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Abstract

With the rapid proliferation of vehicle availability and usage in recent years, finding a vacant car parking space is becoming more and more difficult, resulting in a number of practical conflicts. Parking problems are becoming ubiquitous and ever growing at an alarming rate in every major city. Wide usage of wireless technologies with the recent advances in wireless applications for parking, manifests that digital data dissemination could be the key to solving emerging parking problems. Wireless Sensor Network (WSN) technologies have attracted increased attention and are rapidly emerging due to their enormous application potential in diverse fields. This field is expected to provide an efficient and cost-effective solution to the effluent car parking problems. This paper proposes a Smart Parking Management System based on wireless sensor network technology which provides advanced features like remote parking monitoring, automated guidance, and parking reservation mechanism. The paper describes the overall system architecture of our embedded system from hardware to software implementation in the view point of sensor networks.

One of the challenging problems for shopping mall and big parking area the vehicle owner are searching for parking in long time and many security issues in parking lot. In this paper we would like to propose finding free space in parking lot and it allocate to all car with nearest manner by using IR sensor. The slot availability details are collected using an GSM modem and are updated periodically into a web server via internet and the sensor data are stored in database it gives exact parking condition through webpage.

Index Terms—Wireless Sensor Networks (WSN), Smart Parking, Remote Monitoring, Automated Guidance.

I.INTRODUCTION

Recent increase in the growth of automotive industry coupled with the perpetual demand of commuters urged the have control at the entrance & exit and use vehicle detectors as an essential element to provide smart parking. Though inductive loop is one of the most widely used detectors today, it includes various problems in installation and maintenance which might disturb the normal operations of parking. The widespread use of wireless technologies paired with the advancement in wireless applications for parking implies that digital data dissemination could be the key for resolving the growing parking challenges. WSN have a great potential towards providing an easy and cost effective solution to this credible application for various reasons. Ease of deployment in existing parking lots without excavation and expensive cable installations has increased our attention towards wireless sensor network technology. Flexibility to couple with sophisticated but cheap sensors that can accurately detect vehicles makes WSN a natural candidate to solve the emerging car parking problems. Wireless sensor network usually consists of a large number of nodes that are deployed in the sensing area and are equipped with different kinds of sensing, computation and communication units. These functional units enable WSN nodes to cooperatively collect, process, and transmit information to the communication subsystem. Compared with the existing parking management systems, this paper proposes a Smart Parking solution based on wireless sensor network technology. Our choice was motivated by the need for an automated, cost-effective, real time and easy-to-use system for car parking. The proposed system is capable of monitoring & managing individual parking spaces, providing automated guidance and advanced reservation services as well. In the remainder of this paper, we present the complete overview of Smart Parking Management System, including the design and implementation of the developed prototype model as part of the project. We begin with a detailed discussion of related works on various parking management systems using WSN. We describe the system architecture of our proposed system and its functional components. Discusses the subsystem level interactions and user interfaces to the system. As a proof of concept, we present a full-fledged prototype deployment and give some preliming.

II.RELATED WORKS

In this section we review the literature on existing and proposed parking lot applications based on WSN. Lee, Yoon and Ghosh proposed a hybrid approach [1] For an intelligent parking system using a combination of ultrasonic and magnetic sensors. They demonstrated promising results through various real world experiments and showed that these hybrid solutions are more practical and accurate. Though the main goal was to count the number of vehicles on each floor and provide a cheap and accurate solution, the scope of their work restricts itself to vehicle detection using WSN than providing a smarter parking management solution. D-Systems Project [2] Presented various issues for a reliable WSN system using magnetic sensors. As part of this project an implementation of a car-park management system using a tiered architecture is detailed using magnetic sensor boards. of dynamic & robust routing, delayed retransmissions, etc. Jatuporn et al. [3], proposed optical WSN as a vehicle counting system in smart parking garages. Their proposed solution is to add another optical sensor head to the wireless sensor node. Two sensor heads were used to classify the objects of different sizes thereby distinguishing and identifying different vehicles.

III. OUR SYSTEM ARCHITECTURE
In this section, we describe the design of Smart Parking management system which consists of WSN, communication subsystem, Parking Management, Automated Guidance, Entrance Display and Client Reservation subsystems. At a glance, the system shall be able to graphically display real time information related to the availability of parking lots to the users and would also enable users to reserve parking lot from remote locations. The system will also be capable of guiding users to efficiently locate vacant parking spaces so as to park their cars quickly and safely. Figure 1 details the system architecture of our system. The overall architecture is divided into six major subsystems as mentioned. The functions of each subsystem are as follows.

A. WSN Subsystem

WSN subsystem mainly deals with monitoring of parking status. This subsystem detects the status of parking space with hybrid sensing techniques and transmits status information through RF. It also receives commands from parking management subsystem to carry out various procedures. The subsystem internally consists of four major modules which include sensing, routing, dissemination and status modules. System Architecture of our embedded system.

B. Communication Subsystem

This subsystem collects the parking status report from WSN subsystem and delivers them to the parking management subsystem. It acts as a gateway between wireless sensor network and external networks. This subsystem also forwards the information regarding the change in parking status received from management subsystem to the guidance subsystem through Wi-Fi/Bluetooth/RF interfaces.
C. Parking Management Subsystem

This subsystem acts as the heart of entire our system. Whenever communication subsystem sends data to the parking management subsystem, the gateway transceiver module associated with the subsystem receives the data, processes it and forwards to the database module and vice versa. The database module stores the event based sensor data and the health information of the sensor nodes. The sensor & guiding node information from the database will be collected by the parking guidance module and displays the corresponding information on the parking lot GUI. It also takes the health information from sensor health monitoring module & displays on GUI. Parking entrance display module existing on this subsystem gets consolidated status information from the database and then processes the information to be sent to the parking entrance display. Whenever the client reserves a parking lot, the reservation message will be forwarded to parking reservation module running on the management subsystem. It will further retrieve data from the sensor database and based on the availability of parking lots will forward an acknowledgment to the client.

D. Automated Guidance Subsystem

Guiding nodes divide their managing areas into several sections according to the turn offs of the parking layout. This subsystem helps vehicles to find idle parking spaces within less time. It consists of 2 modules which are as follows:

availability of the parking lots in all the directions (Left/Right/Ahead) which shown figure 7.

E. Entrance Display Subsystem

As the name suggests, this subsystem is placed at the entrance of the parking. It shows the status of the parking lots to the users before entering the parking area. This subsystem is divided into 2 modules as follows

a) Entrance Display Application

Whenever there is a change in the status, the parking entrance display module on the management subsystem processes the information and forwards it to the parking entrance display subsystem. The entrance display application running on this subsystem receives and processes the data. The processed data is then forwarded to the parking entrance display for displaying the status

b) Parking Entrance Display

This module displays the parking status information to the users received from the entrance display application. It shows the complete status of the whole parking layout (Total lots occupied/vacant) which shown figure 8.

F. Client Subsystem

Client Subsystem is the one which allows the clients to remotely interact with our system. This subsystem consists of 2 modules which mainly run on the clientele devices.

They are

ss1. Client Application

This mainly runs as a background process which processes the inputs given by the user through the parking reservation GUI and sends the information to the parking management subsystem.

2. Parking Reservation GUI

Parking reservation GUI is a front-end application running on the clientele devices allowing the users to give their parking details (License Number + Time of parking) in order to reserve a parking lot. This information is later processed by client application and sent to the parking management subsystem to allocate a parking lot

a) Guiding Application

If there is a change in the status, the management subsystem processes the information and forwards it to the sink subsystem. The processed data is then forwarded by sink subsystem to the guiding application running on the guidance subsystem, which is later depicted on parking guidance display.

b) Parking Guidance Display

This module collects the information from the guiding application and displays it to the users. It shows the

G. Sensing Technique

To detect an event we evaluate (Base light - Sn) > Threshold, where Base light is calculated through reference motes deployed in the parking lot. This value will eliminate the disparity in light readings due to environmental variations. Sn is the averaged light readings for a predefined period of time (1 second in our case). If the difference in readings exceed the set threshold, then we assume that the lot is occupied with a car, else, we consider that the lot is vacant.

while(1)
{
    do
    {
        temp = rx();
    }
    while(temp!=='A');
    //printf("%b\r\n", temp); temp = rx(); cmd_lcd(0x8e);
    dat_lcd(temp);
    temp1 = 0x39-temp;
    temp2 = temp1+0x30; cmd_lcd(0xCe); dat_lcd(temp2);
    printf("Vehicles Parked :%c\n", temp);
    printf("Vacancy Slots: %c\n\n", temp2);
}

6. PROTOTYPE OF PARKING LAYOUT
Our prototype system is developed as a proof of concept to meet the real time requirements of parking management systems. We have carried out preliminary experiments to evaluate the functionalities and features provided by our prototype system. In our initial experiment we have modelled this prototype for 4 parking lots which is shown in figure 4.

1 Parking Monitoring

a) Scenario 1: Total parking lots are vacant: When all the parking lots are vacant, the sensor nodes placed in the parking lots detect that there is no event generated. The entrance display shows total vacant lots as 4 and parking lot as 0 and GUI depicts the same as shown in figure 8.

b) Scenario 2: Two cars are parked: In this scenario we experimented by parking two cars in the parking lots. The sensor nodes detected the events and transmitted the report message to the communication subsystem. The communication subsystem in turn forwarded these messages to the management server. The management server processes this information and sends the status report to the respective guiding nodes and entrance display. The entrance display and parking lot GUI then, displayed the total no of vacant lots as 2.

3. Parking Guidance

We depict the feature of parking guidance provided by our prototype system in this case. The parking guiding nodes are deployed at the turn offs of the parking area these nodes depict the availability of parking lots in three directions (left/right/ahead) which is shown in figure 5.

V. CONCLUSION

In this paper, we described the Smart management system...
using wireless sensor networks. Based on the requirement analysis for existing car parking management systems, we designed the system architecture and its subsystem level components. We implemented a full-fledged prototype model as a proof of concept to realize and understand the real time scenarios in parking management systems. Through our prototype system we demonstrated that the proposed architecture can effectively satisfy the requirements of a car park management system and we believe that wireless sensor networks can be a promising technology to solve future parking hassles.

REFERENCES

[9] Michelle Crowder, C. Michael Walton Developing An Intelligent Parking System For The University Of Texas At Austin, Research Report Swutc/03/167229-I
Renewable Energy Sources Using Quasi-Z-Source Inverter With Distribution Level Power-Quality Improvement
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Abstract:
Quasi-Z-source inverters (QZSI) acquire all the advantages of traditional Z source inverter. The impedance network couples the source and the inverter to achieve voltage boost and inversion in a single stage. By using this new topology, the inverter draws a constant current from the PV array and is capable of handling a wide input voltage range. It also features lower component ratings, reduces switching ripples to the PV panels, causes less EMI problems and reduced source stress compared to the traditional ZSI.
The quasi-Z-source inverter (QZSI) is a single stage power converter derived from the Z-source inverter topology, employing an impedance network which couples the source and the inverter to achieve voltage boost and inversion. A new carrier based pulse width modulation (PWM) strategy for the (QZSI) which gives a significantly high voltage gain compared to the traditional PWM techniques is implemented. This technique employs sine wave as both carrier and reference signal, with which the simple boost control for the shoot-through states is integrated to obtain an output voltage boost. The conventional triangular wave carrier used in simple boost control technique is replaced by sine wave, which improves the shoot-through duty ratio for a given modulation index. The conventional perturb and observe maximum power point tracking algorithm is modified for QZSI and used along with the PWM technique for tracking the maximum power from PV. All the simulations are done using MATLAB. Hardware implementation and Microcontroller programming are done in the lab. All of these functions may be accomplished either individually or simultaneously. The combination of grid-interfacing inverter and the 3-phase linear/non-linear unbalanced load at point of common coupling appears as balanced linear load to the grid. This new control concept is demonstrated with extensive MATLAB/Simulink simulation studies and validated through digital signal processor-based laboratory experimental results.

Index Terms: Distributed generation (DG), distribution system, grid interconnection, power quality (PQ), renewable energy.

INTRODUCTION
Electric utilities and end users of electric power are becoming increasingly concerned about meeting the growing energy demand. Seventy five percent of total global energy demand is supplied by the burning of fossil fuels. But increasing air pollution, global warming concerns, diminishing fossil fuels and their increasing cost have made it necessary to look towards renewable sources as a future energy solution. Since the past decade, there has been an enormous interest in many countries on renewable energy for power generation. The market liberalization and government’s incentives have further accelerated the renewable energy sector growth. Renewable energy source (RES) integrated at distribution level is termed as distributed generation (DG). The utility is concerned due to the high penetration level of intermittent RES in distribution systems as it may pose a threat to network in terms of stability, voltage regulation and power-quality (PQ) issues. Therefore, the DG systems are required to comply with strict technical and regulatory frameworks to ensure safe, reliable and efficient operation of overall network. With the advancement in power electronics and digital control technology, the DG systems can now be actively controlled to enhance the system operation with improved PQ at PCC. However, the extensive use of power electronics based equipment and non-linear loads at PCC generate harmonic currents, which may deteriorate the quality of power.

Generally, current controlled voltage source inverters are used to interface the intermittent RES in distributed system. Recently, a few control strategies for grid connected inverters incorporating PQ solution have been proposed. In an inverter operates as active inductor at a certain frequency to absorb the harmonic current. But the exact calculation of network inductance in real-time is difficult and may deteriorate the control performance. A similar approach in which a shunt active filter acts as active conductance to dump out the harmonics in distribution network is proposed. In a control strategy for renewable interfacing inverter based on theory is proposed. In this strategy both load and inverter current sensing is required to compensate the load current harmonics.

The non-linear load current harmonics may result in voltage harmonics and can create a serious PQ problem in the power system network. Active power filters (APF) are extensively used to compensate the load current harmonics and load unbalance at distribution level. This results in an additional hardware cost. However, in this paper authors have incorporated the features of APF in the, conventional inverter interfacing renewable with the grid, without any additional hardware cost. Here, the main idea is the maximum utilization of inverter rating which is most of the time underutilized due to intermittent nature of RES. It is shown in this paper that the grid-interfacing inverter can effectively be utilized to perform following important functions: 1) transfer of active power harvested from the renewable resources (wind, solar, etc.); 2) load reactive power demand support; 3) current harmonics compensation at PCC; and 4) current unbalance
and neutral current compensation in case of 3-phase system. Moreover, with adequate control of grid-interfacing inverter, all the four objectives can be accomplished either individually or simultaneously. The PQ constraints at the PCC can therefore be strictly maintained within the utility standards without additional hardware cost.

The paper is arranged as follows: Section II describes the system under consideration and the controller for grid-interfacing inverter. A digital simulation study is presented in Section III. Extensive experimental results are discussed in Section IV and, finally, Section V concludes the paper.

**SYSTEM DESCRIPTION**

The proposed system consists of RES connected to the dc-link of a grid-interfacing inverter. The voltage source inverter is a key element of a DG system as it interfaces the renewable energy source to the grid and delivers the generated power. The RES may be a DC source or an AC source with rectifier coupled to dc-link. Usually, the fuel cell and photovoltaic energy sources generate power at variable low dc voltage, while the variable speed wind turbines generate power at variable ac voltage. Thus, the power generated from these renewable sources needs power conditioning (i.e., dc/dc or ac/dc) before connecting on dc-link. The dc capacitor decouples the RES from grid and also allows independent control of converters on either side of dc-link.

### A. DC-Link Voltage and Power Control Operation

Due to the intermittent nature of RES, the generated power is of variable nature. The dc-link plays an important role in transferring this variable power from renewable energy source to the grid. RES are represented as current sources connected to the dc-link of a grid-interfacing inverter. The systematic representation of power transfer from the renewable energy resources to the grid via the dc-link. The current flow on the other side of dc-link can be represented as, where and are total power available at grid-interfacing inverter side, active power supplied to the grid and inverter losses, respectively.

The actual dc-link voltage is sensed and passed through a first-order low pass filter (LPF) to eliminate the presence of switching ripples on the dc-link voltage and in the generated reference current signals. The difference of this filtered dc-link voltage and reference dc-link voltage is given to a discrete-PI regulator to maintain a constant dc-link voltage under varying generation and load conditions. The dc-link voltage error at the sampling instant is given as:

\[ V_{dcerr}(n) = V_{dc}(n) - V_{dcref}(n). \]

The output of discrete-PI regulator at the sampling instant is expressed as

\[ I_m(n) = I_m(n-1) + K_P V_{dcerr}(n) + K_I V_{dcerr}(n-1). \]

Proportional and integral gains of dc-voltage regulator. The instantaneous values of reference three phase grid currents are computed as

\[ I_a^* = I_m \cdot U_a, \]
\[ I_b^* = I_m \cdot U_b, \]
\[ I_c^* = I_m \cdot U_c. \]

The neutral current, present if any, due to the loads connected to the neutral conductor should be compensated by fourth leg of grid-interfacing inverter and thus should not be drawn from the grid. In other words, the reference current for the grid neutral current is considered as zero and can be expressed as

\[ I_n^* = 0. \]
The reference grid currents ($I_a^*, I_b^*, I_c^*$ and $I_n^*$) are compared with actual grid currents ($I_a$, $I_b$, $I_c$ and $I_n$) to compute the current errors as

$$I_{a\text{err}} = I_a^* - I_a$$
$$I_{b\text{err}} = I_b^* - I_b$$
$$I_{c\text{err}} = I_c^* - I_c$$
$$I_{n\text{err}} = I_n^* - I_n.$$

These current errors are given to hysteresis current controller. The hysteresis controller then generates the switching pulses ($P_1$ to $P_5$) for the gate drives of grid-interfacing inverter. The average model of 4-leg inverter can be obtained by the following state space equations

$$\frac{dI_{\text{Inv}a}}{dt} = \frac{(V_{\text{Inv}a} - V_a)}{L_{sh}}$$
$$\frac{dI_{\text{Inv}b}}{dt} = \frac{(V_{\text{Inv}b} - V_b)}{L_{sh}}$$
$$\frac{dI_{\text{Inv}c}}{dt} = \frac{(V_{\text{Inv}c} - V_c)}{L_{sh}}$$
$$\frac{dV_d}{dt} = \frac{(I_{\text{Inv}ad} + I_{\text{Inv}bd} + I_{\text{Inv}cd} + I_{\text{Inv}nd})}{C_d}.$$

Where, $V_{\text{Inv}a}$, $V_{\text{Inv}b}$, $V_{\text{Inv}c}$, and $V_{\text{Inv}n}$ are the three-phase ac switching voltages generated on the output terminal of inverter. These inverter output voltages can be modeled in terms of instantaneous dc bus voltage and switching pulses of the inverter as

$$V_{\text{Inv}a} = \frac{(P_a - P_4)}{2}V_{dc}$$
$$V_{\text{Inv}b} = \frac{(P_b - P_5)}{2}V_{dc}$$
$$V_{\text{Inv}c} = \frac{(P_c - P_6)}{2}V_{dc}$$
$$V_{\text{Inv}n} = \frac{(P_n - P_7)}{2}V_{dc}.$$

Similarly the charging currents for $I_{\text{Inv}ad}$, $I_{\text{Inv}bd}$, $I_{\text{Inv}cd}$, on dc bus due to the each leg of inverter can be expressed as

$$I_{\text{Inv}ad} = I_{\text{Inv}a}(P_1 - P_4)$$
$$I_{\text{Inv}bd} = I_{\text{Inv}b}(P_2 - P_5)$$
$$I_{\text{Inv}cd} = I_{\text{Inv}c}(P_3 - P_6)$$
$$I_{\text{Inv}nd} = I_{\text{Inv}n}(P_4 - P_7).$$

**SIMULATION RESULTS**

In order to verify the proposed control approach to achieve multi-objectives for grid interfaced DG systems connected to a 3-phase network, an extensive simulation study is carried out using MATLAB/Simulink. A 4-leg current controlled voltage source inverter is actively controlled to achieve balanced sinusoidal grid currents at unity power factor (UPF) despite of highly unbalanced nonlinear load at PCC under varying renewable generating conditions. A RES with variable output power is connected on the dc-link of grid-interfacing inverter. An unbalanced 3-phase 4-wire nonlinear load, whose unbalance, harmonics, and reactive power need to be compensated, is connected on PCC.

The experimental results for simultaneous active power filtering and RES power injection mode are in this case study it is considered that the generated power at grid-interfacing inverter is more than the total load power demand. Therefore, after meeting the load power demand, the additional RES power flows towards grid.

Positive values of grid active-reactive powers and inverter active-reactive powers imply that these powers flow from grid side towards PCC and from inverter towards PCC, respectively. The active and reactive powers absorbed by the load are denoted by positive signs. Thus, this mode of operation validates the concept of utilization of grid-interfacing inverter as shunt APF when there is no power generation from the RES. The experimental results demonstrate the effective compensations of load current unbalance, harmonics and reactive power.

**C. Dynamic Performance of Proposed Control Approach**

The experimental results to validate the dynamic performance of proposed control approach under different modes of operation. Initially, it is considered that the system is working under mode-A operating condition (i.e., non-linear load current harmonics and reactive power compensation). After few cycles, the power at dc-link is initially increased and then decreased, which can be noticed from the amplitude of injected inverter current profile. The corresponding decrease (for increased power level at dc-link) and increase (for decreased power level at dc-link) in
grid current magnitude can also be noticed from Fig. 10, under constant load conditions.
Experimental results: Dynamic performance of proposed approach

CONCLUSION
This paper has presented a novel control of an existing grid interfacing inverter to improve the quality of power at PCC for a 3-phase DG system. It has been shown that the grid-interfacing inverter can be effectively utilized for power conditioning without affecting its normal operation of real power transfer. The grid-interfacing inverter with the proposed approach can be utilized to: i) inject real power generated from RES to the grid, and/or, ii) operate as a shunt Active Power Filter (APF). This approach thus eliminates the need for additional power conditioning equipment to improve the quality of power at PCC. Extensive MATLAB/Simulink simulation as well as the DSP based experimental results have validated the proposed approach and have shown that the grid-interfacing inverter can be utilized as a multi-function device. It is further demonstrated that the PQ enhancement can be achieved under three different scenarios: 1) \( P_{\text{RES}} = 0 \), 2) \( P_{\text{RES}} < P_{\text{Load}} \), and 3) \( P_{\text{RES}} > P_{\text{Load}} \). The current unbalance, current harmonics and load reactive power, due to unbalanced and non-linear load connected to the PCC, are compensated effectively such that the grid side currents are always maintained as balanced and sinusoidal at unity power factor. Moreover, the load neutral current is prevented from flowing into the grid side by compensating it locally from the fourth leg of inverter. When the power generated from RES is more than the total load power demand, the grid-interfacing inverter with the proposed control approach not only fulfills the total load active and reactive power demand (with harmonic compensation) but also delivers the excess generated sinusoidal active power to the grid at unity power factor.

REFERENCES
A MANET Security Using Routing Methodology

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Abstract—Wireless networks are growing now in these days and different kind of wireless applications are developed using ad hoc configuration. Mobile ad hoc network is a kind of such wireless network. Due to its ad hoc nature and mobility support the routing protocol played essential role in network. The main responsibility of routing protocol is to create and maintain topology on demand basis. Therefore the ad hoc network is suffers from performance and security issues. Therefore the proposed study investigates the routing protocols supported by mobile ad hoc network and the routing based attack deployment techniques. After analysing them a solution for black hole attack security is provided. The proposed solution involves the implementation of secure route discovery protocol. In order to implement the proposed routing technique traditional AODV routing protocol is modified. The routing protocol is modified in such ways by which the routing path trust value is evaluated and compared for making a decision for malicious path detection. For creating the decisional threshold packet delivery ratio, energy and high sequence number is selected. The implementation and simulation of the proposed routing protocol is performed using network simulator 2. In addition of that the comparative performance study between AODV routing protocol and modified AODV routing protocol is performed. In the comparative study packet delivery ratio and throughput of network is found optimum and better than traditional routing protocol.

Keywords—MANET, Black hole attack, MAC, AODV, QOS, NS2, Packet delivery ratio

I. Introduction

Mobile ad hoc is a popular communication network in research and development. Due ad hoc nature the main responsibility of data transmission and topology formation is depends on the routing technique. Therefore a number of different kinds of routing protocols are supportable in network. AODV is one of the most popular routing protocols in ad hoc network. The AODV routing protocol is an on demand vector routing protocol. According to the AODV routing strategy it does not collect the routing information periodically. This discovers path on demand basis. Therefore whenever a sender wants to send data to a target node the route discovery process is initiated. During this process first the source router broadcast a RREQ (route request) packet and when the RREQ packet riches to the target node. The target node sends the RREP (route reply) message to the sender. Source node receives the route reply from different routes and the routing table is updated. The first path is routing table is preferred for the routing purpose.

On the other hand when a malicious node deployed in network the malicious node start advertise, and promising to have the shortest path for the target node. The source router starts sending through the available shortest path. This leads the drop of all the data, thus performance of the network is degraded significantly. Thus in order to detect the attack deployment and preserve the network performance a new routing protocol is introduced. The proposed routing technique usages the highest sequence number, remaining energy and packet delivery ratio for locating the malicious node. The utilization of the given network parameters using the routing protocol is reported in further sections.

II. PROPOSED WORK

The mobile ad hoc network supports a number of different routing protocols. These protocols are used for finding the optimum route between source and destination. During study there are OLSR, AODV, DSDV and DSR routing protocols are found which frequently used in MANET simulation. In order to implement the proposed solution the AODV routing protocol is suggested to analyse. The AODV routing is an on demand vector routing protocol which find route when necessary. Additionally the routing protocol has higher performance over the studied routing protocols.
The proposed routing protocol is an extension of the traditional routing protocol, thus some of the properties of traditional routing is utilized. In addition of that some new properties are added to the newer routing protocol. Therefore the proposed system is works on the basis of the given figure. According to the above given diagram first the routing protocol compute the threshold values and then the route discovery is performed. These threshold values are estimated in normal network conditions when malicious node is not present in network. Thus using different communication sessions the threshold values are calculated to make decisions of secure routing path discovery. The proposed routing protocol is waiting till the entire possible path among source and destination is not discovered. In other words the source waits for the replies from all the neighbours. After finding all the possible routes form the target node source router contains a list of possible routes and the shortest path. Now one by one the entire routing path among source and destinations are evaluated and the detection of malicious node is performed if exist in the concerning route. Therefore in order to describe the entire process of the proposed routing protocol the entire routing process can be divided in three different modules.

1. Threshold computation
2. Route discovery
3. Routing decisions

### 1. Threshold computation
The threshold values are help in making the routing decisions for selecting the appropriate path. Most of time the malicious attacker is found in first routing path in routing path but for evaluation of first path and assuring the security for multiple malicious nodes in network a history table of sessions is created as the given manner in table.

<table>
<thead>
<tr>
<th>Node ID</th>
<th>Remain energy</th>
<th>Packet delivery ratio</th>
<th>Last sequence number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table history table
Using the history table values the three different parameters as threshold is computed using the following formulas.

For energy

$$E_t = \frac{1}{n} \sum_{i=0}^{n} E_i$$

The energy is an essential network parameter the mobile ad hoc network devices are made with limited resources. When a malicious node is deployed in network the node replies all the nodes when it found the RREQ message. According to the literature for each device events the node consumes a fixed amount of energy thus if node frequently replies the request then the node losses their energy rapidly.

For packet delivery ratio

$$P_t = \frac{1}{n} \sum_{i=0}^{n} P_i$$

According to the black hole nodes properties when the malicious node find the data packets it drop the whole data. Therefore the node has the low packet delivery ratio as compared to other nodes in network.

And for sequence numbers

$$S_t = \frac{1}{n} \sum_{i=0}^{n} S_i$$

Sequence number is one of the most essential node properties of the network. Highest sequence
number means the router contains the fresh route to the destination. After computing the threshold values the route discovery process is taken place as given in the next section.

2. Route discovery
As discussed previously the proposed routing protocol is an extension of traditional AODV routing protocol. Therefore the route discovery is performed in traditional process of AODV. In this manner first the source node broadcast the RREQ (route request) packets for the target node. As the RREQ found at the target node the RREP message is broad casted and different reply message from different sources are found at source node. Thus the source node routing table is updated and a number of different paths for data transmission is available. Now first path is selected and detection process is taken place in the below given manner.

3. Routing decisions
In order to perform the detection of the malicious host in network the following process is taken place:
Suppose the network contains N nodes such that

\[ N = \{N_1, N_2, ..., N_n\} \]

And for each node the remaining energy is denoted by \(E_i\) where the \(i = \{1, 2, ..., n\}\) similarly the node PDR is denoted using \(P_i\) and the sequence number of \(i^{th}\) node is given by \(S_i\). For evaluating the suspected node an array of node is created which is named as SS Now the node evaluation process is performed in the following steps.

Step 1: finding suspected node

\[
\text{For each node in routing path} \{ \\
\text{If } (E_i \leq E_t \text{ and } S_i \geq S_t) \\
\quad \text{Node marked as suspected; SS.add } (N_i) \\
\} \\
\}
\]

Step 2: finding malicious node

\[
\text{For each node in suspected list} \{ \\
\text{If } (P_i \leq P_j) \\
\quad \text{// node marked as malicious node and eliminate the route} \\
\}
\]

II. NETWORK SETUP

1. Simulation Setup
In this section provides the desired network configuration for simulation of security scheme implementation using AODV routing protocol.

<table>
<thead>
<tr>
<th>Simulation properties</th>
<th>Values</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antenna model</td>
<td>Omni Antenna</td>
<td>In radio communication, an Omnidirectional antenna is an antenna which emits radio wave power regularly over all directions in a plane, using the emitted power reducing with elevation angle above or below the plane, reducing to zero on the antenna's axis. This emission pattern is often called as &quot;doughnut shaped&quot;.</td>
</tr>
<tr>
<td>Dimension</td>
<td>1000 X 1000</td>
<td>That is size of the simulation screen where the mobile and base station</td>
</tr>
<tr>
<td>Radio-propagation</td>
<td>Two Ray Ground</td>
<td>This model, the shadowing fading factor is not considered. For that reason, for an exclusive distance, the (P_r) is a deterministic value.</td>
</tr>
<tr>
<td>Channel Type</td>
<td>Wireless Channel</td>
<td>This list of WLAN channels is the set of validly allowed Wireless LAN channels using IEEE 802.11. The 802.11 workgroup currently documents use in three different frequency ranges 2.4 GHz, 3.6 GHz and 4.9/5.0 GHz bands.</td>
</tr>
<tr>
<td>No of Mobile Nodes</td>
<td>30</td>
<td>Nodes in the simulation presents the devices that behaves like actual mobile devices and base stations</td>
</tr>
<tr>
<td>Routing protocol</td>
<td>AODV</td>
<td>The Ad hoc On Demand Distance Vector</td>
</tr>
</tbody>
</table>
(AODV) routing algorithm is a routing protocol designed for MANET. AODV is capable of both unicast and multicast routing.

| Time of simulation | 50.0 Sec. | The total time when the simulation is visible and locating its positions. |

Table network setup

2 Simulation scenarios

After setting up desired network configuration the proposed simulation model is desired to introduce. Thus in order to simulate the effect of the black hole attack on unsecured network and the effectiveness of the proposed technique is given using the following simulation scenario:

1. Implementation of traditional AODV routing: In this experimentation a mobile ad hoc network is prepared and configured using AODV routing protocol. After that a malicious node (black hole node) is deployed on the network. After deploy in the attack the malicious node initiate working and drops almost all the captured packets. And during this process the performance of the routing protocol using the obtained trace file is evaluated. The simulation scenario can be visualized according to the figure

2. Implementation of the proposed routing technique:

In this simulation scenario the mobile ad hoc network is configured using the proposed routing protocol. After that a malicious node is deployed over the network. Finally the performance of evaluation of the proposed technique is evaluated in terms of throughput, end to end delay and packet delivery ratio.

3 Traditional AODV:

1. Initially the network is functioning normally even when a malicious node is deployed on network.
2. When a network node tries to discover the route the malicious node starts working
3. If more than one session is active in network, most of the traffic attracted towards the malicious node.

4 Proposed routing technique:
1. Initially the network functioning normally even a malicious node deployed
2. The network acts as normal function during different communication sessions under attack conditions.

5 Performance Evaluations
The given chapter provides the detailed experimentations and their results evaluation. In order to perform the results analysis the comparison of the obtained results are performed in terms of throughput, packet delivery ratio and end to end delay.

6. End to end delay
End to end delay on network refers to the time taken for a packet to be transmitted across a network from source to destination device. The end to end of both the methods during attack deployment is given using figure. In this diagram blue line represents proposed routing scheme and the green line shows the traditional AODV routing performance in terms of end 2 end delay. In this diagram the X axis shows the packets ID and the Y axis shows the end to end delay of network during black hole attack deployment. According to the obtained results the end to end delay of the proposed routing technique is less than the traditional AODV routing. Therefore the performance of the network is not much affected by the proposed routing scheme.

7 Packet delivery ratio
Packet delivery ratio provides information about the performance of any routing protocols, where PDR is estimated using the formula given

\[
\text{packet delivery ratio} = \frac{\text{total delivered packets}}{\text{total sent packets}}
\]
The comparative packet delivery ratio of both the routing protocols are given using figure 6.5, in this diagram the amount of packet successfully delivered by the proposed routing technique is given using blue line and the green line shows the packet delivery ratio of the traditional AODV routing protocol. For demonstrating the results X axis contains the simulation time in terms of second and Y axis shows the total percentage of packet delivered. According to the obtained results the performance of the proposed routing protocol is higher than the traditional routing protocol during attack conditions.

**8 Throughput**

Network throughput is the usual rate of successful delivery of a message over a communication medium. This data may be transmit over a physical or logical link, or pass by a certain network node. The throughput is calculated in terms of bit/s or bps, and occasionally in terms of data packets per time slot or data packets per second. The given diagram 6.6 shows the comparative throughput between traditional AODV (represented using green line) and the proposed AODV routing (given using blue line). In this diagram the X axis shows the simulation time in seconds and the Y axis represents the throughput in terms of KBPS. According to the evaluated results the obtained throughput by the proposed routing protocol is much better than the traditional AODV routing protocol during black hole attack deployment.

**III. Conclusions**

Mobile ad hoc network is a kind of wireless network. That supports mobility and decentralized manner of communication. The routing protocols are responsible for creating and managing the routes for communication. Thus the network is suffers from the performance and security issues. Most of security flaws are occurred in the network due to the routing strategy. The presented work introduces a security system for mobile ad hoc network. This security protocol provides the secure AODV routing technique against black hole attack. In black hole attack the attacker deploy the attack using a malicious host. According to the routing technique secure routing protocol search the secure route between source and destination. Therefore, first a threshold value of network parameters is prepared using energy, sequence number and packet drop ratio. After route discovery most of the methods are evaluate only first route for attack detection, and if a malicious node found in path then again route discovery is performed. Thus leads additional time and control message exchange in network. Therefore the traditional system affects the performance in terms of energy and packet delivery ratio. In order to simulate the entire issues and solution process a simulation using NS2 network simulator.
is provided. After implementation of the proposed routing protocol the performance of the network is evaluated in terms of packet delivery ratio, throughput and end to end delay. The performance results are summarizing in the given table 7.1.

<table>
<thead>
<tr>
<th>S. No</th>
<th>Parameters</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Packet delivery ratio</td>
<td>With respect to the traditional routing protocol the performance of proposed routing protocol is better and even not affected during black hole attack.</td>
</tr>
<tr>
<td>2</td>
<td>Throughput</td>
<td>The routing offers the next route adaptation policy for improving additional control message exchange rate. Thus network offers the better throughput in attack conditions.</td>
</tr>
<tr>
<td>3</td>
<td>End 2 end delay</td>
<td>The end to end delay of network is much better than the traditional routing protocol even when the attack is deployed in network.</td>
</tr>
</tbody>
</table>

Table 7.1 performance summary
According to obtained results and performance the routing protocol complete the proposed objective of study. The future extension of the presented protocol is given in next section.

1 Advantage
The mobile ad hoc network is a wirelessly group of nodes. In this network a node can any time leave or join the network thus a probability occurred a malicious node can join the network and active communication any time. In order to improve the security gap, the proposed routing technique offer the following advantages over the traditional routing protocol.

1. Able to locate the malicious attacker: the proposed technique is able to distinguish the malicious and trust worthy nodes among the available set of routers.
2. Able to preserve the network performance even when the malicious node active in network: the proposed technique is an immune system by which during route discovery process the intermediate routers are evaluated for their trust. Thus the effect of malicious node is node affected the network performance.
3. Reduces the amount of control message exchange: the proposed technique only send the control message when required thus the routing overhead in terms of control message exchange is reduced.
4. Improve the throughput, PDR and end to end delay of network: the proposed secure discovery algorithm evaluates the routing path by applying constrain to the routers. And only those routers are selected for communication which is efficient and secure.

2 Limitations
The proposed routing technique is able to find the trust values of each node which participating in the communication. Thus, there are only a single drawback is observed during design. The proposed routing technique performs additional computations for finding the trusted node in network. Thus additional memory and time is consumed which is also responsible for frequently energy consumption in the network nodes.

3 Future Works
The proposed routing technique offers high performance network and secure route discovery. The obtained results demonstrate the high throughput, high packet delivery ratio and less end to end delay. In near future additional literature is studied for enhancing secure routing by including technique various different attacks too. Additionally the method is optimized for energy preservation and efficient computing.

Acknowledgment
I express my deep sense of gratitude to Mr Ashish Tiwari Asst. Professor & head in the in the Department of Computer Science & Engineering, at Vindhya institute of technology and seccence, Indore. Whose kindness valuable guidance and timely help encouraged me to complete this volume on a very crucial issue related to the work.

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At last but not the least I want to thank my friends who appreciated me for my work and motivated me and finally to god who made all the things possible.

References


[8] Performance Analysis of AODV, DSR and OLSR in MANET.


A SYSTEM OF PIEZOELECTRIC CANTILEVERS AND ACCELEROMETER FOR ON-BODY ENERGY HARVESTING

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Panimalar Engineering College

ABSTRACT

Over the past two decades, there has been significant interest in converting mechanical energy from human motion into electrical energy. This electrical energy can then be used to Recharge batteries in electronic devices or directly power small-scale, low-power circuits. A number of commercial devices use human power to produce electricity such as hand-crank generators and pedal Generators. However, these generators require concentrated human effort for long periods of time, which might preclude the User from doing other tasks. It is desirable to scavenge or harvest Energy from human movement, while the user is performing his/her everyday activities. Some of the earliest work to harvest energy includes the modern electromechanical self-winding watches, and various shoe mounted Foot cranks driven by the potential to power small, portable electronic devices. This paper focuses on harvesting the vibration generated during human motion into electrical energy that can be used to power electronic devices like mobile phone, flashlights, etc.

INTRODUCTION

Harvesting the mechanical energy of the human body through piezoelectric transduction could provide a means for powering portable and implantable systems. Human motion, however, is irregular and is limited to very low frequencies (a few Hz). Therefore, resonant type devices, where the natural frequency of the harvester is matched to the frequency of ambient vibrations, do not present a viable option. Impact-type harvesting in which the environmental motion is coupled to an inertial object which transfers its accumulated energy to the harvester through physical impacts provides a means of coupling low frequency irregular motion to high frequency piezoelectric oscillators.

Priya et al. first presented an impact harvester based on a windmill design in which a wind powered rotating wheel with notches plucks a series of harvesters extending radially outwards from its center. Pozzi et al. inverted the windmill design to reduce the dimensions of the harvester in order to extract the energy from a bending knee. The movement of the vibrating mass is transferred to the piezoelectric cantilevers through direct mechanical impact with a set of pins inserted near the rotational center of the eccentric mass.

The presented approach differs from recent work in which the vibrations are sensed using a piezoelectric cantilever, MEMS accelerometer and digitized using ADC0809. The digital output from ADC is fed to the Atmel microcontroller AT89S52 which has a 16 x 2 LCD interface for the purpose of displaying the generated voltage. This output voltage is boosted using XL6009 DC-DC Booster and stored in a battery. This power is fed to a regulator LM723. This regulated output voltage is then utilized to charge portable electronic devices like mobile phones or cardiac pacemakers.

SYSTEM DESIGN

The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The AT89S52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes.

![Fig1: Block diagram of energy harvesting](image-url)
The ADC0808, ADC0809 data acquisition component is a monolithic CMOS device with an 8-bit analog-to-digital converter, 8-channel multiplexer and microprocessor compatible control logic. The 8-bit A/D converter uses successive approximation as the conversion technique. The converter features a high impedance chopper stabilized comparator, a 256R voltage divider with analog switch tree and a successive approximation register. The 8-channel multiplexer can directly access any of 8-single-ended analog signals. The device eliminates the need for external zero and full-scale adjustments. In order to display the generated values obtained from the vibrations, a 16x2 LCD is interfaced with the microcontroller as shown.

![Fig2: Interfacing of Microcontroller with LCD.](image)

It is the user who has to specify whether the content at its data pins are data or commands. For this, if a command is inputted then a particular combination of 0s and 1s has to be applied to the Control lines so as to specify it is a Command on the other hand if a data is inputted at the data lines then another combination of 0s and 1s has to be applied to the control lines to specify it is Data. The combinations are as follows:

<table>
<thead>
<tr>
<th>No.</th>
<th>Instruction</th>
<th>Hex</th>
<th>Decimal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Function Set: 0 bit, 1 Line, 5x7 Dots</td>
<td>0x30</td>
<td>48</td>
</tr>
<tr>
<td>2</td>
<td>Function Set: 0 bit, 2 Line, 5x7 Dots</td>
<td>0x38</td>
<td>56</td>
</tr>
<tr>
<td>3</td>
<td>Function Set: 4 bit, 1 Line, 5x7 Dots</td>
<td>0x20</td>
<td>32</td>
</tr>
<tr>
<td>4</td>
<td>Function Set: 4 bit, 2 Line, 5x7 Dots</td>
<td>0x28</td>
<td>40</td>
</tr>
<tr>
<td>5</td>
<td>Entry Mode</td>
<td>0x06</td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>Display off Cursor off (clearing display without clearing DRAM content)</td>
<td>0x08</td>
<td>8</td>
</tr>
<tr>
<td>7</td>
<td>Display on Cursor on</td>
<td>0x0E</td>
<td>14</td>
</tr>
<tr>
<td>8</td>
<td>Display off Cursor</td>
<td>0x0C</td>
<td>12</td>
</tr>
<tr>
<td>9</td>
<td>Display on Cursor blinking</td>
<td>0x0F</td>
<td>15</td>
</tr>
<tr>
<td>10</td>
<td>Shift entire display left</td>
<td>0x10</td>
<td>24</td>
</tr>
<tr>
<td>11</td>
<td>Shift entire display right</td>
<td>0x1C</td>
<td>30</td>
</tr>
<tr>
<td>12</td>
<td>Move cursor left by one character</td>
<td>0x10</td>
<td>16</td>
</tr>
<tr>
<td>13</td>
<td>Move cursor right by one character</td>
<td>0x14</td>
<td>20</td>
</tr>
<tr>
<td>14</td>
<td>Clear Display (also clear DDRAM content)</td>
<td>0x01</td>
<td>1</td>
</tr>
</tbody>
</table>

If, Command - RS=0, RW=0, E=1’0 and Data- RS=1, RW=0, E=1’0

Before sending Data to be displayed to the LCD, it should be prepared to hold that particular value. For this certain initializations are to be done as per the Instructions.

- Move Value 0X38, 3 times. (Applied max 3 times due to rise time factor)
- Move Value 0X06, 1 time.
- Move Value 0X0F, 1 time.
- After each initializations command function and delay should be called.

After Initialization move Data to the LCD. Call the Data Function and delay.

**CODING USING EMBEDDED C**

Embedded C language is used for programming the microcontroller which in turn is interfaced with ADC 0809 and LCD whose working depends on the user programmed functions. The µVision IDE from Keil combines project management, make facilities, source code editing, program debugging, and complete simulation in one powerful environment. The µVision editor and debugger are integrated in a single application that provides a seamless embedded project development environment.

![Fig4: Screenshot of coding part 1.](image)

The first part of coding focuses on interfacing LCD and ADC with microcontroller for the purpose of displaying the generated values which are converted into digital by 0809IC.
The command set of LCD (Fig.3) is chosen as per the characters need to be displayed and the alignment need to be done.

**HARDWARE FABRICATION**

*MEMS:* The MMA7361L is a low power, low profile capacitive micro machined accelerometer featuring signal conditioning, a 1-pole low pass filter, temperature compensation, self test, 0g-Detect which detects linear freefall, and g-Select which allows for the selection between 2 sensitivities. Zero-g offset and sensitivity are factory set and require no external devices. The MMA7361L includes a Sleep Mode that makes it ideal for handheld battery powered electronics.

**PIEZOPlate:** A piezoelectric plate is a device that uses the piezoelectric effect to measure pressure, acceleration, strain or force by converting them to an electrical charge. Piezoelectric effect, is the ability of certain materials to generate an AC (alternating current) voltage when subjected to mechanical stress or vibration, or to vibrate when subjected to an AC voltage, or both. The most common piezoelectric material is quartz. Certain ceramics, Rochelle salts, and various other solids also exhibit this effect. The vibrations generated externally will be sensed by the piezoplate which in produces corresponding output voltage value. This value may range between 2-3V.

**DC-DC BOOSTER:** The XL6009 regulator is a wide input range, current ode, DC/DC converter which is capable of generating either positive or negative output voltages. It can be configured as either a boost, flyback, SEPIC or inverting converter. The XL6009 built in N-channel power MOSFET and fixed frequency oscillator, current mode architecture results in satable operation over wide range of supply and output voltages.
**REGULATOR:** The LM723/LM723C is a voltage regulator designed primarily for series regulator applications. By itself, it will supply output currents up to 150 mA; but external transistors can be added to provide any desired load current. The circuit features extremely low standby current drain, and provision is made for either linear or foldback current limiting. The LM723/LM723C is also useful in a wide range of other applications such as a shunt regulator, a current regulator or a temperature controller.

**COMPLETE HARDWARE:** The flow of energy starts with piezoplate which sense the vibration and generate an equivalent analog voltage. The measurement of static forces or gravity is taken from the mems accelerometer MMA7361L. These analog values are digitised by an ADC 0809 which in turn is interfaced with AT89S52 and an LCD for the purpose of displaying the generated voltage values. Since the output power from the piezoplates are very small, it is boosted by XL6009 which can be used to charge a battery with the help of a super capacitor. The charge stored in capacitor is consequently discharged into the battery which is capable of storing upto 12V. This stored charges can then be used for charging mobiles or other portable devices by passing through a regulator whose output is constant 5V.

**RESULTS**

As the vibrations are generated, the pins strike the tips of the piezoelectric cantilevers producing voltage pulses. To measure the voltage pulse, the values are digitized and displayed in a 16x2 LCD interfaced with ATS952 microcontroller. Thus the changing voltages generated for different pressures or vibrations applied can be practically measured in terms of voltages obtained from them. Finally, the output from the regulator can be taken to charge a mobile phone or other portable household devices by connecting the appropriate jack with it.

**CONCLUSIONS**

We have demonstrated a working concept for a compact, portable energy harvesting system to convert the mechanical energy of the human body into useable electrical energy to provide a sustainable power source for on-body microelectronics and implantable devices. The system employs piezoelectric cantilevers actuated by an eccentric mass. We are presently working to optimize this concept by increasing the number of pins and the number of cantilevers while improving the compactness of the design. Through optimization, the presented concept could eventually be used to power on-body electronics.

**FUTURE WORK**

The work can be extended by minimizing the size of the hardware and employing it in areas where a huge amount of human energy can be harnessed to generate power. This can be stored and used to power major hubs in the city.

**REFERENCES**


Gender Influence On Child Survival, Health And Nutrition
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ABSTRACT
There is increasing recognition in international health
and nutrition that gender inequities and dynamics are a
major social determinant of health and nutrition
outcomes. However, reviews of evidence to date have
tended to concentrate on comparisons of the health and
nutrition outcomes, healthcare utilisation or coverage of
services/programmes between boys and girls or women
and men. This literature review and accompanying
guidance document respond to a range of questions
exploring how gender influences household dynamics in
relation to aspects of young child health and nutrition.

INTRODUCTION:
Health is the level of functional or metabolic efficiency of a
living organism. In humans, it is the general condition of a
person's mind and body, usually meaning to be free from
illness, injury or pain. According to World Health Education
(WHO) the term health defined as – “Health is a state of
complete physical, mental and social well-being and not
merely absence of disease or infirmity”. Health is
multidimensional. The WHO definition envisages three
specific dimensions – the physical, the mental and the
social. Health policies in developing countries, including
India, have focused on the issues related to population
growth, common diseases, nutrition, disability, newly
emerging diseases such as AIDS, occupational diseases,
mental diseases, and so on. Reducing population growth
rates continues to be a very important goal of the health
sector owing to the high fertility rates in many states.
Malaria, tuberculosis, waterborne diseases, respiratory
diseases, and diseases related to mal and under-nutrition
continue to trouble the population. Nutritional deficiencies
among women, children and the poor; particularly
deficiencies of basic minerals, some vitamins, and proteins
resulting in stunted growth of women and children, is a
major concern. New health problems have emerged. For
example, AIDS has become a threatening disease with its
high incidence among migrants, particularly among single
male migrants and circular migrants. There are new
challenges because of environmental pollution and increased
exposure to toxic substances in everyday life. Increasing
urbanization has thrown up new health challenges
emanating from dense living conditions. While, new
challenges keep emerging, the earlier health agenda
continues to require attention. The challenges in the health
sector are thus multiple.

CHILD SURVIVAL:
Child survival is a field of public health concerned with
reducing child mortality. Child survival interventions are
designed to address the most common causes of child deaths
that occur, which includes diarrhoea, pneumonia, malaria,
and neonatal conditions. Of the portion of children under
the age of 5 alone, an estimated 9.2 million children die each
year mostly from such preventable causes. According to an
estimate by UNICEF, one million child deaths could be
prevented annually at a cost of US$ 1 billion per year (an
average of US$ 1000 for each child). The British medical
journal The Lancet has published a widely-quoted series of
ing articles outlining the current child survival situation;
include challenges and feasible solutions, commonly
referred to as "The Lancet Child Survival Series". The series
outlines a number of child survival interventions which have
been scientifically proven to reduce mortality, include oral
rehydration therapy, sleeping under insecticide-treated
mosquito nets, vitamin A supplementation, and community-
based antibiotic treatment for pneumonia. Agencies
promoting and implementing child survival activities
worldwide include UNICEF and non-governmental
organizations; major child survival donors worldwide
include the World Bank, the British Government's
Department for International Development, the Canadian
International Development Agency and the United States
Agency for International Development. In the United States,
most non-governmental child survival agencies belong to
the CORE Group, a coalition working, through collaborative
action, to save the lives of young children in the world's
poorest countries.

Every year nearly 10 million children under age five die,
mostly from preventable and treatable diseases. Nearly
27,000 children die every day as a result of diseases like
pneumonia, diarrhea and complications during childbirth.
Malnutrition is an underlying contributor in over half of
these deaths. Similarly, 4 million newborns die in the first 4
weeks of life (40 percent of under-5 deaths). 98 percent of
under-5 deaths occur across only 42 developing countries.
Proven, cost-effective interventions can save the lives of
millions of children per year. Immunization interventions
still do not reach 30 million children, despite success in
immunizations in reducing polio, tetanus, and measles.
Measles and tetanus still kill more than 1 million children
under 5 each year. Vitamin A supplementation costs only
$0.02 cents for each capsule and given 2-3 times a year will
prevent blindness and death. Although vitamin A
supplementation saved an estimated 2.3 million lives
between 1999 and 2004, only half of young children in poor
countries receive these treatments. Between 250,000 and
500,000 children become blind every year, with 70 percent
of them dying within 12 months. Oral rehydration therapy
(ORT) has helped to reduce diarrhea deaths by half; saving
an estimated 1 million lives annually; yet more than 2
million children still die from diarrheoa-related causes each
year.

Essential newborn care - including immunizing mothers
against tetanus, ensuring clean delivery practices in a
hygienic birthing environment, drying and wrapping the
baby immediately after birth, providing necessary warmth,
and promoting immediate and continued breastfeeding,
immunization, and treatment of infections with antibiotics -
could save the lives of 3 million newborns annually.
Improved sanitation and access to clean drinking water can
reduce childhood infections and diarrhea. Over 40 percent of the world's population does not have access to basic sanitation, and more than one billion people use unsafe sources of drinking water.

**IMPORTANCE OF HEALTH**

Health is important in three distinct ways:

- It has intrinsic importance
- It has an instrumental importance at personal and social levels
- It promotes empowerment of people. In the intrinsic sense health is important, because it is a direct measure of human wellbeing. It is a fulfilment of life. Being healthy is a valuable achievement in itself. The 'basic needs approach' considers health as a basic need along with food, clothing, shelter, and education. Health is important because it is better living and not because it is an instrument for better living or has a utility.

Better health can have interpersonal benefits. There are many externalities of morbidity. Continuous illness in a family can stifle the options for a family. More often than not, it is the woman, who is socially obliged to take the responsibility of a sick person in a family patriarchal. In the instrumental sense, good health has an economic rationale. It leads to reduced medical costs of the government and households. More the public sector expenditure on preventive health, less the household sector expenditure on curative health. Better health status of the population also leads to reduced mortality and higher life expectancy. It leads to decline in infant and child mortality. With increase in chances of child survival, fertility rates tend to decline, which leads to lowering down of population growth rates. Thus, better health status leads to demographic transition steadying the population growth rate essential for sustainable development. Health therefore has many instrumental roles at personal and social level.

In the case of children, better health leads to better attendance in school and to higher level of knowledge attainment, which leads to better paid jobs and larger benefits to future generations. Nutritional deficiency in children, on the other hand, leads to irreversible and long-term disabilities such as blindness, reduction in cognitive functions, mental retardation, etc.

**FACTORS AFFECTING HEALTH STATUS**

Health status is an outcome of a large number of factors:

- Poverty, food security, food pricing and malnutrition
- Environmental pollution and degradation
- Occupational health problems
- Reproductive health problems
- Household economy and wages
- Economic development; represented by per capital income, urbanization and industrialization
- Social development; especially literacy rates
- Prices of private health care system
- Public health care delivery system
- Supply of fresh air, light and potable water
- Balanced diet
- Proper health and shelter
- Adequate clothing
- Hygienic environment sanitation
- Protection from communicable diseases and non-communicable diseases
- Adequate rest and relaxation according to individual needs
- Suitable occupation with job satisfaction
- Good and simple habits leisure and pleasure
- All these factors help to maintain a normal balance of body which is must for positive health.

**Precautions of Child Health:**

- **Breastfeeding**
  - Breastfeeding: “Exclusive breastfeeding of the first six months of life” to be propagated as it would the following benefits:
    - It is the ideal method of infant feeding.
    - Is the single most cost effective intervention for reduction of infant mortality?
    - A delay returns to fertility in the mother and hence acts as a natural contraceptive.
    - **Iron and folic acid supplementation**
      - Screening of children for anaemia wherever required and appropriate treatment of those found anaemic.
      - Reducing prevalence of anaemia by 25% and moderate and severe anaemia by 50% in children.
    - **Strategy**
      - Improve dietary intake to meet RDA for all macro and micronutrients;
      - Dietary diversification-inclusion of iron folate rich foods as well as food items that promote iron absorption.
      - Food fortification, including introduction of iron and iodine-fortified salt and other iron-fortified items.
      - Health and nutrition education to improve over all dietary intakes and promote consumption of iron and folate-rich foodstuffs.
    - **Infants:**
      - Exclusive breast feeding for six months, and introduction of green leafy vegetables along with cereal/pulse/oilseed mix in the seventh month for the prevention of anaemia.
      - Screening for anaemia in pre-term, low birth weight infants and those with growth faltering and repeated episodes of infection.
      - Appropriate treatment for anaemic infants.
    - **Preschool children**
      - Advocacy with regard to dietary diversification for the prevention of anaemia.
      - All growth retarded children and those with repeated infections have to have HB estimation carried out and those found to be anaemic are provided with appropriate treatment.
      - In hookworm endemic areas, it is necessary to improve:
        - sanitation and educate people not to walk barefoot;
        - treat children with a history of passing worms with broad spectrum antihelminthics;
        - screen all anaemic children for hookworm infestation and treat them
      - The co-operation of the PRIs and women’s’ self-
help groups, where ever existent, may be sought to promote and monitor intake of IFA tablets in their community.

- **Coverage**
  - As per a survey carried out in 2002 by the National Nutrition Monitoring Bureau, under the ICRR, 67% of the preschool children were anaemic.
  - 2, 84,729 kits are distributed throughout the country each year under the RCH programme, each kit containing 13,000 tablets of paediatric IFA tablets.

- **Vitamin A supplementation strategy**
  - Decrease prevalence of Vitamin A deficiency form the current 0.7% to 0.3%.

- **Strategy**
  - Infancy
  - Health and nutrition education is being taken up to encourage colostrums feeding, exclusive breastfeeding for the first six months and the introduction of complementary feeding thereafter.
  - 1,00,000 IU dose of Vitamin A is being given at nine months.

- **Childhood**
  - Health education efforts to ensure adequate intake of Vitamin A rich food throughout childhood.
  - Early detection and prompt treatment of infections.
  - Vitamin A dose of 2,00,000I.U at 18,24,30 and 36 months of age.

- **Sick children**
  - All children with xerophthalmia to be treated at health facilities.
  - All children suffering from measles to be given one dose of Vitamin A if they have not received it in the previous one month.
  - All cases of severe malnutrition to be given one additional dose of Vitamin A.

- **Coverage**
  - Vitamin A supplementation coverage rate (6-59 months) 2001 44% 1st dose.
  - 2, 84,729 kits are distributed throughout the country each year under the RCH programme, each kit containing 6 bottles of 100 ml each.

**NUTRTION:**
The homeostasis can be maintained indefinitely only if the digestive tract absorbs fluids, organic substrates, minerals and vitamins on a regular basis, keeping pace with cellular demands. A nutrient is any substance that we digested, absorbed and utilized to provide the body functions. These substances are -- Carbohydrates, Proteins, Fats, Vitamins, Mineral, Salts and Water. The absorption of nutrients from food is called nutrition.

Nutrition is the selection of foods and preparation of foods, and their ingestion to be assimilated by the body. By practicing a healthy diet, many of the known health issues can be avoided. The diet of an organism is what it eats, which is largely determined by the perceived palatability of foods.

Dietitians are health professionals who specialize in human nutrition, meal planning, economics, and preparation. They are trained to provide safe, evidence-based dietary advice and management to individuals (in health and disease), as well as to institutions. Clinical nutritionists are health professionals who focus more specifically on the role of nutrition in chronic disease, including possible prevention or remediation by addressing nutritional deficiencies before resorting to drugs. Government regulation of the use of this professional title is less universal than for "dietician."

A poor diet may have an injurious impact on health, causing deficiency diseases such as scurvy and kwashiorkor; health-threatening conditions like obesity and metabolic syndrome; and such common chronic systemic diseases as cardiovascular disease, diabetes, and osteoporosis.

**IMPORTANCE OF NUTRTION IN CHILD HEALTH:**
Nutrition is a very important key factor for the child health. It play important key role in maintaining the health. Due to deficiency of the nutrition there are many diseases which developed in to the body.

In child up to Age 2-5 years nutrition is very important. Due to the lack of nutrition there are many diseases such as Kwashiorkor, Marasmus, Goitre, Anaemia, Rickets etc.

<table>
<thead>
<tr>
<th>NO.</th>
<th>NUTRIENTS</th>
<th>DEFICIENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Calories</td>
<td>Starvation, Marasmus</td>
</tr>
<tr>
<td>2.</td>
<td>Proteins</td>
<td>Kwashiorkor</td>
</tr>
<tr>
<td>3.</td>
<td>Vitamin A</td>
<td>Night blindness &amp; Xerophthalmia</td>
</tr>
<tr>
<td>4.</td>
<td>Vitamin B1</td>
<td>Beri Beri</td>
</tr>
<tr>
<td>5.</td>
<td>Vitamin B2</td>
<td>Skin &amp; Corneal lesion</td>
</tr>
<tr>
<td>6.</td>
<td>Vitamin B12</td>
<td>Pernicious Anaemia</td>
</tr>
<tr>
<td>7.</td>
<td>Vitamin C</td>
<td>Scurvy</td>
</tr>
<tr>
<td>8.</td>
<td>Vitamin D</td>
<td>Rickets</td>
</tr>
<tr>
<td>9.</td>
<td>Vitamin E</td>
<td>Neurological Diseases</td>
</tr>
<tr>
<td>10.</td>
<td>Vitamin K</td>
<td>Haemorrhage</td>
</tr>
<tr>
<td>11.</td>
<td>Irons</td>
<td>Anaemia</td>
</tr>
<tr>
<td>12.</td>
<td>Iodine</td>
<td>Goitre, Hypothyroidism</td>
</tr>
</tbody>
</table>

**Projects undertaken by Government:**
The Child Survival and Safe Motherhood Programme jointly funded by World Bank and UNICEF were started in 1992-93 for implementation up to 1997-98. The Child Survival and Safe Motherhood Programme were implemented in a phased manner covering all the districts of the country by the year 1996-97. The objectives of the programmes were to improve the health status of infants, child and maternal morbidity and mortality. The programmes seek to sustain high coverage levels achieved under the Universal Immunisation Programme (UIP) in good performance areas and strengthen the immunisation services of Poor performing areas. The programme also provides for augmenting various activities under the Oral Rehydration Therapy (ORT) Programme, universalising prophylaxis schemes for control of anaemia in pregnant women & control of blindness in children and initiating a programme for control of acute respiratory infection (ARI) in children. Under the safe motherhood component, training of traditional birth attendants (TBA), provision of aseptic delivery kits and strengthening of first referral units to deal with high risk and obstetric emergencies were taken up.
In order to effectively improve the health status of women and children and fulfill the unmet need for Family Welfare services in the country, especially the poor and underserved
by reducing infant child and maternal mortality and morbidity, Government of India during 1997-98 launched the RCH Programme for implementation during the 9th plan period by integrating Child Survival and Safe Motherhood (CSSM) Programme with other reproductive and child health (RCH) services.

**REFERENCE**

3. Mills, Shirley J.; Pankake, Anita; Schall, Janine (Source of Influence on Gender Role Development: Analysis of Female Characters Using Jung’s Four Archetypes
FEM Analysis of Impact of Cylindrical Tool on Composite Laminated Plate
Suman Anand1, Dr. Pawan Whig2, Sharad Shrivastava3
Rajasthan Institute of Engineering and Technology, Jaipur, Rajasthan
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ABSTRACT
Aviation sector, War and general purpose Helmet making industries, War equipments making industries uses high velocity impact analysis for design purposes. To analyze high velocity impact conditions, it is very difficult to achieve it by experimental set up because of high costing of experimentation as well as technical limitations of experiment like high velocity cameras, velocity measurement instruments etc. While the use of computer simulation help researchers to conduct these type of studies easily.
In this study the failure of an alloy AL6061-T6 with Kevlar-29, and E-Glass composite laminated plates under high velocity impact from cylindrical projectile tool of structural Steel was investigated using the nonlinear explicit FEM software, ANSYS AUTODYN. Two velocities of 150 m/s and 500 m/s were selected for FEM simulation. It was analyzed that metal alloy AL6061-T6 is more resistant than composite materials at various combination of layers of composite plate. Only use of composite material combination can not be sufficient for overall strength of laminated plate so use of metal alloy is good approach. It was also observed that tool mass and tool overall dimension play an important role for failure of composite laminated plates. In this study Plate thickness was kept constant but plate layer combinations were changed. Experimental validation was also done in this study by previous published research paper.

KEY WORDS
FEM Analysis, AL 6061-T6, Kevlar-29, E-Glass, Ansys Autodyne.

1. INTRODUCTION
High velocity impact is of concern to many different fields and has been the subject of much research, especially in the last 5 decades. Over this period of time, the techniques used to analyze high velocity impact have changed naturally, as have the disciplines interested in these analyses. Researchers are still trying to get a clear cut picture of the impact performance. Mainly this applies to the various important industries like defense and aviation industries. Armor flexibility and impact resistance are extremely important in warfare applications.

Many theories and procedures emerged to study the impact and blast phenomena. Blast phenomena leads to portion deformation of composite plates for two different materials; (1) E-Glass and (2) KEVLAR-29 for various different velocities like 150 m/s and 500 m/s. The complex response of composite materials coupled with high costs and limited amount of data from ballistic testing has lead to experimental characterization of ballistic helmet becomes expensive and time consuming. In order to address this issue, finite element analysis can be used as a method to characterize the response of composite ballistic material and to obtain valuable information on parameters affecting integral equations having complex geometries of real world. With the help of this technique real complex problems are now solvable without any experimental work. The method essentially consists of assuming the piecewise continuous functions for the problem solution and obtaining the final parameters of the functions in a manner that reduces the error in the analytical solution.

FEM technique is useful for various fields which are following:
- Mechanical/Aerospace/Civil/Automotive Engineering
- Structural/Stress Analysis
  - Static/Dynamic
  - Linear/Nonlinear
- Fluid Flow
- Heat Transfer
- Electromagnetic Fields
- Soil Mechanics
- Acoustics
- Biomechanics

A general procedure used in FEM technique is shown below:

Pre-processing
- Define the geometric domain of the problem.
- Define the element type(s) to be used.
- Define the material properties of the elements.
- Define the geometric properties of the elements (length, area, and the like).
- Define the element connectivity (mesh the model).
- Define the physical constraints (boundary conditions). Define the loadings.

Solution
- Computes the unknown values of the primary field variable(s)
- Computed values are then used by back substitution to compute additional, derived variables, such as reaction forces, element stresses, and heat flow.

Post processing
- Postprocessor software contains sophisticated routines used for sorting, printing, and plotting selected results from a finite element solution.

3. PROBLEM DESCRIPTION
In general, there are two tests utilized to determine deformation of composite plates for two different materials; (1) E-Glass and (2) KEVLAR-29 for various different velocities like 150 m/s and 500 m/s. The complex response of composite materials coupled with high costs and limited amount of data from ballistic testing has lead to experimental characterization of ballistic helmet becomes expensive and time consuming. In order to address this issue, finite element analysis can be used as a method to characterize the response of composite ballistic material and to obtain valuable information on parameters affecting...
impact phenomena.

4. OBJECTIVE OF RESEARCH
The main focus of this research work is to study the response of thick plate made of composite materials when impacted at high velocity by using finite element analysis. The objectives of this research are:

- To determine the effect of high velocity impacts on thick plates made of composite materials.
- Three materials are simulated to find high velocity impact on their structure. First material is alloy of Al named AL6061-T6, second and third are composite materials used in Aviation industry and war industry etc.
- To analyze the deformation as well as residual velocity distribution of the thick plate when struck by a bullet at velocity of 150 m/s and 500 m/s.
- To evaluate the deformation mechanism occurred on thick plate after the impact.

5. EXPERIMENTAL VALIDATION
Various researchers give importance to experimental validation of any analytical or numerical or simulation research work. In this study experimental validation were performed for simulation verification. There are two methods to perform this task, first one is that create a setup for experimental validation, but it was both time and money consuming. Second method is to validate previous published experimental work from any SCI index journal. We opted second method for experimental validation.

Title of previous research work: High velocity impact response of Kevlar-29/epoxy and 6061-T6 aluminum laminated panels.
Journal name: Materials and Design (2013)

Geometry and boundary conditions of domain from research Paper

<table>
<thead>
<tr>
<th>Geometry</th>
<th>Boundary Conditions for Experimental validation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fig 1: Al plate stacking front side with Epoxy layer</td>
<td>Case 1 Al plate stacked in front of tool having thickness 0.7 mm, tool dia was 7.62 mm and made of steel 4340.</td>
</tr>
<tr>
<td>Fig 2: Al plate stacking back side with Epoxy layer</td>
<td>Case 2 Al plate stacked in back relative to impact of tool having thickness 0.7 mm.</td>
</tr>
</tbody>
</table>

Results

Case 1

Fig 3: Experimental result (Research Paper)

Case 2

Fig 4: Experimental result (Research Paper)

Table 1 Comparison between Experimental and Simulated work (Case 2)

<table>
<thead>
<tr>
<th>Experimental Work (previous)</th>
<th>Simulation Work</th>
<th>% Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial velocity</td>
<td>Initial velocity</td>
<td></td>
</tr>
<tr>
<td>Residual Velocity</td>
<td>Residual Velocity</td>
<td></td>
</tr>
</tbody>
</table>
After validation with experimental research work (Fig 1 to Fig 4 with Table 1), it was concluded that simulation work was perform good results with experimental work.

6. DESIGN OF EXPERIMENT

After experimental validation of simulation results, design of final research work was carried forward. In this study main focus was on impact of various shape projectile tool on laminated test specimens made of composite materials and metal combination. Velocity range was selected from previous research work.

Combinations of composite materials with Al 6061 material in test specimen were shown in figure. A, B and C represent material type which was shown in figure are Al6061-T6, E-Glass and Kevlar-29 respectively.

Combinations

<table>
<thead>
<tr>
<th>Sr. no.</th>
<th>Tool</th>
<th>Test Specimen</th>
<th>Initial Velocity (m/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cylindrical-A</td>
<td>A-B-C</td>
<td>150, 500</td>
</tr>
<tr>
<td>2</td>
<td>Cylindrical-A</td>
<td>A-B-C</td>
<td>150, 500</td>
</tr>
</tbody>
</table>

In this study total 18 cases were simulated using Ansys WB 14.5. Results of all cases were shown in graphical form and all outcomes were converted into tabular format and were shown in following sections. Comparison between initial velocity and final residual velocity was important part of this study because it was very important to know how metal plate can change impact of projectile to composite plate.

Table 2 Total test specimens used in study

<table>
<thead>
<tr>
<th>Height (mm)</th>
<th>Front Layer</th>
<th>Middle Layer</th>
<th>Back Layer</th>
<th>Initial Velocity (m/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Al6061</td>
<td>E-Glass</td>
<td>Epoxy</td>
<td>150, 500</td>
</tr>
<tr>
<td>10</td>
<td>E-Glass</td>
<td>Al6061</td>
<td>Epoxy</td>
<td>150, 500</td>
</tr>
<tr>
<td>15</td>
<td>Al6061</td>
<td>E-Glass</td>
<td>Epoxy</td>
<td>150, 500</td>
</tr>
<tr>
<td>15</td>
<td>E-Glass</td>
<td>Al6061</td>
<td>Epoxy</td>
<td>150, 500</td>
</tr>
<tr>
<td>20</td>
<td>Al6061</td>
<td>E-Glass</td>
<td>Epoxy</td>
<td>150, 500</td>
</tr>
<tr>
<td>20</td>
<td>E-Glass</td>
<td>Al6061</td>
<td>Epoxy</td>
<td>150, 500</td>
</tr>
</tbody>
</table>

Table 3 Summary table of simulation of Cylinder shape tool impact for various variables

<table>
<thead>
<tr>
<th>Sr. no.</th>
<th>Shape</th>
<th>Dimension (Dia, length) (mm)</th>
<th>Layer Thickness (mm)</th>
<th>Initial Velocity (m/s)</th>
<th>Residual Velocity (m/s)</th>
<th>Strain Rate (m/m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cylindrical-A</td>
<td>(5, 10)</td>
<td>A-B-C</td>
<td>5</td>
<td>150</td>
<td>4.17</td>
</tr>
<tr>
<td>2</td>
<td>Cylindrical-A</td>
<td>(5, 10)</td>
<td>A-B-C</td>
<td>5</td>
<td>500</td>
<td>11.5</td>
</tr>
</tbody>
</table>
In this table all 18 cases for different layer combinations of plate with various velocities and overall tool thickness of conical shaped tool is given in tabular form. There is also a graphical comparison of initial velocity and residual velocity of conical tool is discussed for all three cases of tool length.

Notation in layer column was following: A represents Al6061, B represent E Glass and C represents Kevlar-29.

Like that Shape column notation was following: A, B, C, D…… represents group combinations of velocity range (150 and 500 m/s).

### 7.2 GRAPH BETWEEN INITIAL VELOCITY AND RESIDUAL VELOCITY

**Figure 6** Test Specimen (Cylindrical Tool) velocity results at various laminated plate combination at tool height 10 mm

From Table 3 it was shown that when tool dimension was changed it was found that residual velocities of tool facing large change comparing with initial velocity. When this dimensional effect was perform with laminated plate combinations, changing results again found out.

**Figure 7** Test Specimen (Cylindrical Tool) velocity results at various laminated plate combinations at tool height 15 mm

When tool length was changed to 15 mm (overall length) by previous tool length 10 mm, it was found that residual velocity for all cases were changed from 10 mm length tool results, but also approaching high magnitude than previous case. In this study the effect of mass of tool was show high changes in impact results of composite laminated plates.

**Figure 8** Test Specimen (Cylindrical Tool) velocity results at various laminated plate combinations at tool height 20 mm

### 7.3 TOTAL DEFORMATION OF TOOLS AND LAYER PLATE

150 Design1 (Cylinder)
Figure 12 Impact of tool on composite plate at velocity 150 m/s and 500 m/s for layer combination ABC for 10 mm tool.

Figure 13 Impact of tool on composite plate at velocity 150 m/s and 500 m/s for layer combination ABC for 20 mm tool.

Figure 14 Impact of tool on composite plate at velocity 150 m/s and 500 m/s for layer combination BAC for 10 mm tool.
Figure 15 Impact of tool on composite plate at velocity 150 m/s and 500 m/s for layer combination BAC for 20 mm tool

Figure 16 Impact of tool on composite plate at velocity 150 m/s and 500 m/s for layer combination BCA for 10 mm tool

Figure 17 Impact of tool on composite plate at velocity 150 m/s and 500 m/s for layer combination BCA for 20 mm tool

Figure 12 to Figure 17 show deformation effects at various conditions during simulation of composite plate. All 18 cases were shown in this section. It was clear that when impact velocity was increased from 150 m/s to 500 m/s, most of the cases show full three layer deformation. It was also shown from figures that metal layer play important role to reduce damage of composite plate. In this study tool was also opt as flexible material and it means simulation show effect of impact on tool also. On the basis of simulation study, the shape of tool can also increases or decreases the impact effect on composite plates.

8. CONCLUSION

A finite element model using Ansys Autodyn 14.5 was developed to simulate the high-velocity impact reaction of an AL6061-T6, E-Glass and Kevlar-29 composite plate combination. The interaction between the impactor tool and the laminate was simulated using a minimum length contact theory. Numerical analyses were conducted at two impact velocities of 150 m/s and 500 m/s of a structural steel impactor.

Main conclusions from this study were shown in tabular form as following:

<table>
<thead>
<tr>
<th>Tool</th>
<th>Plate Combinatio n</th>
<th>Initial Velocit y</th>
<th>Conclusion Remark</th>
<th>Plate Surviv e</th>
<th>Plate Not Surviv e</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cylindrical Tool</td>
<td>ABC</td>
<td>150,500</td>
<td>150</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BAC</td>
<td></td>
<td>150,500</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BCA</td>
<td></td>
<td>150,500</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
From Table 5 it was concluded that best results from simulation for 20 mm tool length is achieved for plate combination BAC and BCA. It was also concluded that shape of tool may increase damage in composite plate combination. General conclusion is that metal layer position play important role to increase impact strength of composite plates.

Table 6 Impactor mass effect on composite plate at constant velocity 500 m/s

<table>
<thead>
<tr>
<th>Tool</th>
<th>Plate Combination</th>
<th>Tool overall length</th>
<th>Mass of Tool (gm)</th>
<th>Conclusion Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cylindrical Tool</td>
<td>ABC</td>
<td>10</td>
<td>1.54</td>
<td>Damage layer A</td>
</tr>
<tr>
<td></td>
<td>ABC</td>
<td>15</td>
<td>2.31</td>
<td>Damage layer A &amp; B</td>
</tr>
<tr>
<td></td>
<td>BAC</td>
<td>10</td>
<td>1.54</td>
<td>Damage layer A</td>
</tr>
<tr>
<td></td>
<td>BAC</td>
<td>15</td>
<td>2.31</td>
<td>Damage layer A</td>
</tr>
<tr>
<td></td>
<td>BCA</td>
<td>20</td>
<td>3.07</td>
<td>Damage layer A &amp; B</td>
</tr>
<tr>
<td></td>
<td>BCA</td>
<td>15</td>
<td>2.31</td>
<td>Damage layer A</td>
</tr>
</tbody>
</table>

Mass of impactor tool also play important role on deformation of composite plate. It is concluded that if mass of tool was increased than damage of composite plate was also increased. Maximum deformation on composite plate on the basis of tool mass was observed at layer combination ABC. Both BAC and BCA show better result than ABC layer combination.

In this study residual velocity of all simulated cases were also carried out and it predict some important results for composite laminate plate. It was predict that residual velocity was increased or decreased with composite layer combinations. Effect of residual velocity on laminate layers of composite plate at initial velocity 500 m/s, 20 mm length of tool was shown in tabular form as below:

Table 7 Summary of residual velocity

<table>
<thead>
<tr>
<th>Tool</th>
<th>Plate Combination</th>
<th>Residual Velocity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cylindrical Tool</td>
<td>ABC</td>
<td>61.70</td>
</tr>
<tr>
<td></td>
<td>BAC</td>
<td>9.58</td>
</tr>
<tr>
<td></td>
<td>BCA</td>
<td>24.10</td>
</tr>
</tbody>
</table>

It is observed from the table that minimum residual velocity represents best layer combination of composite plate, and for this study it was BAC.

Experimental validation was also done for this study to prove FEM validation for this type of work. Simulation work show good result agreement with previous experimental works.

9. FUTURE SCOPE

- Effect of thermal aspects on composite plate at high velocity impacts.
- Application of Nano and micro mechanics for composite laminate layer.
- Application of Advanced optimization techniques like Ant colony optimization, generic algorithm etc.

REFERENCES


