Values for Patient under test (Disease detection stage)**

## V. Conclusion

This work presents a new method to calculate the features in the wavelet packet space, called as wavelet packet features. The aim is to demonstrate the application of wavelet method to analysis of the segment of spontaneous EEG. This application may turn especially useful for studying EEG synchronization in conditions with certain limitation for long duration records. Thus Wavelet coefficients were used as feature vectors identifying characteristics of the signal. Selection of appropriate wavelet and the number of decomposition levels is very important in analysis of signals using the WT to remove dominant frequency.

Selection of the ANN inputs is the most important component of designing the neural network based on pattern classification since even the best classifier will perform poorly if the inputs are not selected well. Input selection has two meanings: (1) which components of a pattern, or (2) which set of inputs best represent a given pattern [8]. The first-level networks were implemented for the EEG signals classification using the statistical features as inputs. To improve diagnostic accuracy, the second-level networks were trained using the outputs of the first-level networks as input data. Three types of EEG signals recorded from healthy volunteers, epileptic patients, patients with brain death disease were classified. ANNs do not need any specific rules but only examples for training. Thus, ANNs offer an attractive solution to recognition and classification tasks where complete rules cannot written.

## VI. Future Scope

Developing algorithms by combining ANN models and Fuzzy logic is another approach in classifying extracted features of EEG signals. Neuro-fuzzy systems are fuzzy systems, which uses the ANNs theory in order to determine their properties (Fuzzy sets and fuzzy rules) by processing data samples. By replacing the extreme values of wavelet coefficients with suitable percentiles, the classifiers gave better classification accuracy. The high overall classification accuracy obtained verified the promising potential of the proposed classifier that could assist clinicians in their decision making process. The task of epileptic seizure prediction [8] is another interesting task where it requires the classifier to differentiate between pre-ictal and inter-ictal data. A major drawback of the existing wavelet neural networks is that their application domain is limited to static problems due to their inherent feed forward network structure. In the future, a recurrent wavelet neural network will be proposed for solving identification and control problems.

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# Performance Of Voice Activity Detection Method Based On Zero Crossing Rate And Energy Level In Arabic Language

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## ABSTRACT

*This work investigates the detection of voice activity of /CVCVCV/ word for /b, d, k/ introducing vowel /a, u, i/ in Modern Standard Arabic (MSA) using the Zero Crossing Rate (ZCR) and Energy Level algorithm. This algorithm has allowed us to identify with good accuracy the beginning and end of words studied.*

***Keywords -*** *Modern Arabic Standard, Voice Activity Detection, Zero Crossing Rate, Energy Level, Performance Rate.*

## 1. Introduction

The Voice Activity Detection allows us to distinguish between segments of an audio signal that include the human voice (period of activity) and non-voice signals (period of non- activity) in the environment of noise, then determine the start and end points of the operation. [1], [2]. Generally, the feature parameters used for endpoint detection are highly sensitive to the environment. Figure.1 represents an example of activity and no activity.

Research has shown the existence of more than half of the errors in the speech recognition caused by inaccurate detection of the end point even in the ideal conditions.[3]. For this, researchers have devoted their work on the determination of the beginning and the end of the word with exactly offering different algorithms.

J. Li & al., adopted a method based on TEO in a noisy environment. It uses three-state transitions, and a

judgment mechanism based on double thresholds and the results obtained by performing a comparison with two other endpoint detection algorithms showed the robustness of this algorithm. [2]. J. Wu & X. Zhang presented an algorithm based on statistical models and empirical rules based on an energy detection algorithm through two steps: detection of the parameters characterizing the speech by using the algorithm Detection energy, and offering a Gaussian mixture model to align the endings of their optimal positions. The results obtained show better performance in various noisy scenarios [4]. As the formant structure occurs on the spectrogram, this is called the voice print, Wu & al, used the band spectral entropy (BSE) to trace these characteristics [5]. Another method of adaptive band selection (RABS) is combined with BSE to generate a new parameter called (ABSE). The results show that this parameter is very reliable in various noisy conditions [5]. In this article, we proposed a voice activity detection algorithm based on the Zero Crossing Rate (ZCR) and Energy Level to distinguish the active part of the non-active part of the speech signal in the case of standard Arabic for three places of articulation: bilabial, alveolar and velar. Our study is to make a comparison between these three places by calculating the reliability rate.

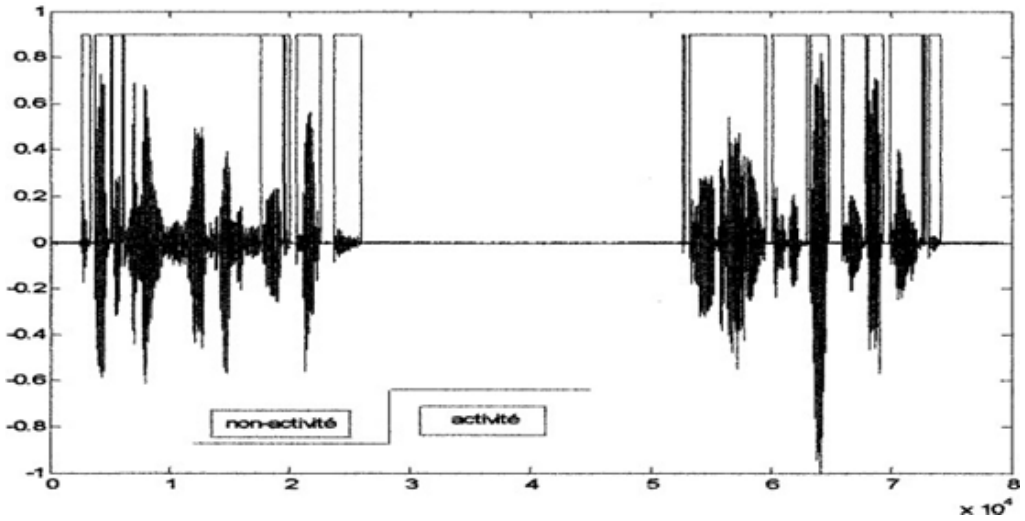


**Fig. 1: Example of activity and non-activity [1]**

## 2. Zero Crossing Rate And Energy Level

### 2.1. Zero Crossing Rate

For A Sampled Signal, There Is Zero Crossing When Two Successive Samples Have Opposite Signs [6]. The Short-term Zero-crossing Rate Is Estimated By The Formula:

$$Z_n = \sum_{i=1}^{N} sgn[x(i)].sgn[x(i+1)]$$

With:

$$sgn[x(m)] = \begin{cases} 1, & if\ x(m) \geq 0 \\ 0, & if\ x(m) < 0 \end{cases}$$

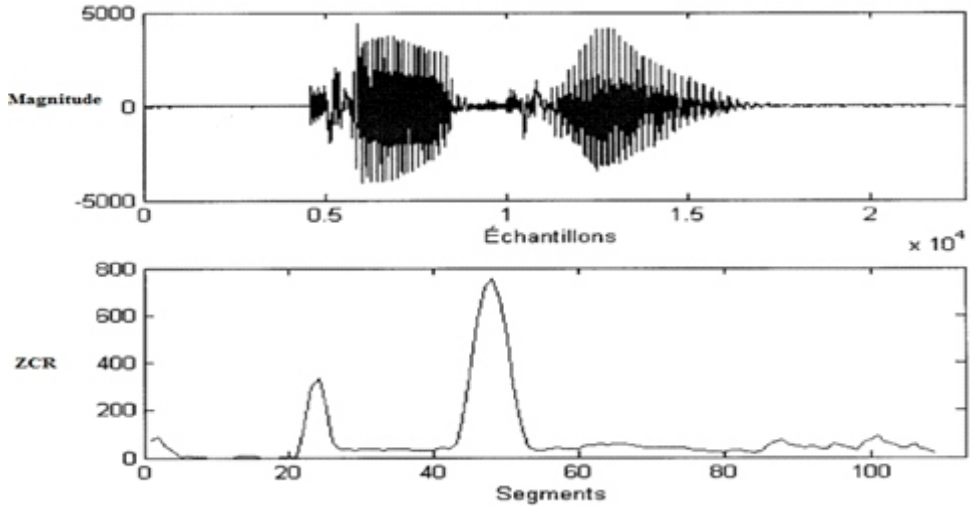


**Fig. 2: Zero Crossing Rate of a speech signal**

A characteristic for zero crossing rate is that it is high for the unvoiced sound and low for the voiced sound. The zero crossing rate is an important tool to classify voiced / unvoiced and to detect the beginning and end of the word in a speech signal (figure.3).

### 2.2. Energy Level

One of the tools to provide a faithful representation of changes in the amplitude of the voice signal x (n) over time is energy short term [6]. In general, the energy of the frame of a signal is given by:

$$E_n = \frac{1}{N}\sum_{i=1}^{N}[x(i)]^2, 1 \le i \le N$$

$w(n)$: Hamming window

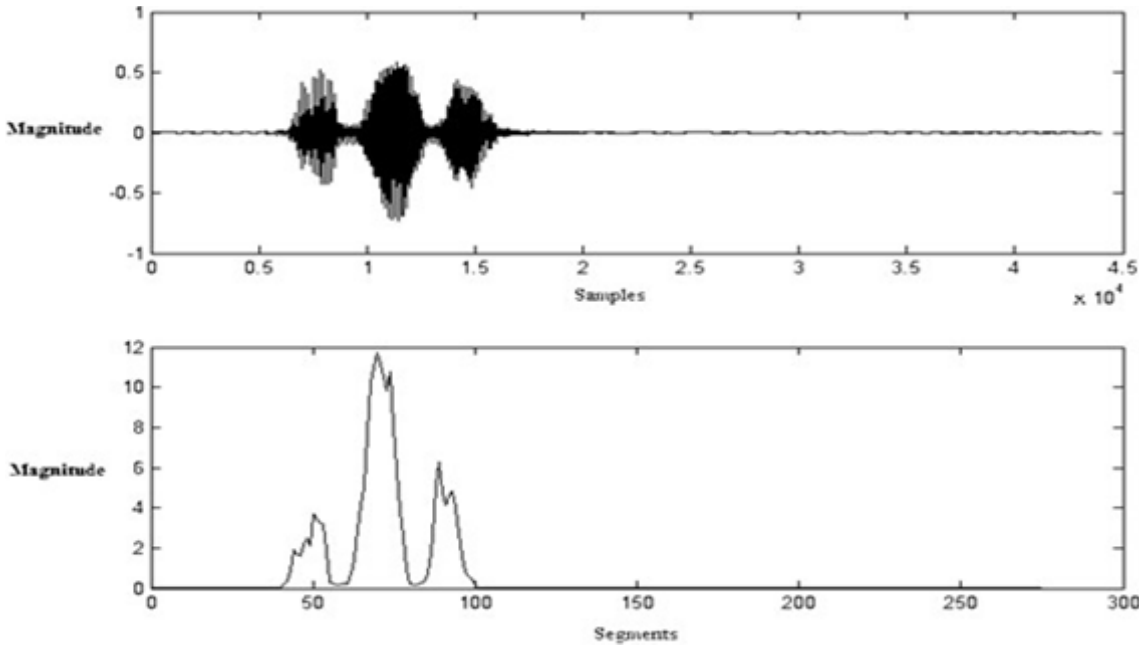


**Fig. 3: Short term energy of a speech signal**

## 3. Methodology

### 3.1. Corpus

Four Moroccan adult speakers (men) speaking Modern Standard Arabic has been invited to pronounce a series of words CVCVCV (C: consonant V vowel) four times to three different places of articulation (/ b /: Bilabial; / d /: Alveolar, / k /: velar) with three short vowels (/ a, i, u /). The recording was made using a microphone (AM-232 Labtec; Sensitivity: -35dB, Impedance: 2.2 kOhm, bandwidth: 20-8500 Hz) at a distance of 20 cm in an isolated and quiet room via the software "Praat". The sound is digitized directly to a PC with a sampling frequency of 22050 Hz because the maximum possible frequency is 11025 Hz beyond this frequency, the signal is extremely poorly sampled and the resulting sound is unusable. The quantization used is a 16-bit linear quantization to reduce the quantization error. The recording time is 2 seconds for each syllable. The results are obtained by applying the recordings to a program made by us in matlab.

### 3.2. Algorithm

In this study, we proposed a voice activity detection algorithm based on the zero crossing rate and energy shown in Figure 3 by using high and low thresholds of zero crossing rate and energy level

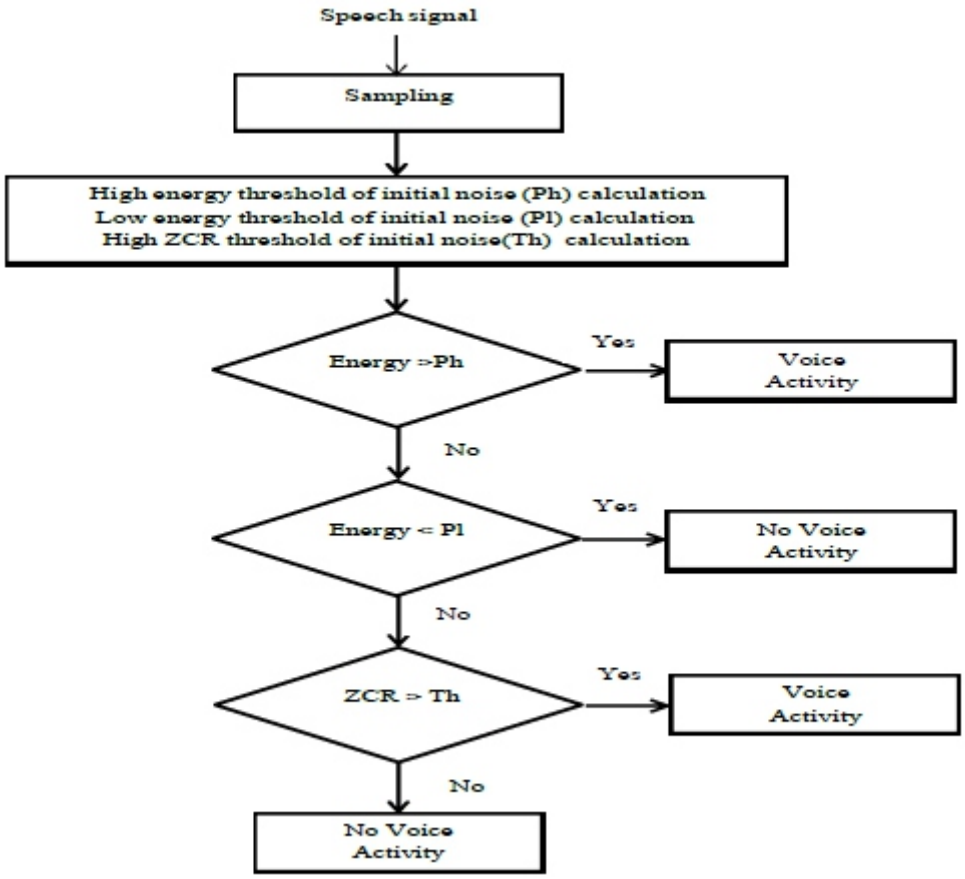


**Figure 4 : VAD algorithm based ZCR**

## 4. Results And Discussions

We realized a program in Matlab code based on this algorithm. The results obtained showed that the performance rate for the alveolar (90%) is larger than bilabial (76%) than velar (59%) (Figure 5).

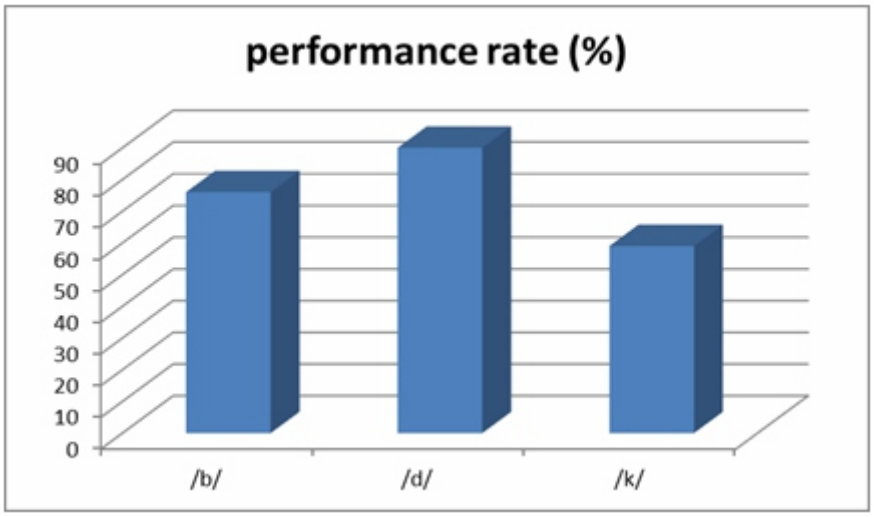


**Figure 5: Performance rate of the algorithm ZCR/energy level for / b /, / d / and / k /**

Figure.6 indicates the result of our algorithm, it shows accurately the beginning and the end of the speech signal in the case of /bababa/.

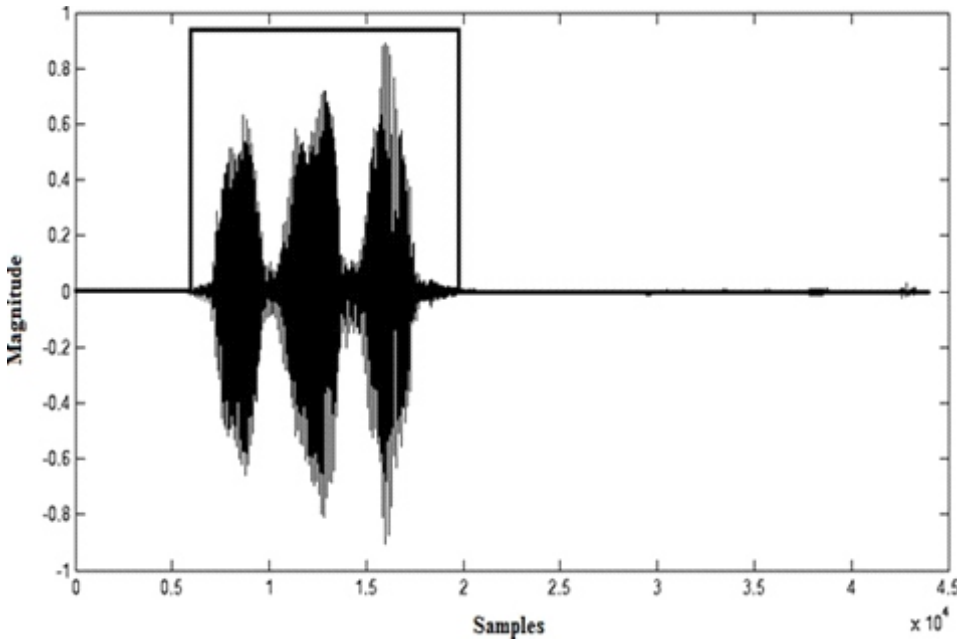


**Figure 6: Voice Activity for /bababa/**

Figure 7 shows the results of VAD / kakaka /. It is clear that there is difficulty in determining the vocal part of speech and this is due to the energy of the consonant / k / which is very low and confused noise.

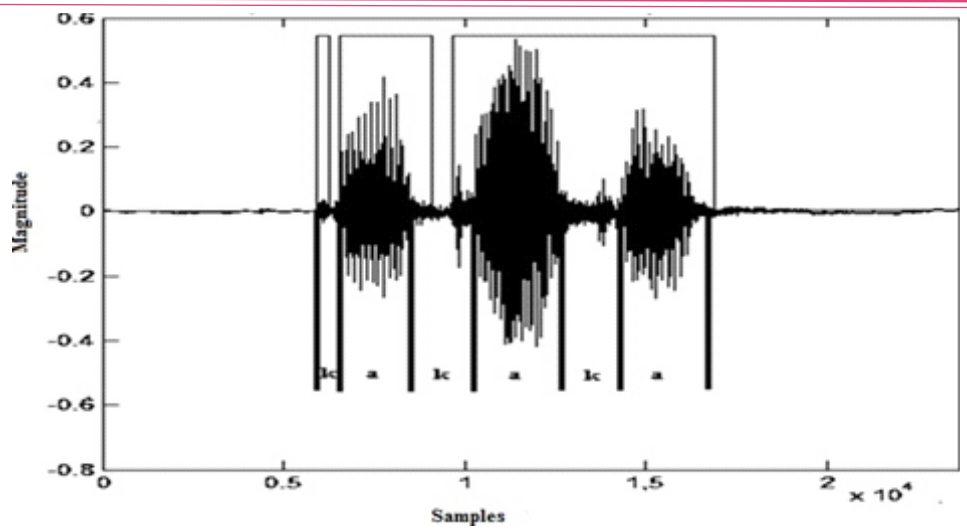


**Figure 7: Voice Activity for /kakaka/**

According spectrograms words / dadada / and / kakaka /, we note that the energy level of the consonant / d / is higher than / k /: the gray level of the consonant / d / is dense than / k / (Figure 8 and Figure 9).

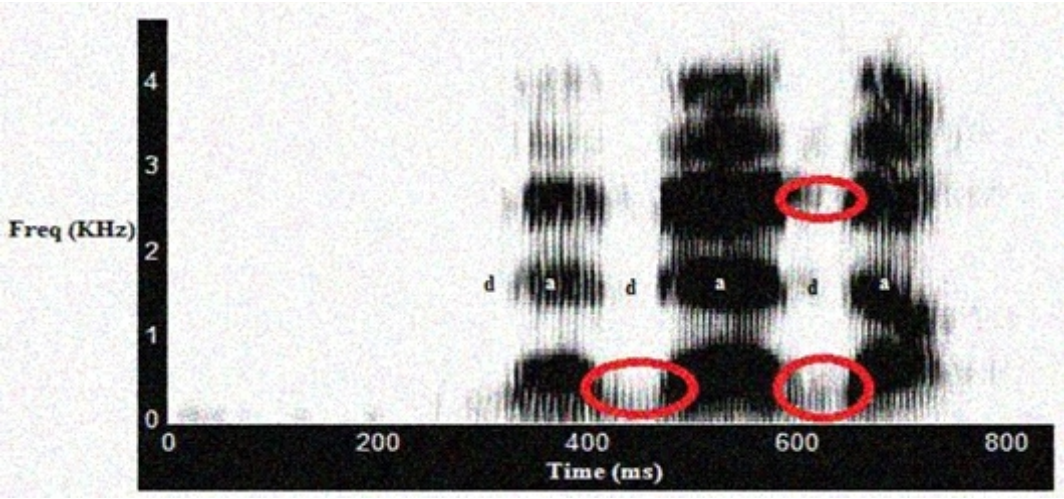


**Figure 8: Spectrogram of /dadada/**

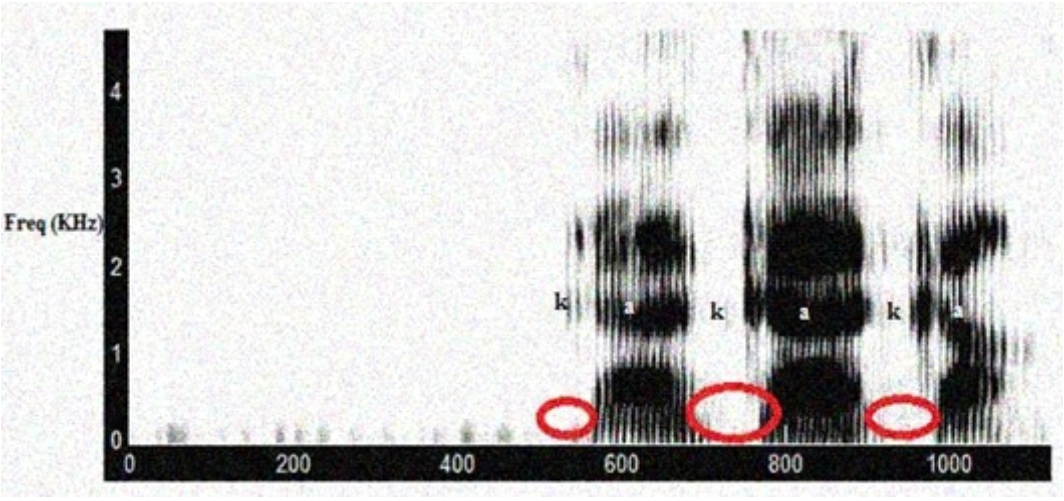


**Figure 9: Spectrogram of /kakaka/**

These results are consistent with those obtained in the work of Mounir & al [7], where this is explained by the phenomenon of coarticulation in the work of Munir et al, where they showed that the application of the equation of the locus CV context allowed on the one hand, to identify the place of articulation of the consonants according to their virtual locus (bilabials ≈ 1200 ≈ 1800 and velar alveolar ≈ 2600). On the other hand, the locus equation indicates that the slopes of velar have the largest degree of coarticulation and alveolar have the smaller. This result indicates that the intervention of the language in the production of the consonant is inversely proportional to the degree of coarticulation, and therefore the energy of the consonant / k / is less important compared to other consonants / b, d /.This means the energy level is nearer to that of the noise, and it is considered by the algorithm as no voice activity.

## 5. Conclusion

In this work, the results obtained showed a good performance of the algorithm ZCR / energy level for the alveolar, but less performance for velar where we noticed that this algorithm considers that there is no voice activity during the pronunciation of the consonant / k / for most recordings. This is explained by the fact that the energy level of the velar close to that of the noise. This low power is shown in the work of Mounir & al [7].

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# Plug In Vehicles- A Technology For The Future

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## ABSTRACT

*A plug-in vehicle (PEV) is a motor vehicle that can be recharged from an external electricity source. PEV is a set of all electric vehicles like Battery Electric Vehicles (BEVs), Plug- in Hybrid Vehicles (PHEVs). Plug-in cars have several benefits compared to conventional internal combustion engine vehicles with regard to the environment and safety issues. They have lower operating and maintenance costs, and produce little air pollution. Thus, such vehicles are becoming more popular. However, they also have some drawbacks such as the impact of charging these cars on the electrical utilities. The main objective of this paper is to highlight these advantages, the research done in this field. Experiments have been conducted on several smart grids to analyze the impact on the energy distribution, network energy losses, cost etc. This paper reviews the economics, the disadvantages of PEVs, methods to counter them, recent government incentives, the current market trends and impact of PEVs in the future markets.*

***Keywords:*** *Plug-In Vehicles, Smart Grid, Energy Distribution, Network energy losses, Economics, Current trends and Future strategies.*

## 1. Introduction

The fast developing technological industry coupled with the growing concerns of increasing environmental pollution, oil prices and depleting sources of energy have led to the invention of innovative automobiles. One such example is the Plug-In vehicles (PEVs) that can be classified into Hybrid Electric Vehicles (HEVs), Battery Electric Vehicles (BEVs), and Plug-in Hybrid Vehicles (PHEVs). Electricity is supplied from different sources such as a wall socket or rechargeable battery packs is used to charge the PEVs. In electric vehicles, the challenges are to achieve high efficiency, ruggedness, small sizes, and low costs.A PHEV has characteristics of both- a hybrid electric vehicle, with an electric motor and an ICE, with a plug that connects to the electrical grid. PHEVs also dissolve the problem of whether the vehicle will reach its desired destination associated with electric vehicles, because the I.C.E. acts as a backup when the batteries run out, giving PHEVs a driving-range that is along the lines to of vehicles that have gasoline or diesel tanks. [1]

## 2. Working

The working of HEVs is basically based on the powertrain of the assembly of the vehicles. The electric

motors are quite different from gasoline engines. An engine needs to spin around to work more efficiently. However, wheels do not need to move fast. For example, when you are starting from a cold start at a signal, the engine needs to produce more torque and start off at a very low speed. On the other hand, while moving on a highway, you need the reverse i.e. more speed and less torque. In an I.C.E you need to burn more fuel to produce more power or torque, which is the basis of the law of conservation of energy. So it is referred to as 'Stepping on Gas'. But in an electric motor- the same power is produced irrespective of how slow or fast the wheels spin. [2]

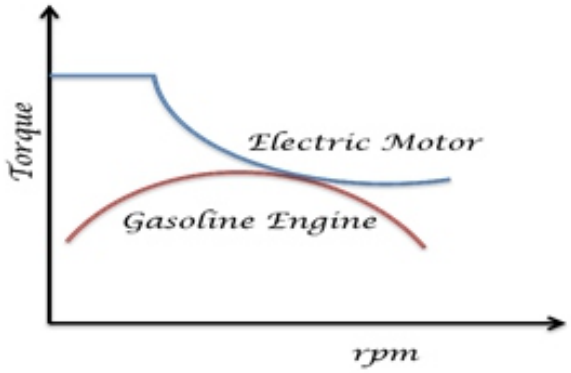


**Figure 1: Torque vs. rpm for Gasoline and Electric vehicles**

The working of the electric motor forms the basis of the powertrain of the hybrid electric vehicles. It is because of this principle that the electric vehicles have an edge over internal combustion engine vehicles.

**Hybrid Electric Vehicles**

A Hybrid Electric Vehicle (HEV) converts the stored chemical energy into mechanical energy, to drive a vehicle in a useful and an environmentally friendly manner. The powertrain of a HEV includes electric motors, generators, batteries and an internal combustion engine running on gasoline. (Refer to Fig 4).

**Types by Powertrain Structure** [3]

**Series**

Series Hybrids use an I.C.E in order to run a generator which then turns the electric motor through a battery and rotates the wheels. The battery Is used to store excess charge (Flywheels). Over short distances, the battery can be used without engaging the I.C.E. examples: Chevrolet Volt, Opel

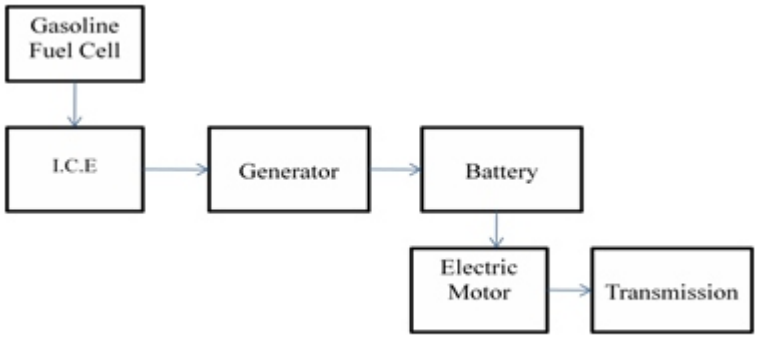


Figure 2: Working of Series Hybrid Electric Vehicle

**Advantages Of Series Hybrid Vehicles** [5]

1. No mechanical link between the combustion engine and wheels and so no mechanical transmission.
2. The generator can be located anywhere.
3. More efficient during stop and go in-city driving.
4. Separate electric wheel motors can be implemented.

**Disadvantages Of Series Hybrid Vehicles** [5]

1. The weight, cost and size of the powertrain is excessive because the electric motor, generator and I.C.E are all connected to handle the power.
2. Over large distances, the overall efficiency is less because of energy conversions.

**Parallel**

In contrast to series hybrids, parallel hybrids can use two different sources of power simultaneously – an I.C.E. and a battery driven electric motor. The advantage of using a parallel over a series hybrid is that electric motor can be used at low power over short distances (increases fuel economy) whereas the I.C.E can be used over long distances at high power which helps to reduce range anxiety. Examples: Honda Insight, Accord and Civic etc.[6]

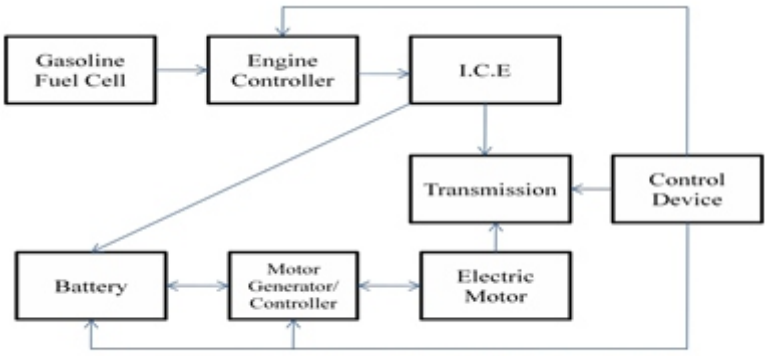


Figure 3: Working of Parallel Hybrid Electric Vehicle

**Disadvantages Of Parallel Hybrid Electric Vehicles**

1. It has a complex design.
2. I.C.E is not decoupled with the wheels; so it cannot be charged at standstill.
3. It doesn't operate in a narrow range of RPM and so the efficiency is low at low rotation speed.

**Advantages of Parallel Hybrid Electric Vehicles**

1. Overall efficiency is high over long distances. It can easily switch between I.C.E and electric power.
2. Only one motor or generator is required and so it can be designed for a less powerful I.C.E vehicle as it is assisting traction.

**Series-Parallel**

When the vehicle is can be operated in the series mode and the parallel mode depending on the situation, it is a series-parallel hybrid. Examples: Toyota Prius, Ford, Nissan, Lexus etc. [7]

**Battery Electric Vehicles**

An Electric car is a plug-in battery powered automobile which is run by electric motors. These cars usually use DC motors wound in series. Recent advances have used a variety of AC motors as they cannot wear out easily.The power supply to the motor is controlled by the motor controller. Depending on the motor type, it supplies either AC or DC power.

**Table 1: Fuel use in vehicle design[5]**

| Vehicle Type | Fuel Used |
|---|---|
| All-Petroleum Vehicle | Petroleum |
| Hybrid Electric Vehicle | Less use of petroleum (cannot be plugged in) |
| Plug-In Vehicle | Less use of petroleum, more of electricity |
| All-Electric Vehicle | Maximum use of electricity |

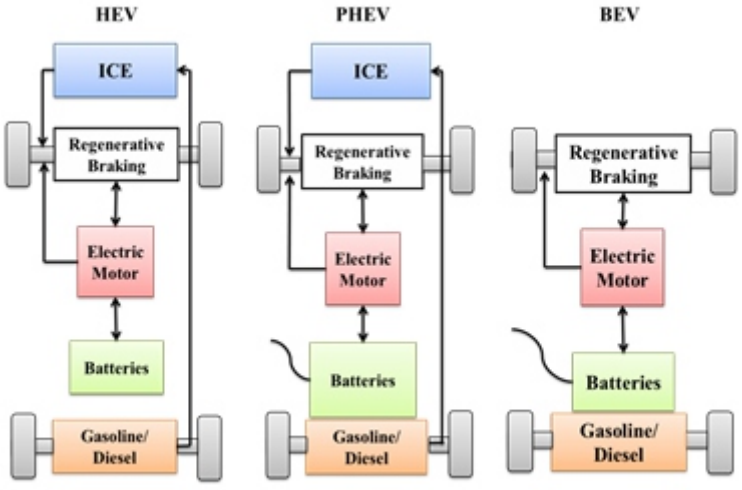


Figure 4: Comparison between HEV, PHEV, BEV

Types by Degree of Hybridization [5]

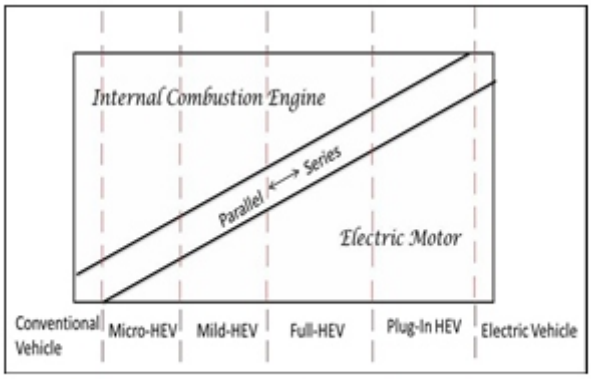


Figure 5: Properties of I.C.E and Electric Motor

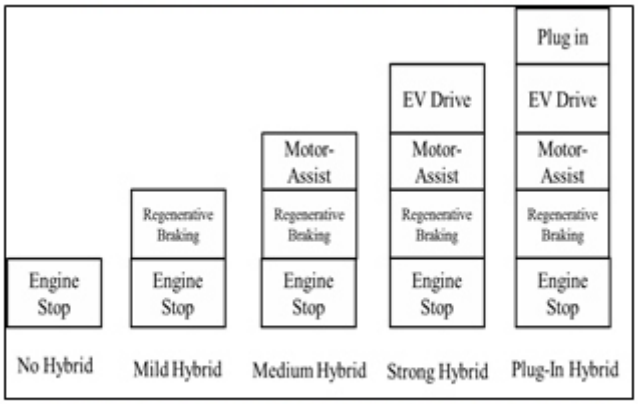


Figure 6: Overview of Hybrid-power train concepts

## 3. Advantages Of Pevs

### Reduction In Air Pollution And Greenhouse Gas Emissions

The exhaust gas from conventional gasoline/diesel vehicles consists of carbon dioxide, carbon monoxide, nitrogen oxides, particulate matter, etc. The release of these gases into the atmosphere results in global warming, acid rain, carbon monoxide poisoning and smog among other detrimental effects to the environment.

Gasoline and diesel are both obtained from fossil fuels for which the resources are depleting at an alarming rate. While drawing power from the battery, the automobile releases no pollutant and is hence environmentally friendly. PHEVs thus, are a great step forward in improving the quality of air around us and reducing our dependency on the meager resources of fossil fuels.

### Mileage And Overall Efficiency

Gasoline/diesel based vehicles are most efficient on highways whereas their efficiency is very low in the city where traffic is high. Since a PHEV is a hybrid of both-fuel based vehicles and battery operated electrical vehicles, the efficiency does not drop down. In regions of high traffic, the automobile utilizes energy from the pre-charged battery and in regions of low traffic or on the highway, the car is driven by the internal combustion engine using the fuel since in cases of long drives, the charge in the battery will get extinguished.

I.C.E has a very low efficiency because the majority of the energy generated from the fuel is lost as heat while the engine is idling. On the other hand, PHEVs convert stored energy to drive a vehicle much more efficiently. Efficiency of vehicles using gasoline does not go beyond 15% and for diesel based engines; the maximum efficiency achievable is around 20%, whereas for PHEVs efficiencies around 80% are observed.

**Mechanical Advantages Of Phevs**

- The maintenance cost for an I.C.E is much greater than the maintenance cost for a PHEV because mechanical systems break down much more often as compared to electrical and electronic systems.
- The amount of driving between consecutive recharges determines the claimed fuel economy for plug-in hybrid electric vehicles.
- PHEVs reduce the overall operating costs due to electric power being much cheaper than the ever depleting fuel resources.
- To stabilize CO emissions using efficient vehicles, "Pacala and Socolow wedges" approach is used for which PHEVs can be used as an element.
- PHEVs have the potential to balance the load or reduce the load on the grid during peak loads.
- They can send power back to the grid by the use of the excess battery capacity and then recharge during off peak loads.
- No need to change the oil and other routine maintenances are also avoided.

**4. Disadvantages Of Phevs**

**Cost- Batteries And Ownership**

The cost of Plug-In Vehicles is more than that of the conventional Internal Combustion Engine because of the additional cost of the lithium-ion battery pack. According to a survey done in 2012, the cost of a lithium ion battery is USD 1,700/kWh and knowing that an average PEV-10 requires 2.0kWh which is considerably high. There is also a decrease in the mileage over long distances because the I.C.E does all the work whilst carrying unwanted weight. [8][9][10]

Cost reductions can be made feasible by advances in the battery technology thus increasing the production of PEVs and help it compete with the Internal Combustion Engine Vehicles. Another study published in 2011 revealed that the gasoline cost savings in PEVs did not increase the purchase of PEVs due to short run time.[11][12]

**Availability Of Recharging Facilities**

The ecofriendly aspect of PEVs is based on the assumption that recharging facilities will be easily

available in all places such as streets, parking structures, commercial setups etc. Without the infrastructure, PEVs will not attract majority of the crowd due to range anxiety. However, a huge investment from both private and public sectors will be required for a project of this magnitude.

Battery Swapping: Is a solution deployed by 'Better Place' for recharging of batteries. In this, customers are sold the car without the battery. Since they aren't allowed to buy batteries separately, these are rented to them by better place that has set up various charging sectors that allows people to travel by PEVs over long distances. [13][14]

**Risks Of Battery Fire**

Thermal runaway and cell rupture is a common occurrence in lithium-ion batteries due to overcharging or over heating which in some cases can also lead to combustion.This is similarto phones exploding.In case of a collision there are worries of potential dangers. Manycompanies stopped production of PEVs due to many cases of battery fires and accidents.

In 2014, The U.S. National Highway Traffic Safety Administration (NHTSA) conducted a study to establish if lithium-ion batteries in PEVs posed a potential fire hazard. The research established whether high-voltage batteries caused fires when they were being charged and when the vehicles were involved in an accident. [15]

**Potential Overload Of The Electrical Grid**

The electrical grids present as of now do not have the capacity to cater to the additional power load that will arise due to recharging of PEVs. Also there is a significant increase in the power losses. The charging of a PEV consumes three times the electricity consumed by a home. Therefore overloading problems may arise. To counter this problem, there is a dire need to modify the existing electrical grids.[16] Currently, General Motors is carrying out the Pecan Street demonstration project in Texas. The main objective is to review the charging patterns and how a fleet of residential PEVs might strain the local grid.[17]

**Risks Associated With Noise Reduction**

Electric vehicles run at lower speeds and consequently produce lesser road noise as compared to the regular I.C.E vehicles. However this noise serves as an aid to the visually impaired in crossing roads. Although many studies [18] have recently proved that such incidents are purely coincidental and bear little relation to the noise produced by the PEVs, some companies such as Chevrolet and Nissan have addressed this concern and launched PEVs with an electric warning sound.

In 2013, a rule was published by the National Highway Traffic Safety Administration (NHTSA) that requires hybrids and electric vehicles traveling at less than 30 km/h to give warning sounds that pedestrians must be able to hear. [19][20]

## 5. Assessment Of Impact Of Pevs On Distribution Networks[21]

From the point of view of the distribution system operator, the additional power loss is of huge economic concern. Also the voltage deviations are a concern for power quality. It's better for the PHEVs to be charged at night to avoid generator startups which lead to a decrease in the efficiency. This allows for intelligent or smart charging.The research/experiment conducted focuses on an urban area with more than 6000 low-voltage customers and an industrial area with more than 61,000 customers.This model is also called the Reference Network Model.[22–26]

A large-scale distribution network planning model has been used for the calculation of the required network investment with different future levels of PEV penetration.Two large scale distribution areas have been analyzed. Three scenarios of 35%, 51% and 62% PEVs penetration have been considered. [27]The two base distribution networks chosen are as shown in Fig 7& 8.

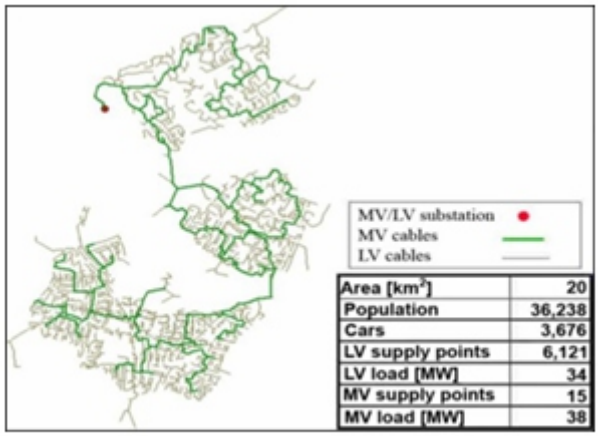


Figure 7: Distribution network in area A

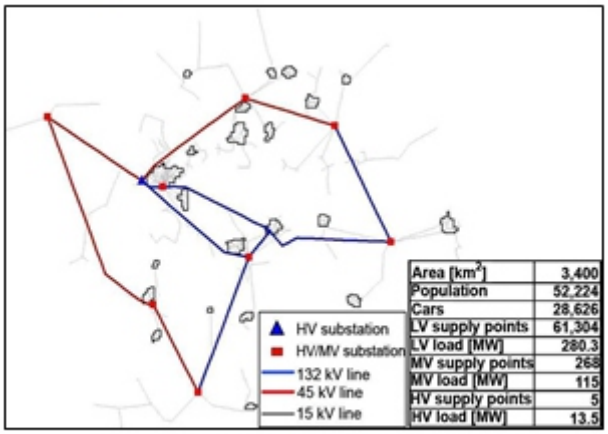


Figure 8: Distribution network in area B

This experiment calculated the peak load of charging via the 'simultaneity factor'. A simultaneity factor of 1 means all the PEVs are charging at the same time. If it is less than 1, then intelligent or smart charging strategies are implemented. The experiment consideredvarious permutation and combination of the above conditions to get various results on the required and incremental investment, energy losses etc.

The following inferences have been made from the results of the experiment:

- If Smart charging strategies are implemented, then 60-70% of the required incremental investment can be avoided. But there is a limit up to which this is satisfied.( see Figure 9 )
- The energy losses can increase up to 40% of the actual value in the off-peak hours if all the PEVs are in charging mode. Energy losses increase with an increase in the penetration level.[28]( See Figure 10 )
- If there are some strategies that devise that some PEVs are charged at off-peak hours instead of peak hours it will lead to saving of up to 5% - 35% of the required investment can be avoided. However there are some limitations such as the population density, power load etc. after which the investment increases.

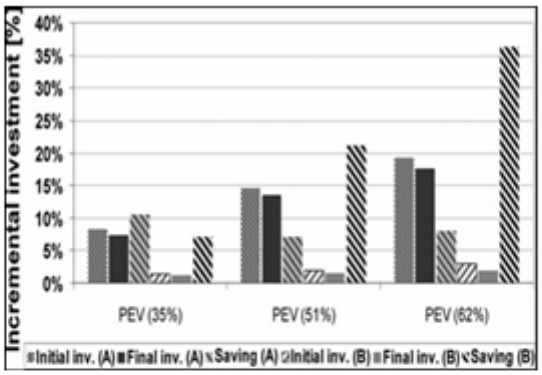


**Figure 9: Savings obtained by moving battery charging from peak to off-peak**

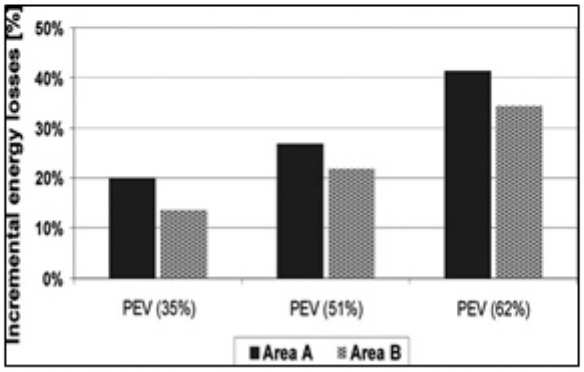


**Figure 10: Incremental energy losses in off-peak hours**

Future research will focus on the design and implementation of smart charging by avoiding the simultaneity of charging time.

## 6. Economics Of Phev's

The Cost Benefit Analysis Of Plug In Hybrid Electric Vehicles Includes A Comparison Between The Lifetime Of The Vehicle And The Ownership Cost. Here The Cost Of Ownership Includes The Cost Of Consumption Of Energy As Well As The Retail Cost, But Excludes The Differences In Cost Of Maintenance. A High Cost Of 5 Usd Per Gallon Of Gasoline Is Assumed For The Near Term Scenario. The Cost Of Consumption Of Electricity Is Assumed To Be 0.09 Usd Per Kilowatt- Hour. [29]

## 7. Government Incentives

Since Reduction Of Pollution Is The Need Of The Hour, Several Public And Private Sectors Have Invested In This Particular Field Of Interest. Grants, Tax Credits, Financial And Non-financial Incentives Have Been Promoted In Order To Push Consumers To Buy Pevs.

Countries All Over The World Have Come Together To Make This Initiative Successful.

### Asia

### China

In June 2010, The Republic Of China Started A Program To Give Up To Usd 8,785 For Private Purchase Of Bevs And Usd 7,320 For Pevs In Five Different Cities.[30][31]

### Japan

In 2009, The Japanese Diet Started The “green Vehicle Purchasing Promotion Measure”. It Allows For Tax Deductions And Exemptions For Eco-friendly And Fuel Efficient Vehicles. It Provides Subsidies For Purchasing A New Passenger Car. [32]

### Europe

In April 2010, Most Of The European Union(eu) Member States Provide Tax, Exemptions, And Bonus Payments For Buyers And Subsidy Incentives For Pevs. Both The Private And Business Fleet Buyers Are Eligible For The Government Grant. [33][34]

### North America

### United States

The American Clean Energy And Security Act Of 2009 And The Energy Improvement And Extension Act Of 2008 In The United States Of America Granted Tax Credits For New Qualified Pevs [35]. Federal Tax Credits For Converted Pevs Were Permitted By The American Recovery And Reinvestment Act Of 2009. This Tax Credit For New Pevs Is Worth Usd 2,500plus An Extra USD417 per kWh of battery capacity over 5 kWh. The maximum credit allowed for new PEVs is USD 7,500. Several incentives, tax exemptions and other non-monetary incentives have been established by multiple states for BEVs and PHEVs. [36]

A goal of having 1 million PEVs on the road by 2015 was set by Barack Obama but owing to the slow rate of PEV sales in mid-2012, this goal was underachieved by a very large margin. Another goal was set in September 2014 by the Governor of California in the Charge Ahead California Initiative bill of placing over 1 million vehicles emitting zero and near zero pollutants on the road in California by 2022. [37]

**Canada**

For the purchase or lease of PEVs after July 1, 2010, a rebate of USD 4,900 to USD 8,320(varying according the size of the battery) was established by Ontario to the first ten thousand applicants who qualified.[38]

Quebec offered rebates of up to USD 8,485 for new PEVs equipped with a 4kWh battery and PHEVs are permissible for a USD 1000 rebate. BEVs with high-capacity batteries are offered rebates of USD 7,985. PEVs and low range BEVs are also given some reduced incentives. [39]

## 8. Future Market Trends

There are two types of scenarios that can be used to predict the future trends:

- Near term scenario
- Long term scenario

**Near Term Scenario**

Here the hybrid electric vehicles will cost lesser than a conventional vehicle after approximately 10 years. But plug in hybrid electric vehicles will never be cheaper than a conventional vehicle or an HEV over the 15 year lifetime of the vehicle. The cost considered here includes the retail cost of the vehicle and the cost of the energy consumed only. [40]

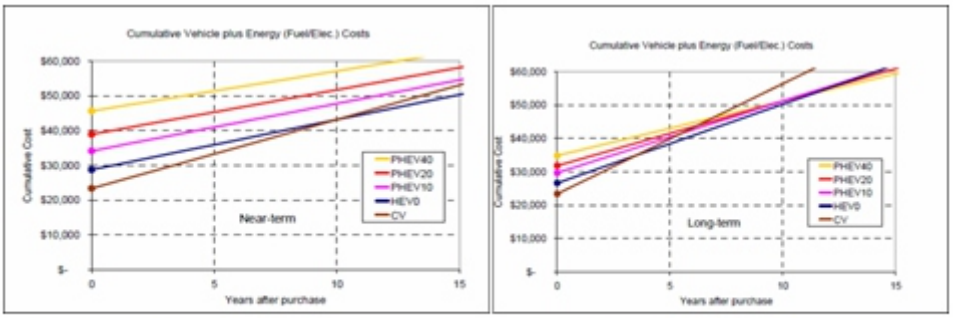


**Figure 11: Economic comparison of PHEVs in the near-term and long-term scenarios**

**Long Term Scenario**

This scenario shows a major change with the hybrid electric vehicle being cheaper than the conventional vehicles in approximately 4 years and the PHEVs becoming cheaper than the hybrid electric vehicles in around 12 years.[40]

From this analysis it is evident that the gasoline and vehicle retail cost is strongly affected by the assumptions taken into consideration for the cost of the battery in each scenario. Another observation made from this comparison is that if the cost of the battery is not reduced and if gas prices remain the same, then it is clear that the economics of Plug in Hybrid Electric vehicles are not promising.

Despite these uncertainties PHEVs may be cheaper due to tax incentives, air pollution, greenhouse emissions, national energy security, reduced maintenance; fewer fill-ups at the gas station; convenience of home recharging; improved acceleration from high-torque electric motors; opportunities to provide emergency backup power in the home; and vehicle-to- grid applications. Alternative business models—such as battery leasing—also deserve further consideration since they might help to mitigate the daunting incremental vehicle cost and encourage Plug in Hybrid Electric Vehicle enthusiasts to focus on the potential for long-term cost savings.

**9. Charging Of Pevs By Renewable Resources** [41]

The solution to the depleting resources of energy is the integrated use of renewable energy resources along with PEVs and PHEVs. Considering the significant and fluctuating cost of conventional fuels, a potential for Plug-in Electric Vehicles was observed by the U.S. Electric Power Research Institute[42]. However, the load on the power grid increases by the use of Plug-in electric vehicles. Hence, more power generating plants need to be installed to supply the peak load which will become very expensive. This will also require complete modification of the existing gasoline stations as well as the current electricity infrastructure. The problem of emission cannot be solved solely by PEVs and Plug-in hybrid electric vehicles since they need electricity which itself is a major source of emissions. This is why the success of PHEVs depends significantly on the utilization of renewable energy resources. Renewable Energy Sources (RESs) are a time varying resource and a dynamic approach is required to optimize their effects on the on the electrical and transportation industry in terms of the cost and the emissions generated.

The effects of PEVs and PHEVs on the electricity and transportation industries are optimized using two models-

- **Load-Leveling Model:** A random system is not feasible because the charging- discharging process cannot be optimized due to the randomness and the peak load is 50% more in the worst possible case. Thus, another possible solution is load-leveling. Load-leveling optimization is used to charge the electric vehicles through conventional generation. Estimating that a vehicle covers an average distance of 32 miles a day, requiring 0.25kWh/mile. Thus, 1 EV will require 8kWh/day. Assuming an average of 50,000 electric vehicles to be operating simultaneously at

the peak load; 400 MWh/day of extra electrical energy will be required. To counter this problem, this extra required energy is leveled and equally distributed over the off-peak hours to reduce the peak load.

- **Smart-Grid Model:** Here, EVs are charged from RESs and discharged back to the grid acting as a source of electricity. In this model the following are observed:

I. RESs reduce emission from the electrical power plant.

ii. EVs are used smartly as a load, small portable power plants and energy storages.

iii. Parking lots can be utilized as virtual power plants.

iv. A bio-inspired algorithm is used to minimize both, emissions and costs. This method is based on the behavior of birds and fishes. This algorithm is called Particle Swarm Optimization. Every potential solution (particle), flies with a velocity, dynamically adjusting it according to its own and other particles' flying experience in a multidimensional search space. The search space dimension, here, is reduced by binary and integer Particle Swarm Optimization.

Using these features, a smart schedule is generated for proper decision making, control and operations for maximum utilization of RESs efficiently to reduce emissions and the cost electric power.

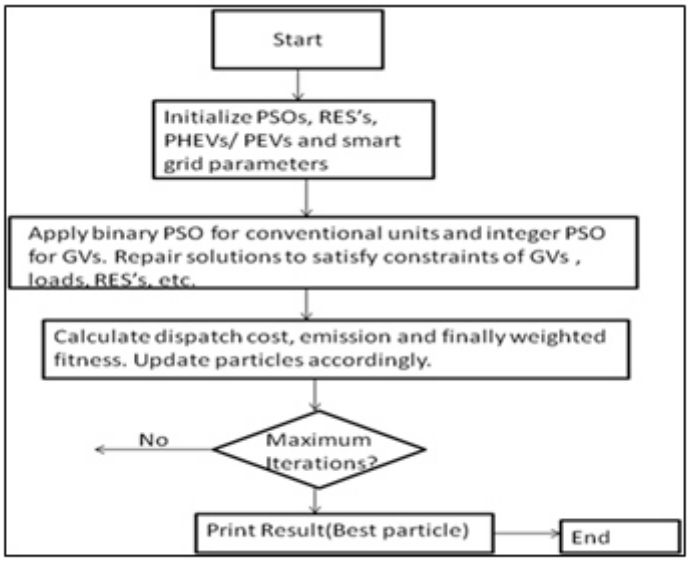


**Figure 12: Flowchart for minimization of cost and emission using GVs and RESs**

The disadvantage of the smart grid model for the optimized use of RESs is the high capital investment required for the establishment of RESs.This capital cost depends on the solar insulation and wind speed profile.

## 10. Conclusion

The advantages, disadvantages, economics, working, market trends, government incentives and the impact of PEVs to our future have been reviewed in this paper. A PHEV is preferred over a BEV due to its ability to function over large distances. PEVs are going to play a major role in the reduction of

emissions and in improving the air quality. The cost of the battery, noise pollution and the overloading of the electrical grid are the issues that hamper the extensive use of PEVs in the present day scenario.

The impact of PEVs on the distribution networks is the most important problem that needs to be addressed for PEVs to replace conventional vehicles globally. Use of renewable resources such as solar and wind energy reduces the emissions from electrical power plants. Smart-grids and load-leveling are some solutions that can be used to optimize the effect of PEVs. Further research must be done in the future to make the use of PEVs globally sustainable.

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# Multiband Circularly Polarized Optimize Microstrip Patch Antenna

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## A B S T R A C T

*In this paper, Ultra wideband circular Microstrip patch antenna is proposed. Over years, great interest was focused on microstrip antennas for their small volumes, low profiles, good integration, low costs and good performance. With the continuous growth of wireless communication service and the constant miniaturization of communication equipment, there are higher and higher demands for the volume of antennas, integration and working band. This paper presents A circular polarized (CP) Circular microstrip antenna with triple band for wireless communications system application which are suitable for the 2.6-GHz, 3.7-GHz and the 5-GHz triple-band operations. These systems may include various combinations of Bluetooth, WiMAX (Worldwide Interoperability for Microwave Access) and wireless local-area network (WLAN). A circular microstrip patch antenna is designed to operate at 2.6 (GHz) with circular polarization, a U slot is inserted thereafter in the original patch to generate the second resonant at 5.4 (GHz). Another C-slot is inserted thereafter to generate the 3.7 (GHz) third band. The C slot insertion effect on the original patch is examined, first arc length effect on the return loss and axial ration is examined in order to get the optimum length, and then the arc orientation effect also is examined to find out the best orientation to place the arc. This design has several advantages as the total antenna volume can be reused, and therefore the overall antenna will be compact. The design is verified through both numerical simulations and measurement of a fabricated prototype. The results confirm good performance of the single and multiband antenna design.*

***Keywords:*** *Triple Band, Dual band, Circular Polarization Antenna (CPA), Circular Microstrip Patch Antenna (CMPA).*

## 1. Introduction

Wireless communications have been developed widely and rapidly in the modern world especially during the last two decades. The future development of the personal communication devices will aim to provide image, speech and data communications at any time, and anywhere around the world. This indicates that the future communication terminal antennas must meet the requirements of multi-band or wideband to sufficiently cover the possible operating bands. However, the difficulty of antenna design increases when the number of operating frequency bands increases. In addition, for miniaturizing the wireless communication system, the antenna must also be small enough to be placed inside the system. However, in order to transmit and receive more information large bandwidths are required, and bandwidth enhancement is currently a popular research area.

The aim of this thesis is to design a Multiband circular polarized Microstrip patch antenna for wireless communication systems and study the effect of various antenna parameters like patch length (L), width (W), substrate parameters relative dielectric constant, truncated corners, substrate thickness etc. Here, coaxial feed method is used to excite the patch antenna.

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.

Microstrip antennas as in fig 1 are very attractive because of their low profile, low weight, conformal to the surface of objects and easy production. A large number of microstrip patches to be used in wireless applications have been developed [1–3]. Various shapes such as square, rectangle, ring, disc, triangle, elliptic, etc. have been introduced [4–7].

When compared with patch elements, the antennas with slot configurations demonstrate enhanced characteristics, including wider bandwidth, less conductor loss and better isolation. Particularly, the multi-slot structure is a versatile approach for multi-band and broadband design. Also, feeding these structures could be simpler by using suitable points to slot techniques for different slots. A dual band circularly polarized microstrip patch Antenna for Wi-Fi applications with an inserted U-slot with the dimension of according to high resonant frequency at 5.4 (GHz) to be inserted in the low frequency patch 2.6 (GHz) is designed operate at these frequency bands [8], simulated results are performed by using commercial software HFSS. Performance of the AR of the proposed antenna is examined through studying the effect of orientation angle of the slot. Also sweep displacement ranging vertically & horizontally is performed to examine the effect of the slot displacement on the return loss and find out the optimum place to get the best performance on the return lossIn this paper we are present a circular polarized (CP) circular microstrip antenna with triple band for wireless communications system applications which are suitable for the 2.6-GHz, 3.7-GHz and the 5-GHz triple-band operations. So a triple band is going to be generated to be operate on the third frequency band 3.5(GHz).

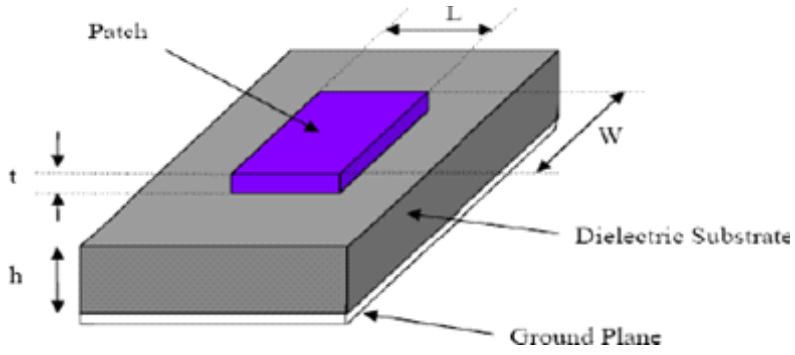


Figure 1: Structure of a Microstrip Patch Antenna

## 2. Antenna Configuration And Design

The geometry, parameters, top and bottom views for a prototype of the simple planar circular patch antenna are shown in Figure 2. The antenna consists of circular patch, 50 ohm micro strip line, a probe connector and ground. Circular patch is printed on the top side of the substrate. The planar circular patch is parallel to x-y plane; micro strip line is along the y-axis. The circle of radius R of dimension 5.24 mm is given. The defected ground structure is offered with the slot of 28.1mm X 10 mm.

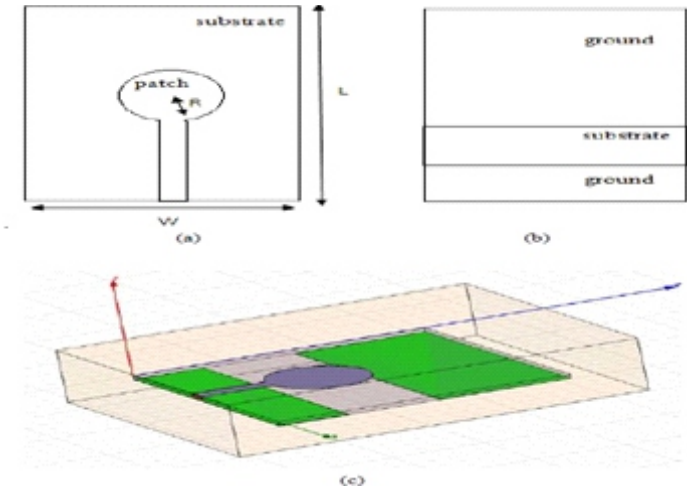


Figure 2: Geometry of circular patch for UWB communication (a) Top View (b) Bottom View (C) Design geometry

## 3. Triple Band Circularly Polarized MPA.

Triple-band operations of antenna have presented to satisfy wireless communications system needs. Triple-band antenna can be achieved by several techniques. Firstly one of the most popular techniques of designing multi-band printed antennas based on the ”window” concept having frequency band separation of 2:1 or 4:1 whereby windows were cut in a low frequency patch radiators to accommodate high frequency patch antennas. Or Slot loaded circular MPA. As we see several multi band microstrip antennas design have been reported over the years. A simple technique for achieving this has been to load the radiating patch with a slot inside the radiating patch. The triple frequency operation is achieved

when the two slots perturb the fundamental resonant frequency of the patch exciting new resonance modes. The resonance frequency of the new modes can be either lower or higher than the original dominant mode with either the same or orthogonal polarization and is strongly dependent on the slot dimensions. According to our Previous presented antenna we are restricted to the Cslot technique which is seems the most suitable one to be inserted into our antenna to generate the third frequency band 3.5(GHz). By using a substrate of FR4 ($\varepsilon r = 4.5$) and height (h = 1.8mm) and by using the same design shown in figure [19] a C-slot with an inner radius of (a=14 mm) and an outer radius of (b=15.5 mm) and arc angle of ($\beta = 180O$) as shown below in figure 3. Simulated return loss result is performed by using commercial software HFSS version-(8.0) they are shown in figure 4.

## 4. C-Slot Effect

The C- slot insertion has some effect on the original patch parameters performance, one of the main affected parameter was the return loss axial ratio. Which changes according to the arc length of the cslot and the orientation angle of the C-slot itself,

### A. Effect Of C-slot Length Polarization Of The First Frequency.

The C- slot insertion has some effect on the original patch parameters performance, one of the main affected parameter was the axial ratio also. Which changes according to the arc angle ($\beta$) of the C-slot itself, we examined these different angles which produce different arc length to see it's effect as shown in figure 4 and we found that the range of angles ($\beta = 1700$ to $\beta = 200o$) have the best axial ration performance as shown in figure 5.

### B. Effect Of C-Slot Length On Return Loss Of Triple Band Frequency.

An important parameter is the return loss of the low and high frequency band, where the arc length of the C-slot has a direct effect on the return loss, since by changing the arc angle we can get a different length of the same arc radius therefore, we tried a sweep range of arc angles to get arcs with different lengths to examine the effect of the C-slot arc length as shown in figure 6 on the return loss of the first and third frequency and find out the optimum arc length at angle of ($\beta = 200o$) to get the best performance on the return loss of both first and third frequency in addition to return loss of our new second band as shown in figure 7 and 8.

### C. Effect Of C-slot Orientation On Return Loss Of Triple Band Frequency.

The C-slot orientation has on the original patch affected the patch parameters performance, one of the main affected parameter was the return loss of both low and high frequency. Which changes according to the orientation angle ($\alpha$) of the C-slot itself, we examined these orientation angles effect as shown in figure 9 and we found that ($\alpha = -100$ & $\alpha = 0o$ & $\alpha = +10o$) angles have the best return loss performance on the first and third frequency as shown in figure 8 and on the second frequency on figure 11.

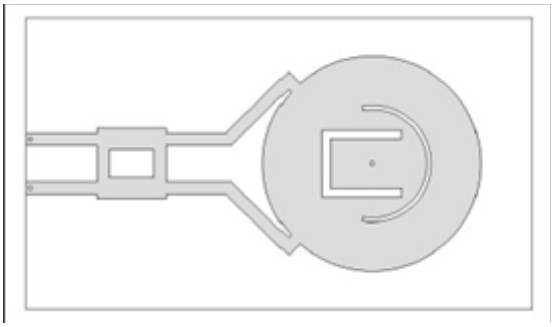

**Figure 3: CMPA Configuration with integrated power divider, inserted U slot and C Slot.**

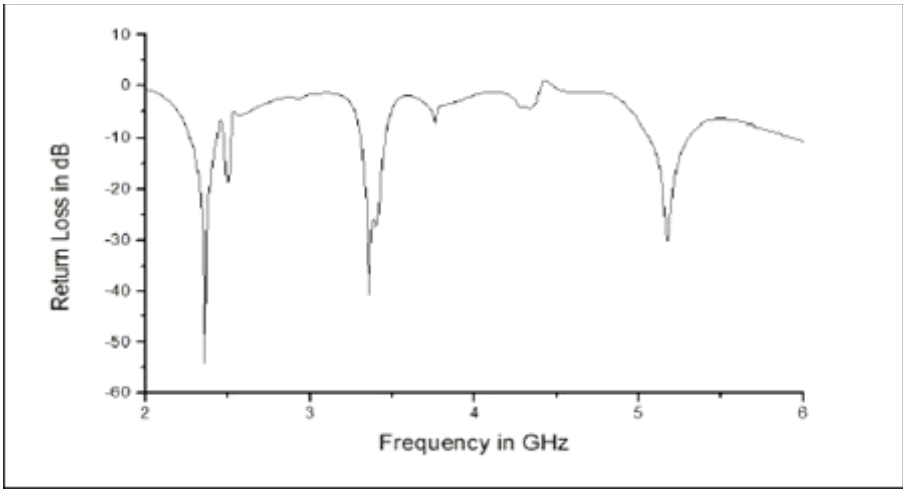


**Figure 4: Simulated return loss of the triple band of CMPA configuration in figure 3**

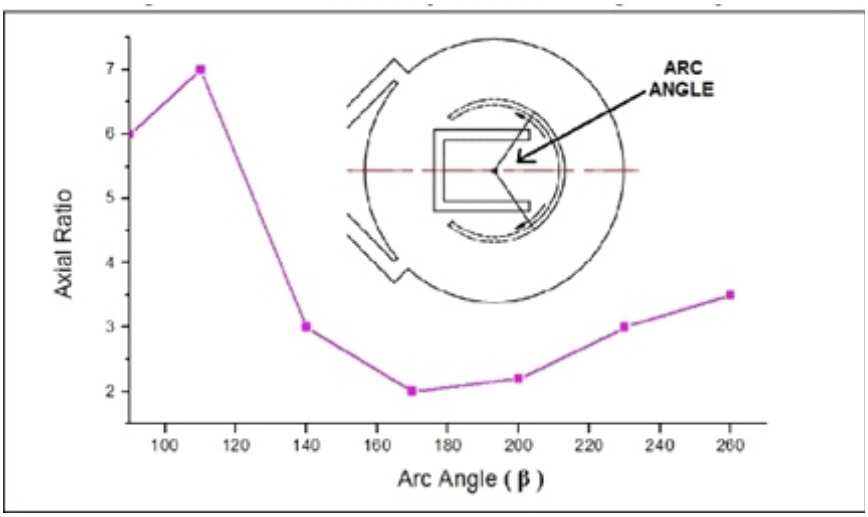


**Figure 5: Effect of different C-slot lengths on axial ratio of first frequency 2.4 GHz**

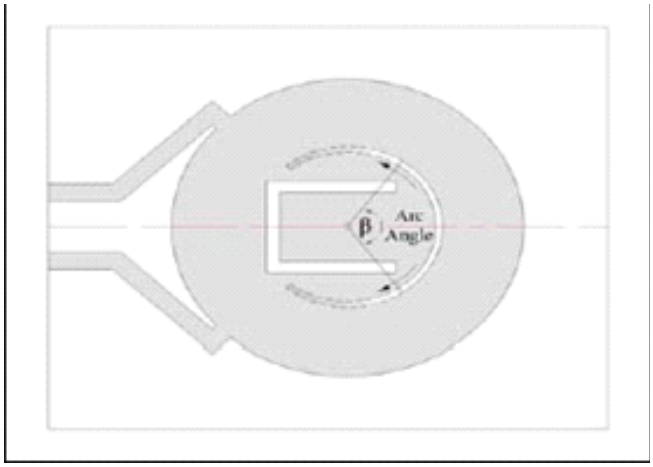


**Figure 6: CMPA Configuration with different C-Slot lengths**

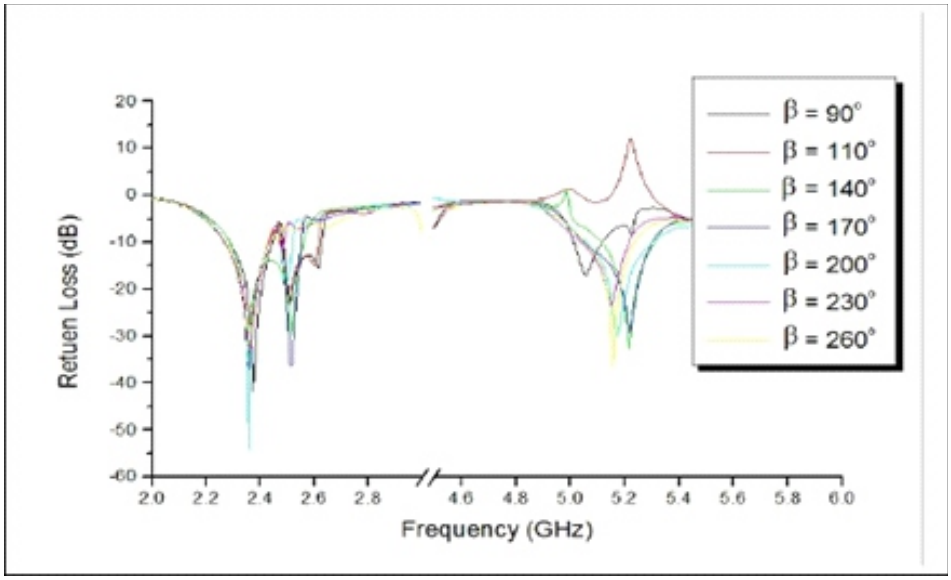


**Figure. 7: Effect of different C-Slot lengths on return loss of the first and third frequency**

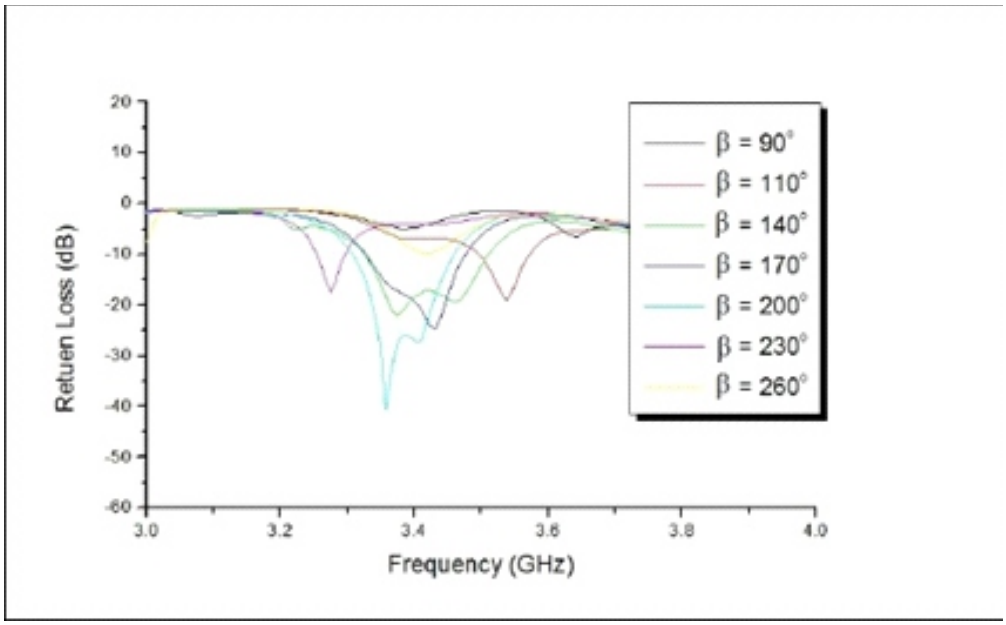


**Figure 8: Effect of different C-Slot lengths on return loss of the second frequency 3.5 GHz**

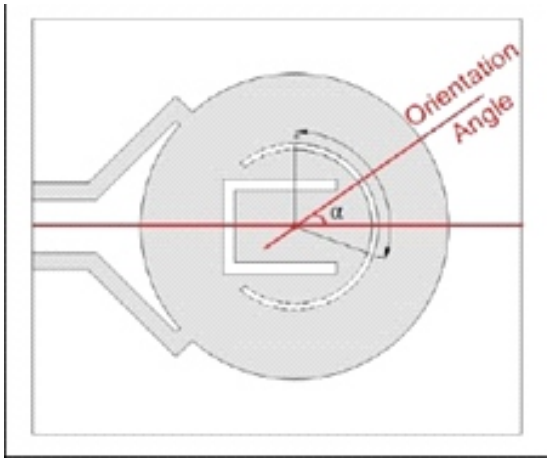


**Figure 9: CMPA Configuration with different C-Slot orientation angle α**

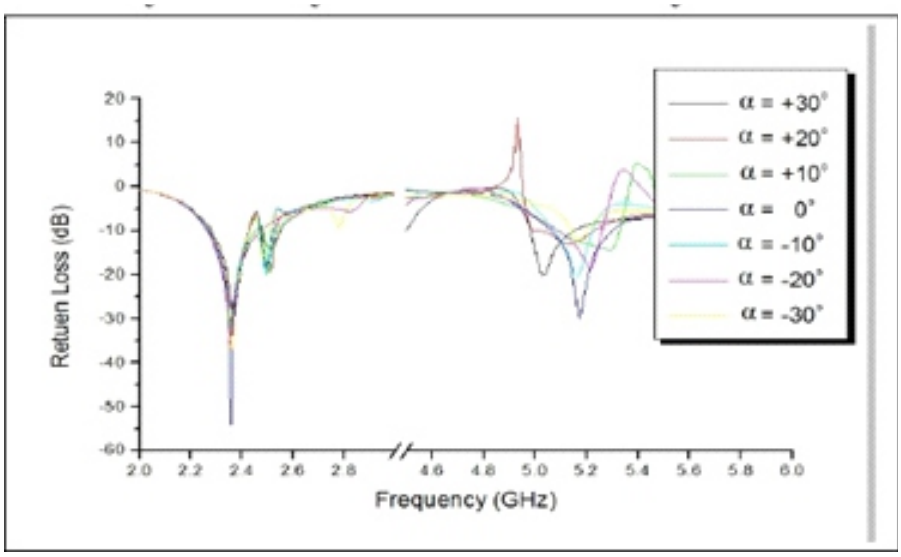


**Figure 10: Effect of different C-Slot orientation angle α on return loss of the first and third frequency**

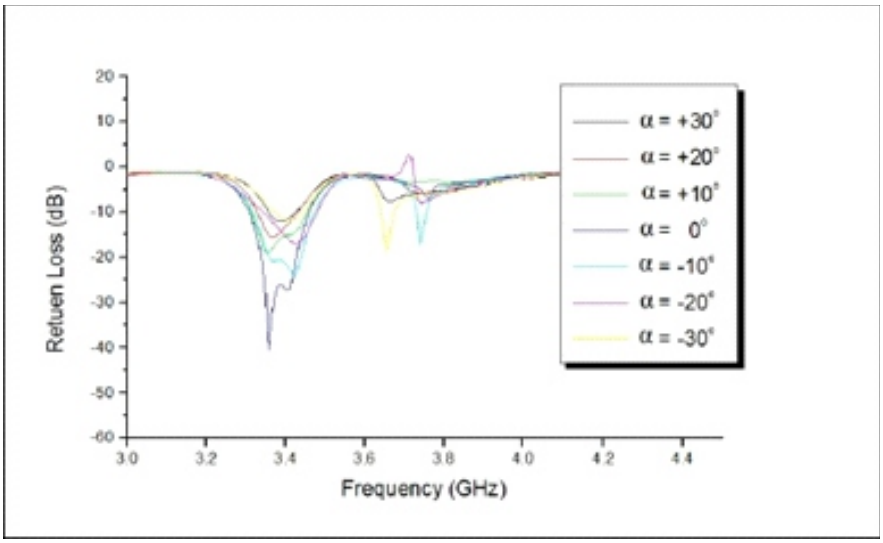


**Figure 11: Effect of different C-slot orientation angle α on return loss of the second frequency 3.5 GHz**

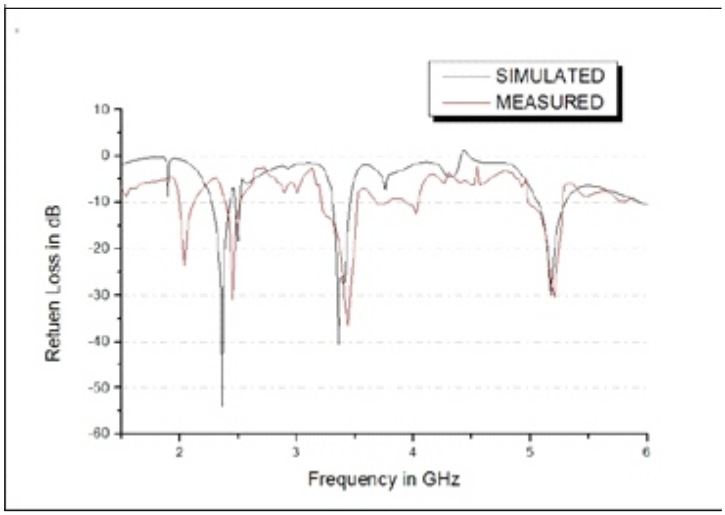


**Figure 12: Simulated and measured result of return loss for the triple band antenna configuration**

## 5. Conclusion

A circular microstrip patch antenna is designed to operate at 2.6 (GHz) with circular polarization, a U slot is inserted thereafter in the original patch to generate the second resonant at 5.4(GHz). Another C-slot is inserted thereafter to generate the 3.7 (GHz) third band. The C-slot insertion effect on the original patch is examined, first arc length effect on the return loss and axial ration is examined in order to get the optimum length, and then the arc orientation effect also is examined to find out the best orientation to place the arc. The design is verified through both numerical simulations and measurement of a fabricated prototype The results confirm good performance of the triple bands antenna design as shown in figure 12.

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