Safe Bike Driving System with Anti Theft Mechanism

Priyanka S. Jain[1], A. Sanjay[2], S. Porselvi[3], L. Bhagyalakshmi[4], Sanjay Kumar Suman[5]
[1, 3, 4, 5]Department of ECE
[2] Department of Mechanical Engineering
[1, 2, 3, 5]MNM Jain Engineering College, Chennai, TN, India
[4] Rajalakshmi Engineering College, Chennai, TN, India.

Abstract-*This paper presents a holistic approach for accident prevention and theft protection for vehicle. In this paper a pothole detection methods and security monitoring system for the vehicles is discussed. Based on the previous system analysis a cost effective solution is proposed to identify potholes and humps on roads and provide timely alerts to drivers to avoid accidents or vehicle damages. Ultrasonic sensors are used to identify humps. For the theft protection a GSM module with GPS module is used for the safe and securely monitoring system. It actually senses exact location of a vehicle if it is stolen. The secure web server which is used in this project is at initial state, it actually gives the current location of a stolen vehicle even in a running state. Also for better safety of human life the system is integrated with the helmet of the bike. If the rider does not wear the helmet the bike will not start as the micro switches in the helmet which senses the head pressure is connected to the ignition system of the bike.*

Keywords-RFID; GSM; GPS; Ultrasonic Sensor; C++; Micro switches; HC12E; HC12D; Relay

.

I. INTRODUCTION

India, the second most populous Country in the World and a fast growing economy, is known to have a gigantic network of roads. Roads are the dominant means of transportation in India today. They carry almost 90 percent of country's passenger traffic and 65 percent of its freight. This proliferation of vehicles has led to problems such as traffic congestion and increase in the number of road accidents. Pathetic condition of roads is a boosting factor for traffic congestion and accidents. Roads in India normally have speed breakers so that the vehicle's speed can be controlled to avoid accidents. However, these speed breakers are unevenly distributed with uneven and unscientific heights. This can detected using the ultra sonic sensor.

In the last few decades, India has progressed at such an enormous rate that many companies have strongly established themselves here. These companies bring a huge amount of workforce with them. Arranging transportation to such a huge mass is a cumbersome task involving many intricacies. Generally, this transport is arranged through the local transport vendors on a yearly contract basis, recently happen mishaps such as burglary, rape cases etc. The development of satellite communication technology is easy to identify the vehicle locations. Vehicle tracking systems have brought this technology to the day-to-day life of the common person.

According to Chen et. al., [1] it is necessary due to the many of applications of both GSM and GPS systems and the wide usage of them by millions of people throughout the world. The GPS/GSM Based System is one of the most important systems, which integrate both GSM and GPS technologies. It is necessary due to the many of applications of both GSM and GPS systems and the wide usage of them by millions of people throughout the world . In theory of Asaad et. al. [2], the hardware and software of the GPS and GSM network were developed. The proposed GPS/GSM based System has the two parts, first is a mobile unit and another is controlling station. Kunalet. al., proposeda vehicle tracking system is an electronic device, installed in a vehicle to enable the owner or a third party to track the vehicle's place [3]. This system designed for users in land construction and transport business, provides real-time information such as location, speed and expected arrival time of the user is moving vehicles in a concise and easy-to-read format. Ramyaet. al. explained, an embedded system for vehicle cabin safety and security which monitors and detects the level of the toxic gases and alcohol inside the vehicle [4]. In [5], Song and Yang have a designed and built on a real-time visual tracking system for vehicle safety applications. Chenet. al., told the remote monitoring system based on SMS and GSM was implemented [6]. Based on the total design of the system, the hardware and software designed.

In [7] Rajeshwari S. et. al. designed an automated traffic control system with ambulance clearance and detection of stolen vehicle using GSM and GPS,. Mirceaet.al., [8] have proposed a method for detecting defects on the road surface using accelerometers. Jin Lin, et.al., have proposed a method for pothole detection based on SVM (Support Vector Machine)[9]. Sachinet.al. have proposed a system that detects potholes based on a vision based approach [10]. The pictures of the road surface are captured using a properly mounted camera. This method distinguishes potholes from other

defects such as cracks. It also makes use of GPS system to identify the exact location of the defects. This system may also useful for communication process among the two points.

II. SYSTEM MODEL

In this project we are using three different systems.

1. Humps notifications.
2. Secure tracking.
3. RF ID Security.
4. Helmet- a key.

The proposed GPS/GSM based System has the two parts, first is a mobile unit and another is controlling station. The system processes, interfaces, connections, data transmission and reception of data among the mobile unit and control stations are working successfully. These results are compatible with GPS technologies. In this vehicle tracking system is an electronic device, installed in a vehicle to enable the owner or a third party to track the vehicle's place. This paper proposed to design a vehicle tracking system that works using GPS and GSM technology. The system of Nitin Agarwal, Anshul Kumar Singh[11] built based on embedded system, used for tracking and positioning of any vehicle by using Global Positioning System (GPS) and Global system for mobile communication (GSM). This design will continuously watch a moving Vehicle and report the status of the Vehicle on demand. The hump is notified using an Ultrasonic sensor and is notified by a buzzer before a few 100 meters from the hump. The RFID security uses an RFID module without which the bike does not start. Further the ignition system of the bike is connected to the helmet using RF module so that the bike does not start id the rider does not wear the helmet.

III. COMPONENTS USED IN THE PROPOSED SYSTEM

The proposed system offers a cost effective solution for detecting potholes and humps on roads and notifying drivers about their presence. we actually used two different systems in this project. Components used in the proposed work are as follows.

A. Ultrasonic Sensors HC-SR04

The HC-SR04 is an active ultrasonic sensor and contains a transmitter and a receiver. It is used to measure distance at which, objects are placed in front of it. The ultrasonic sensor transmits high frequency sound waves and waits for the reflected wave to hit the receiver. The distance is calculated based on the time taken by the ultrasonic pulse to travel a particular distance. The working principle of Manjesh N, Prof. Sudarshan Raju C H[12] this device is shown in figure 2. There are different types of ultrasonic sensors with different transmission ranges and angles of detection. The HC-SR04 sensor work at frequency of 40 KHz and can measure distances of the objects in the range 2 to 400 cm with a 15^{o} angle of detection.

B. Hump Detection

Ultrasonic ranging and detecting devices use high frequency sound waves called ultrasonic waves to detect presence of an object and its range. Normal frequency range of human ear is roughly 20Hz to 20,000Hz. Ultrasonic sound waves are sound waves that are above the range of human ear, and thus have frequency above 20,000Hz.An ultrasonic sensor necessarily consists of a transducer for conversion of one formof energy to another, a housing enclosing the ultrasonic transducer and an electrical connection. These sensors are of two types:

Ultrasonic Transmitter – Before transmitting the ultrasonic wave, transducer is used to generate the ultrasonic waves. The transducer is given a signal to intermittently produce ultrasonic waves. After that the ultrasonic transmitter sends the waves at a predetermined distance frontward. The maximum range for which obstacle can be detected depends on the range of ultrasonic sensors used.

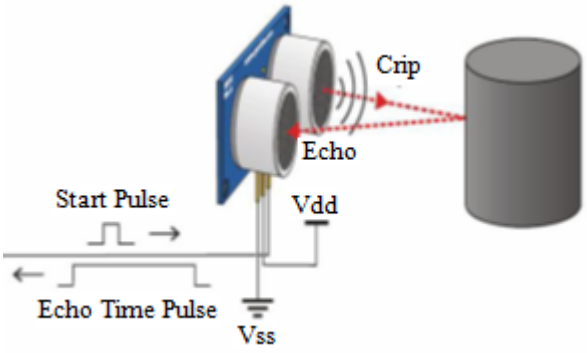

Fig.1. Ultra sonic sensor sensing.

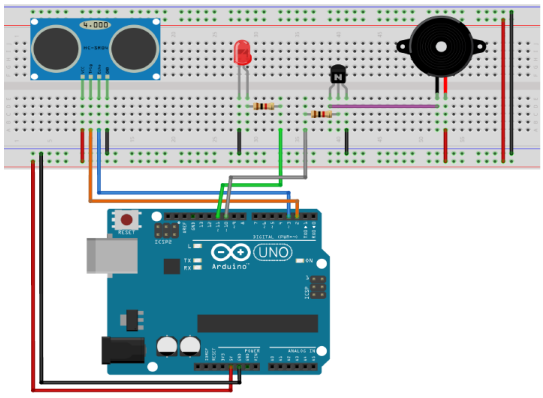

Fig.3. Interfacing Arduino with Ultra sonic sensor.

Ultrasonic Receiver – If the ultrasonic wave detects the obstacle, it will produce a reflected wave. An ultrasonic receiver is used for receiving the ultrasonic waves reflected from the obstacle. The received ultrasonic wave is converted into a reception signal with the help of a transducer. The signal is amplified by an amplifier (operational amplifier). The amplified signal is compared with the reference signal, to detect components in amplified signal due to obstacles on the road.

IV. METHODOLOGY

Ultrasonic transmitter emits sound waves which detects the humps. Once the hump is detected, the waves reflect back and these reflected waves are received by an ultrasonic receiver of the same frequency as that of the transmitter.

These electrical signals are sent to an Arduino which initiates the buzzer on. So this alarms the rider of the speed breaker ahead so with which he can reduce the speed with which he is travelling.

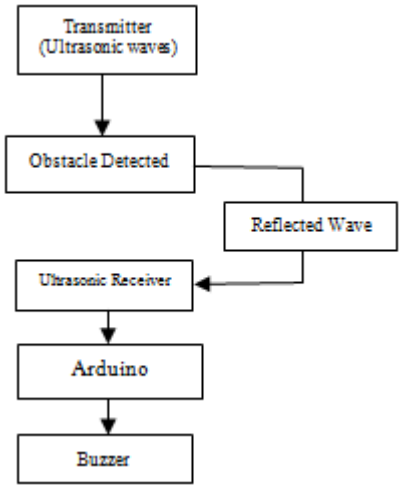

Fig.4. Flow Chart

V. BIKE SECURITY SYSTEM USING RF ID'S

This project describes a security system that can monitor bikes. It is a simple and useful security system which is easy to install. The vehicle's security system consists of two things- One is the key and the other is the RFID Card. If even one component (i.e.) if the key is not open or the RFID card number does not match with the programmed number, the vehicle will not start. . The EM-18 RFID card reader operating at 125 KHz is an inexpensive solution for RFID based application. The reader module comes with an on-chip antenna and can be powered with a 5V power supply. Power up the module and connect the transmit pin of the module to the receive pin of the microcontroller.

Fig. 5 Show the card within the reading distance of 100mm and the card number is thrown at the output. If the output matches the vehicle is in ON state else it is in OFF state.

Fig.5. RF ID System

If somebody tries to drag the vehicle and take it, the IR sensor which is placed near the wheel will detect the number of counts of the wheel.If the count exceeds a certain rpm range the buzzer turns on. The buzzer also rings if a wrong RFID card is shown. The circuit works on a PIC microcontroller, a family of Harvard architecture. 7805 three terminal voltage regulator is used for voltage regulation.

VI. GPS TECHNOLOGY

The Global Positioning System (GPS) is a satellite based navigation system consists of a network of 24 satellites located into orbit. The system provides essential information to military, civil and commercial users around the world and which is freely accessible to anyone with a GPS receiver. Manasi Penta, Monali Jadhav and Priyanka Girme [13] explains GPS works in any weather circumstances at anywhere in the world. Normally no subscription fees or system charges to utilize GPS. A GPS receiver must be locked

on to the signal of at least three satellites to estimate 2D position (latitude and longitude) and track movement. With four or more satellites in sight, the receiver can determine the user's 3D position (latitude, longitude and altitude). Once the vehicle position has been determined, the GPS unit can determine other information like, speed, distance to destination, time and other. GPS receiver is used for this research work to detect the vehicle location and provide information to responsible person through GSM technology.

Fig.6. GSM module neo-6m

VII. GPS MODULE

This circuit is designed for tracking the location of vehicles. In this project we use the GPS Module NEO-6M. Most of tracking systems are made by using GPS. This is very simple and cheap. Tracking systems are mostly used by fleet operators for tracking a vehicle location, routing and others. This is a very good method for preventing our vehicles from stolen. This tracking system sends us the geographical coordinates and by using these coordinates we can track our vehicle position on electronic maps using internet. By theory of Ravi Nandu and Kuldeep Singh[14] using these tacking systems we can share real time information about transportations. And also can be share real time information or position of trains and buses with passengers. Means passengers can see the real time of arriving busses or trains at the platforms on LCD or on Mobiles.

VIII. GSM Modem SIM300 V7.03

The GSM modem is a specialized type of modem which accepts a SIM card operates on a subscriber's mobile number over a network, just like a cellular phone. It is a cell phone without display. Modem sim300 is a triband GSM/GPRS engine that works on EGSM900MHz, DCS1800MHz and PCS1900MHz frequencies.GSM Modem is RS232-logic level compatible, i.e., it takes-3v to -15v as logic high and +3v to +15 as logic low.MAX232 is used to convert TTL into RS232 logic level converter used between the microcontroller and the GSM board. The signal at pin 11 of the microcontroller is sent to the GSM modem through pin 11 of max232.this signal is received at pin2 (RX) of the GSM modem. The GSM modem transmits the signal from pin3 (TX) to the microcontroller through MAX232, which is received at pin 10 of IC1.

Features of GSM

- Single supply voltage 3.2v-4.5v
- Typical power consumption in SLEEP Mode: 2.5mA.
- SIM300 tri-band

XI. GSM MODULE

Fig.7. GSM Module.

Here in this system we are using the GSM module for sending the coordinates of vehicle on mobile phone via message. GPS is sends the coordinates continuously in form of string. After reading this string using Arduino extract the required data from string and then sends it to mobile phone using GSM module via SMS. This information is called latitude and longitude. GPS used 3 or 4 satellite for tracking the location of any vehicle. n circuit diagram three main Components used. These are Global Positioning System(GPS), GSM Module and Arduino. GSM module's Rx pin is directly connected to Tx pin of Arduino and Tx pin of GPS is directly connected Rx pin of Arduino. And a 16X2 liquid Crystal display is also connected with Arduino for displaying coordinate.

X.CIRCUIT EXPLANATION

Circuit Connections of this Vehicle Tracking System Project is simple. Here Tx pin of GPS module is directly connected to digital pin number 10 of Arduino. By using Software Serial Library here, we have allowed serial communication on pin 10 and 11, and made them Rx and Tx respectively and left the Rx pin of GPS Module open. By default Pin 0 and 1 of Arduino are used for serial communication but by using Software Serial library, we can

allow serial communication on other digital pins of the Arduino. 12 Volt supply is used to power the GPS Module.

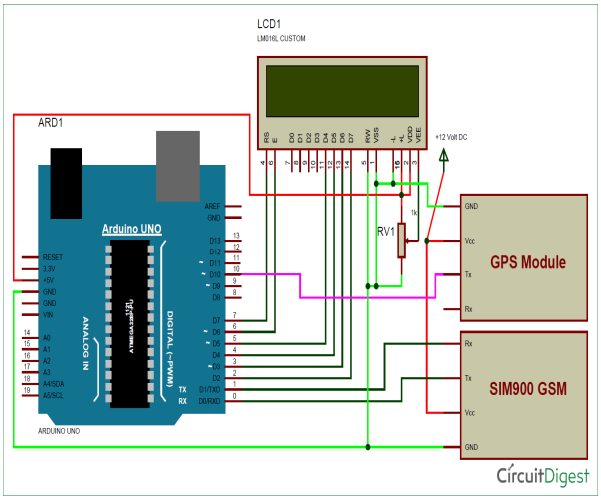

Fig.7. Main Circuit.

GSM module's Tx and Rx pins of are directly connected to pin Rx and Tx of Arduino. GSM module is also powered by 12v supply. An optional LCD's data pins D4, D5, D6 and D7 are connected to pin number 5, 4, 3, and 2 of Arduino. Command pin RS and EN of LCD are connected with pin number 2 and 3 of Arduino and RW pin is directly connected with ground. A Potentiometer is also used for setting contrast or brightness of LCD.

XI. WORKING EXPLANATION

In this project, Arduino is used for controlling whole the process with a GPS Receiver and GSM module. GPS Receiver is used for detecting coordinates of the vehicle, GSM module is used for sending the coordinates to user by SMS. And an optional 16x2 LCD is also used for displaying status messages or coordinates. We have used GPS Module SKG13BL and GSM Module SIM900A.Sent message is received by GSM module which is connected to the system and sends message data to Arduino.

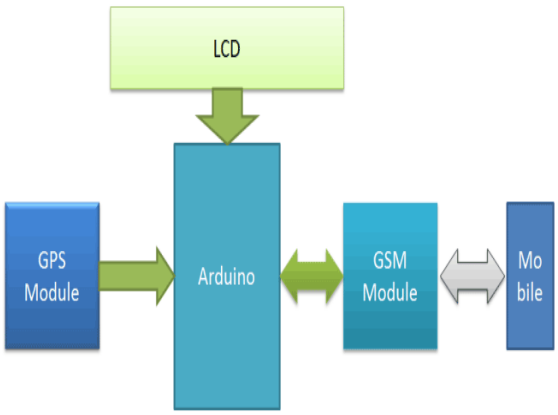

Fig.8.Interfacing Gsm module and Gps with Arduino

Arduino reads it and extract main message from the whole message.And then compare it with predefined message in Arduino. If any matchoccurs then Arduino reads coordinates by extracting $GPGGA String from GPS module data (GPS working explained above) and send it to user by using GSM module. This message contains the coordinates of vehicle location.

XII. HELMET – A KEY

The system is made such that without wearing the helmet the rider will not be able to start the bike. Here, the helmet will be connected to the ignition system of the bike which will be controlled electronically. The helmet will have micro switches fitted inside it which will act as our switch for on/off ignition. The system consists of an RF transmitter and an RF receiver. RF signals are radiated from the transmitter when the rider wears the helmet. These signals are sensed by the RF receiver placed at the ignition switch of the bike which makes the switch ON and the bike gets started.

A. The Helmet (Transmitter Section)

The first step in the working of this system is to wear the helmet, so that the micro switches will sense the head pressure and the transmitter which is embedded in the helmet transmits this signal to the receiver end as shown in Fig. 5.

B. The Bike (Receiver Section)

The signal being transmitted by the transmitter section will be received and accordingly relay will operate in order to switch ON/OFF the ignition of the bike (Fig. 6).

XIII. ENCODER/DECODER

A. HT12E IC

HT12E is an encoder integrated circuit of 212 series of encoders. They are paired with 212 series of decoders for use in remote control system applications. It is mainly used in interfacing RF and infrared circuits.

HT12E converts the parallel inputs into serial output. It encodes the 12 bit parallel data into serial for transmission through an RF transmitter. These 12 bits are divided into 8 address bits and 4 data bits.

B. HT12D IC

HT12D is a decoder integrated circuit that belongs to 212 series of decoders. In simple terms, HT12D converts the

serial input into parallel outputs. It decodes the serial addresses and data received by an RF receiver, into parallel data and sends them to output data pins.

The serial input data are compared with the local addresses three times continuously. The input data code is decoded when no error or unmatched codes are found. A valid transmission in indicated by a high signal at VT pin.integrated circuit (IC). Motor drivers act as current amplifiers since they take a low-current control signal and provide a high current signal. This higher current signal is used to drive the motors. Features of Motor Driver IC include Separate Input Logic Supply, Internal ESD Protection, Thermal Shutdown and High-Noise-Immunity Inputs. It supplies voltage in the range of 4.5 V to 36 V

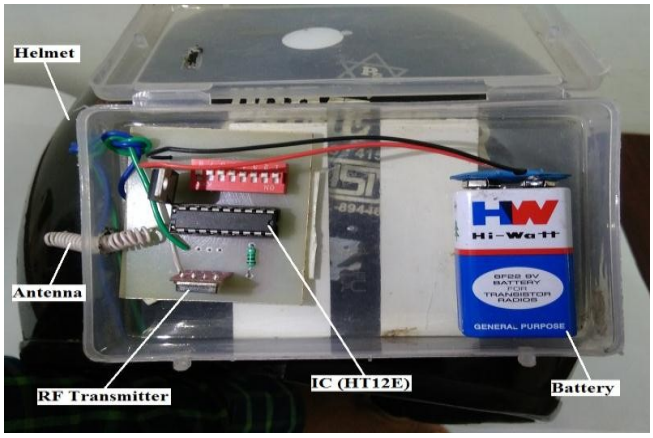

Fig.5. Transmitter system

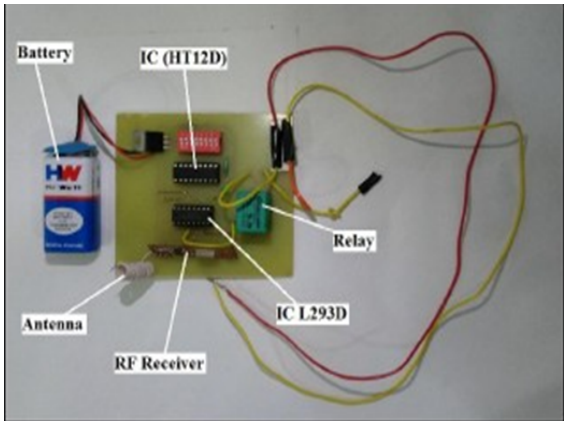

Fig.6. Receiver system

Motor Driver IC L293D is a dual H-bridge motor driver.

Relay: A relay is a simple electromechanical switch made up of an electromagnet and a set of contacts. Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal.

Micro Switches: A micro switch, also known as miniature snap action switch, is a type of momentary contact electric switch that is actuated by very little physical force, through the use of a tipping-point mechanism, sometimes called an "over-center" mechanism used widely in automotive, industrial and medical instruments as sensor.

XIV.WORKING

A. Detection/RF Transmitter Section

In this section, once the head pressure is detected by the micro switches, the encoder IC (HT12E) receives parallel data in the form of address bits and control bits. The control signals from remote switches along with 8 address bits constitute a set of 12 parallel signals. The encoder HT12E encodes these parallel signals into serial bits.

B. Bike Actuation/RF Receiver Section

In this section, after receiving the control signal from the transmitter, the decoder IC (HT12D) converts the serial input into parallel outputs. It decodes the serial addresses and data received by the RF receiver, into parallel data and sends them to output data pins. The serial input data is compared with the local addresses three times continuously. The input data code is decoded when no error or unmatched codes are found. Valid transmissions are indicated by a high signal at VT pin and then relay goes on. Amitava Das, Priti Das, Soumitra Goswami [15] told a string of address and data bit is used to prevent from false triggering. The receiver part is connected with the ignition switch of the bike. As long as the rider wears the helmet the switch will remain ON and actuates the vehicle and as soon as the helmet is kept out from the head the bike stopped working. This means that the bike is ON till helmet is placed on the head.

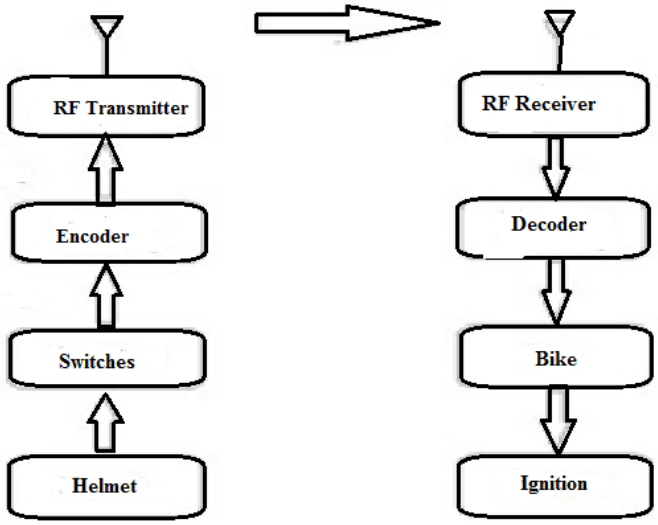

Fig.7. Flow Chart for Tx and Rx

This system is based on radio frequency link. Once the user wears the helmet an RF signal radiate from transmitter and these RF signal gets sensed and synchronized with the help of address matching by the receiver section placed in the ignition switch of the bike and bike gets started and as soon as the helmet is kept out from the head the bike turns off.

The proposed approach makes it mandatory for the rider to use this protective guard in order to drive a two-wheeler vehicle. This system ensures the safety of the human brain and therefore reduces the risks of brain injuries and deaths in case of an accident. This helmet incorporates a very simple and cost effective technology, which if implemented has the potential of drastically reducing fatalities in road accidents due to negligence in not wearing a helmet.

XV. CONCLUSION

The model proposed in this paper serves 3 important purposes, automatic detection of humps and alerting vehicle owners if their vehicle is lost and the safety of the rider riding the bike by making it mandatory to wear helmet. The proposed approach is an economic solution for detection of humps, as it uses low cost ultrasonic sensors. The RFID provides better security to the bike as a thing worth thousands of rupees shouldn't be left on the road without security. The GPS and GSM module used in this system is an additional advantage as it provides alerts with a message to the owner of the vehicle about the location of the bike if it is lost. The proposed approach makes it mandatory for the rider to use this protective guard in order to drive a two-wheeler vehicle. This system ensures the safety of the human brain and therefore reduces the risks of brain injuries and deaths in case of an accident. This helmet incorporates a very simple and cost effective technology, which if implemented has the potential of drastically reducing fatalities in road accidents due to negligence in not wearing a helmet. This model can be further implemented by integrating an alcohol sensor in the helmet so that if a drunken person is driving the vehicle the ignition system of the vehicle turns off sensing the alcohol consumed by the rider.

REFERENCES

[1] Chen, H., Chiang, Y. Chang, F., H. Wang, H. (2010). Toward Real-Time Precise Point Positioning: Differential GPS Based on IGS Ultra Rapid Product,SICE Annual Conference, The Grand Hotel, Taipei, Taiwan August 18-21.

[2] Asaad M. J. Al-Hindawi, Ibraheem Talib, "Experimentally Evaluation of GPS/GSM Based System Design", Journal of Electronic Systems Volume 2 Number 2 June 2012.

[3] Kunal Maurya , Mandeep Singh, Neelu Jain, "Real Time Vehicle Tracking System using GSM and GPS Technology- An Anti-theft Tracking System," International Journal of Electronics and Computer Science Engineering. ISSN 2277-1956/V1N3-1103-1107

[4] V.Ramya, B. Palaniappan, K. Karthick, "Embedded Controller for Vehicle In-Front Obstacle Detection and Cabin Safety Alert System", International Journal of Computer Science & Information Technology (IJCSIT) Vol 4, No 2, April 2012.

[5] Kai-Tai Song, Chih-Chieh Yang, of National Chiao Tung University, Taiwan, "Front Vehicle Tracking Using Scene Analysis", Proceedings of the IEEE International Conference on Mechatronics & Automation 2005.

[6] Chen Peijiang, Jiang Xuehua, "Design and Implementation of Remote monitoring system based on GSM," vol.42, pp.167-175. 2008.

[7] Rajeshwari S., Santhosh Hebbar, Varaprasad G., "Implementing Intelligent Traffic Control System for Congestion Control, Ambulance Clearance and Stolen Vehicle Detection", IEEE Sensors Journal, Vol.15, No.2, pp.1109-1113, 2015 .

[8] Mircea Strutu, Grigore Stamatescu, Dan Popescu, "A Mobile Sensor Network Based Road Surface Monitoring System", In Proceedings of IEEE Conference on System Theory, Control and Computing, pp.630–634, 2013.

[9] Jin Lin, Yayu Liu, "Potholes Detection Based on SVM in the Pavement Distress Image", In Proceedings of International Symposium on Distributed Computing and Applications to Business, Engineering and Science, pp.544-547,2010 .

[10] Sachin Bharadwaj, Sundra Murthy, Golla Varaprasad "Detection of potholes in autonomous vehicle", IET Intelligent Transport Systems, Vol.8, No.6, pp.543-549, 2013.

[11] Nitin Agarwal, Anshul Kumar Singh, Pushpendra Pratap Singh, Rajesh Sahani, Smart Helmet, International Journal of Engg. & Technology (IRJET) Vol. 2 Issue 2

ISSN (Online): 2395□0056 (Print): 2395-0072 (May 2015).

[12] Manjesh N, Prof. Sudarshan Raju C H, Safety measures for two wheelers by Smart Helmet, International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 National Conference on Developments, Advances & Trends in Engineering Sciences (NCDATES), 09th & 10th January 2015.

[13] Manasi Penta, Monali Jadhav and Priyanka Girme, Bike Rider's Safety Using Helmet, International Journal of Electrical Electronic Engineering and Telecommunications (IJEETC) ISSN: 2319-2518, Vol. 4, No. 2, Department of Electronics and Telecommunication, Dr. D Y Patil Technical Campus, Charoli (BK), Pune, India.

[14] Ravi Nandu and Kuldeep Singh, Smart Helmet For Two-Wheelers, Advances in Automobile Engineering, ISSN: 2167-7670, Vol. 3 Issue 2, Department of Automobile Engineering, SRM University, Kattankulathur, Chennai, India.

[15] Amitava Das, Priti Das, Soumitra Goswami, Smart Helmet For Indian Bike Riders, Eleventh IRF International Conference, ISBN: 978-9384209-47-6, 17th August 2014, Chennai, India.