

I-Helmet System With Vehicle Controlling and Accident Prevention

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ABSTRACT

Nowadays, there is an enormous hike in the sales of motor bikes. Today's Young generation are aggressive in their way of riding the vehicles. Of course their rash driving mentality, drunken driving and driving without proper safety precautions could lead to accidents which are fatal, even to death. This system has developed as a part of social responsibility, which assists in reducing the major number of accidents. In this paper, we describe the concept of developing a system that could provide safety to the bike riders as the vehicle will be able to start after satisfying several authentications. After a keen review on current techniques & systems that perform these tasks, we come to describe our approach that aims to build some smart techniques to provide much efficient authentication procedures & efficient means of data communication between the vehicle & the rider. The whole system could eliminate the use of complex advanced microcontroller to control the processes. The system consists of a helmet unit and a vehicle unit. The initial authentications are done in the helmet unit with appropriate sensors and if the authentication fails, the motor bike won't get start. The rider has to put the helmet in proper manner and should not be drunken, so as to start the motor bike. In case if the rider met with an accident, a text message containing the current location of the vehicle will be automatically sent to some pre-defined selected number of persons using GSM and GPS module.

Keywords :- Authentication, Data Communication, Microcontroller, GSM, GPS

I. INTRODUCTION

There is a remarkable hike in the sales of all kind of motor bikes regardless of the company in every year. In a way, the trend of having a motor bike is growing day by day. The interest of young peoples about having their own motor bikes is effectively made use by the motor companies. The rash driving, drunken driving mentality of today's riders could lead them to unfortunate accidents, even to death. India has about only 1% of total number of vehicles that are running on-road. But in a study made by the WHO (World Health Organization), it is come to see that almost 17% of the road accident deaths are reported in the same country. This scenario is very unfortunate and in order to overcome this kind of fatal accidents, we developed our system.

In this paper, we considered to provide an efficient system that could able to perform the authentication task in cost effective. Providing safety to those who need will be the primary concern of our system. Intelligent system has been developed to avoid drunken driving and could provide an alert to the pre-defined numbers immediately, if the rider meets with an accident. . After a keen review on current techniques & systems that perform these tasks, we come to describe our approach that aims to build some smart techniques to provide much efficient authentication procedures & efficient means of data communication between the vehicle & the rider. The whole system could eliminate the use of complex advanced microcontroller to control the processes.

II. LITERATURE SURVEY

Our system has conquered some concepts from several related papers and modification has done with respect to the requirements that we are providing [1]. From the existed techniques, we got the awareness about the alcohol sensor (MQ3 sensor) [3] and [4]. But it has moderate noise immunity and was less resistant to benzene, SO₂ and other gases. There for an efficient alcohol detector (GS-315) were included in our system instead of the above [2]. The use of Arduino microcontroller replaced with PIC16F877a & ATMEGA microcontroller as our system is not too complex & doesn't require advanced microcontrollers to control the whole process. The incorporation of GPS & GSM module to send the status and location of the vehicle are taken into account by a study made on existing technologies [1], [3] and [4].

The reference [1] details a system which is mainly used to track the position of the vehicles by the owner or can also be used in the public transportation system by the people to know the location of the buses or trains. In case of accidents, the system send automated message to the pre-programmed numbers [1]. The GPS & GSM module are used to send the exact location of the vehicle in case of theft or accident to the pre-casted numbers [1] & [4]. This system uses a piezo-electric sensor to detect the pressure & vibration inside the helmet when the rider meets with an accident. An RF encoder & transmitter are used to code the received electric signal to suitable format & transmit it to the receiver section [1]. In the receiver section there is a RF decoder & receiver for receiving & decoding the received signal. A highly advanced Renesas microcontroller is used as the brain for the whole processing [1].

Instead of using advanced Renesas microcontroller as per the requirement, our system was designed with PIC & ATMEGA microcontroller, so as to reduce the complexity and making the system cost effective. Instead of using RF encoder, transmitter, decoder & receiver, our system has designed with a much efficient method for data communication between the master & slave microcontroller [2] & [5]. For the efficient & faster data communication, ZIGBEE is used with UART protocol. Our aim was to develop a much efficient system with some advanced modification from the related systems. It mainly concern in providing safety to the bike riders & providing immediate medical facility when the rider meets with an accident [1].

The existing related systems are rarer except a few those which are reported in patents. Such systems are much costlier as the system uses costly components. The techniques used in existing systems are independently concentrated in some sort of scenarios like alcohol detection or accident alertness only. The use of advanced and costlier microcontrollers and system components for controlling a particular feature therefore doesn't make sense. Those works which uses RF transmitters and receivers for data communication may face information loss or processing delay. Hence there comes a situation for developing a complete system which could integrate all sorts of technologies that are necessary for the rider safety in all manners. Our system provides such kind of features and has overcome the limitations faced by existing works.

III. SYSTEM SPECIFICATIONS

A. Helmet Authentication

For helmet authentication, a limit key and PIR sensor is used. Limit key is used to confirm whether the rider wears the helmet properly or not and a PIR sensor is used to detect the presence of human/living thing inside the helmet.

B. Safety Zone Alert

Whenever any object comes too close to the vehicle or vice versa, the vehicle will automatically slow down and eventually stops. An ultrasonic sensor is used for detecting the objects in front of the vehicle.

C. Automatic Accident Assistance

In case of unfortunate fall or accidents, it is informed to the pre-programmed numbers of family as text along with the exact location via GSM and GPS modules. A piezo-sensor is used to detect the fall which are fatal.

IV. BLOCK DIAGRAM

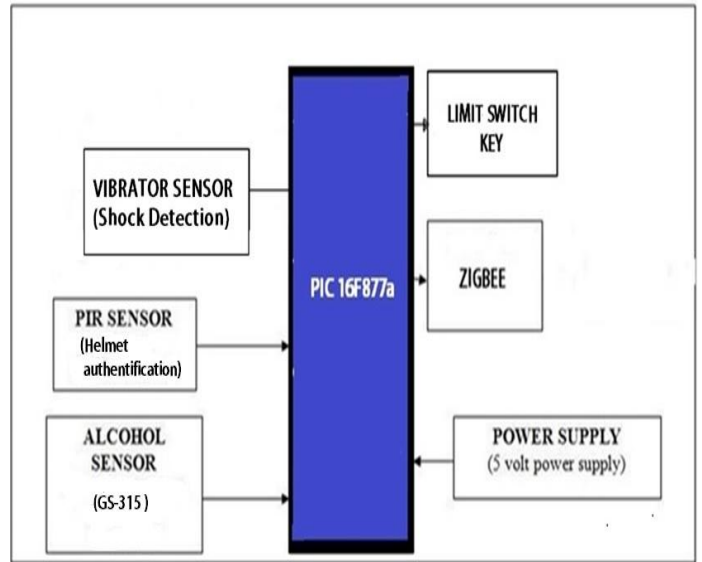


Fig. 1: Block diagram of helmet unit

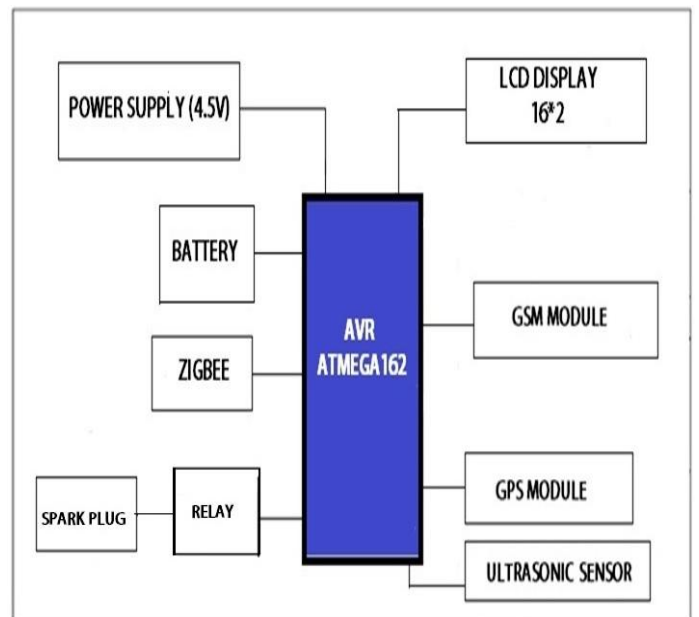


Fig. 2: Block diagram of bike unit

V. METHODOLOGY

This proposed intelligent helmet system is controlled by microcontrollers, hardware and software components.

We considered the method of using a transmitting unit which is being held in the helmet side & a receiver unit which is placed on the vehicle. The helmet unit has several sensors which are considered for providing assistance to the authentication. It has an alcohol detector (GS-315 sensor), which detect the presence of alcohol content in the rider's

breath. Vibrator sensors (piezo-electric) are meant for measuring the shocks & vibrations when the rider meets with an accident [1]. A PIR sensor is calibrated to detect the presence of human inside the helmet. All the above sensors are activated by a limit key held inside the helmet. All the data sensed by the above sensors are processed by PIC16F877a microcontroller. These processed data has to be transmitted to the vehicle unit for further operations & is done by using ZIGBEE which enhance the data communication efficiency.

The data transmitted from the helmet unit are received by ZIGBEE & is given to the AVR ATMEGA microcontroller for processing. In our system, an ultrasonic is provided at the vehicle unit for safety zone indication, i.e. whenever an object is approaching our vehicle too closely or vice versa, it will reach the predefined cut off value there by the vehicle will be automatically slow down and eventually stop. We have a piezo sensor for fall detection of the vehicle [1]. After satisfying all the authentications, the processor provide input to turn on the ignition/battery through the provided relay, in a way the vehicle is now ready to move. Unfortunately when the driver meets with an accident, it has to be informed to the intimates & close relatives. This is done using a GSM module which sends a text about the situation along with the position where the accident has occurred. The data's regarding the location is fetched using the GPS module [1] & [4].

VI. SYSTEM MODULES

A. Microcontroller PIC16F877a

The PIC microcontroller is used as the brain of the transmitting unit. It efficiently fetches and processes the data from different sensors and facilitates the purpose of helmet authentication and automatic accident assistance. The processed data is transmitted through ZIGBEE for further manipulations. This microcontroller is suitable for controlling whole the sensors incorporated in the helmet unit in cost effect. It is featured with flash technology, so that the data will be retained with it even after the power is lost accidentally.

B. Microcontroller ATMEGA16

The ATMEGA16 microcontroller is used to manipulate the data's from the components embedded in the bike unit. The processed data from the helmet unit is received using ZIGBEE and is further checked for controlling the vehicle to start or stop. The input from the ultrasonic sensor is processed as if there is any object approaching the vehicle too closely so as to switch the vehicle from on /off state.

C. Limit Key

An SPDT switch used to turn ON/OFF the entire circuit of helmet unit. It is placed inside the helmet at its top and will be activated only when the rider wears the helmet properly. After activation of the limit key, the whole modules of the transmitting unit are powered.

D. PIR Sensor

The passive infrared sensor is integrated inside the helmet for living body detection. When the rider wears the helmet, there will be a rise in room temperature to the body temperature. This change is seen in the output voltage of the reflected IR rays and is processed in the PIR sensor module which in turn triggers the detection. PIR sensors are mainly used for human detection.

E. Alcohol Detector

In present scenarios, every drunken driver couldn't be found out by the cops practically. There comes a serious problem about the rider's life safety. Hence an alcohol sensor (GS-315) is placed in the helmet unit to detect the presence of alcohol content in the breath. The sensor has high sensitivity and has good response which provides analog resistive output according to the alcohol concentration. As per the Govt. rules, about 0.08 mg/L consumption of alcohol while driving is a punishable offence. But we have defined a threshold value as 0.12mg/L based on some current statistics.

F. Vibrator Sensor

A piezo-electric plate sensor is used as the vibrant sensor in the helmet unit. This sensor measures the shocks/vibrations when the rider meets with accident. Piezo sensor has high sensitivity and could withstand about 6 trillion shocks in its life time.

G. Ultrasonic Sensor

The bike unit is characterized by an ultrasonic sensor which uses the property of sound waves above human audible range (20 KHz). The sensor is used to detect any object moves axially or laterally in front of the bike. The time delay between the transmitted and received ultrasonic signal are calculated by the microcontroller and there by locate an object. In such cases when it detects some objects too close to the bike within the pre-casted limit range, the corresponding data is feed to the AMEGA16 microcontroller for manipulation and thus eventually stops the bike within a short time.it has a detecting range about 15 feet.

H. GSM Module

In this paper, the GSM module is needed to send a text message whenever the rider meets with accidents. The text message will be delivered to the pre-programmed numbers of close relatives or friends which will have two data streams-status and location where accident has occurred.it is standard used to describe the protocols for 2G digital cellular networks. The GSM module is designed with a frequency of 900MHz. The digitized and compressed data are sends down to a channel with two other streams of user data, each will be in its own time slot.

I. GPS Module

The global positioning system is the abbreviation of the above, which are used in vehicle tracking works for providing the location coordinates, speed, current time and so on anywhere on earth. Here in this system, it is included in the bike unit for providing the geographical coordinate in case of unfortunate fall or accident which are fatal to the rider. This module has a GPS receiver with an onboard antenna with a tracking sensitivity of 157 dbm.

J. ZIGBEE

It is a 2.4GHz transceiver which enables the data communication between the helmet and bike unit efficiently. The processed data from the helmet unit are transmitted through the ZIGBEE which is implanted in it and is received at the bike unit through the same. It has programmable data rate ranging from 1.2-500K baud according to the requirement.

VII. CASE STUDY

A. Result With Flowchart

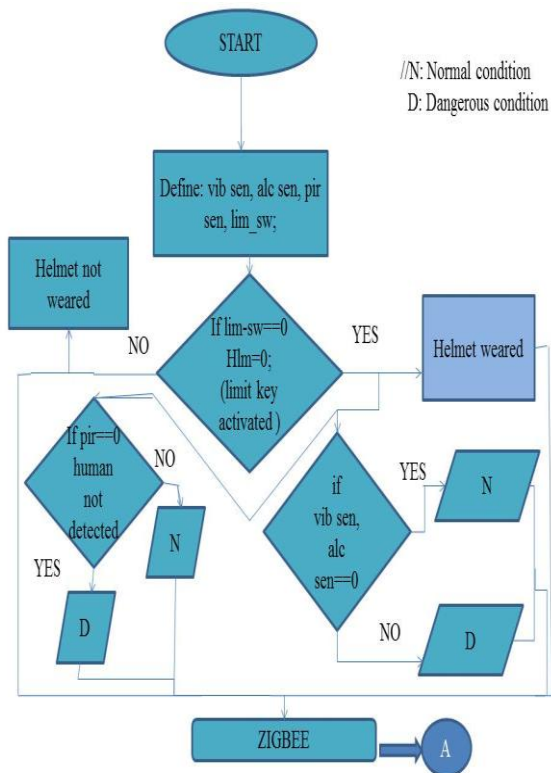


Fig. 3: Flowchart of helmet unit

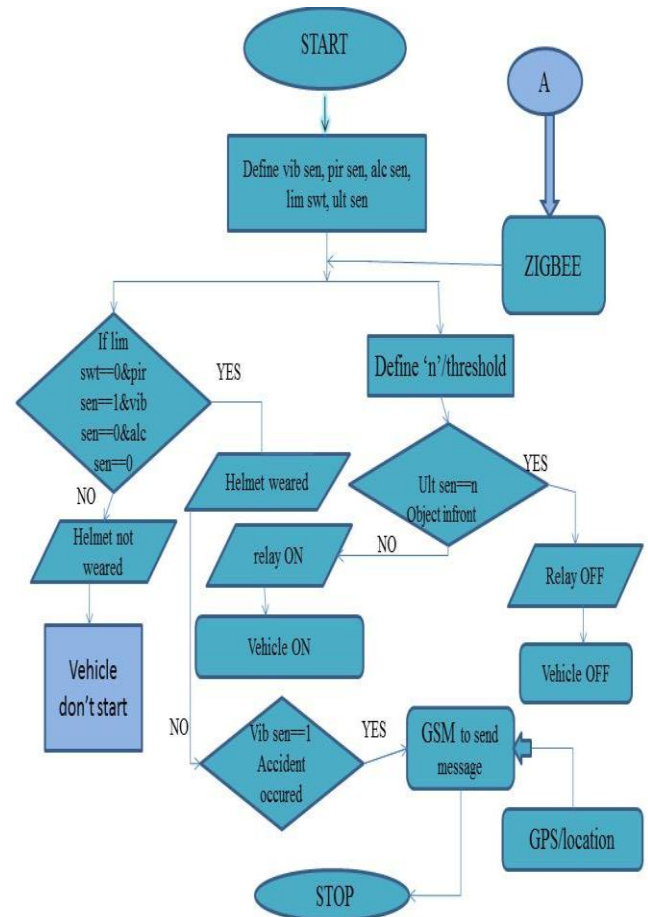


Fig. 4: Flowchart of bike unit

B. Real Time Testing



Fig. 5: Intelligent system with vehicle

The above figure details the design an real time implementation of the proposed intelligent helmet system with the vehicle. In practical cases, the helmet unit is powered with a rechargeable battery which can be charged again and again

at the time when the vehicle is not using. The vehicle unit is designed to be powered by the battery of the vehicle itself so as to facilitate the transportation in real occasions.

C. Hardware Implementation

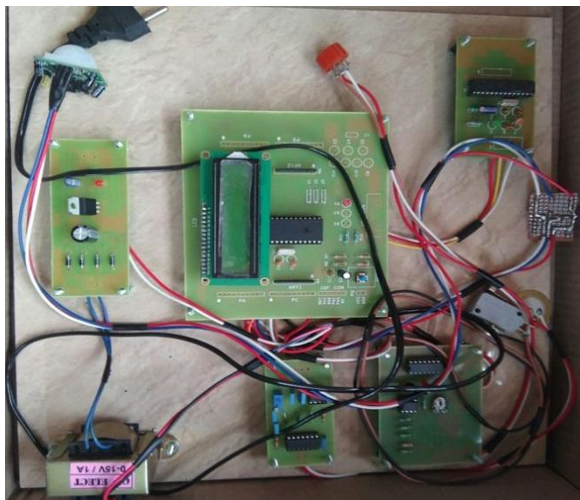


Fig. 6: Helmet unit (Transmitter section)

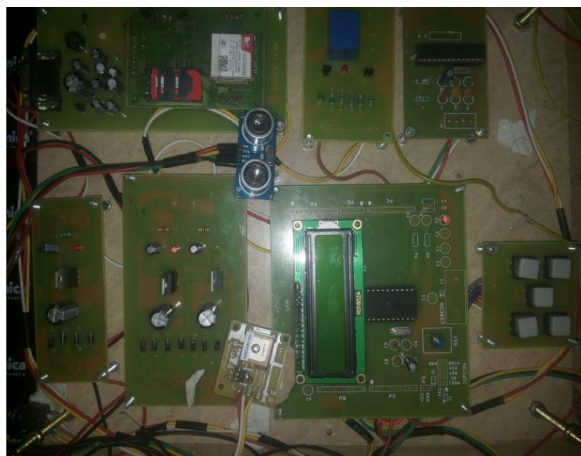


Fig. 7: Bike unit (Receiver section)

VIII. CONCLUSIONS

A serious problem that has arisen in this century is crashes and injuries which heavily include the motorbikes. An Abnormal hikes in craze towards motorbikes of peoples are made used by the different motorbike companies. Nowadays, the number of new generation riders are increased and thereby the count of motor bike accidents. Our system is designed on behalf of social responsibility. We implemented our intelligent helmet system with vehicle controlling to avoid unfortunate accidents

those are fatal to our health and wealth by taking some precautions. Several authentications will ensure and reminds the rider to wear the helmet properly and avoid drunken driving strictly as if the rider is drunken, the bike won't get start. Safety zone alert is provided so as to avoid collision with objects which are too close to us by slowing down the bike. This system could provide an automatic assistance when the user meets with an accident by sending a text message to the pre-casted numbers with the exact location where accident occurred. Prevention with our system is much better than having unfortunate incidents.

IX. ACKNOWLEDGEMENT

We take this great opportunity to express our sincere thanks to all those personalities who were helped us from the very beginning to make our dream so real. Hereby expressing our keen gratitude towards the respected guide Ms. Anila Susan George whose ideas and guidance channeled us in the right way. We have been very fortunate to her for the whole support and heartily coordination which triggered the easy completion of the paper.

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