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Bike Rider's Safety Measures Using Helmet as a Key

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Abstract :-Background/Objectives: The basic idea of the project is to make the helmet so smart that without wearing it the driver won't be able to start the bike, so that it can ensure the safety of the riders. The main purpose of the project is to encourage wearing helmet.

Method: The system design will be such that without wearing the helmet the rider cannot start two wheelers. The helmet will be connected to vehicle key ignition systems which will be electronically controlled. The smart helmet will be having micro switches fitted inside it, which will act as our switch for on/off ignition. It consist of a RF transmitter and an RF receiver system, the bike will not get started without wearing helmet by the driver, as the rider wear helmet an RF signals radiate from the transmitter and once these RF signals get sensed by the receiver placed in the ignition switch on the bike, bike will get started.

Findings: People prefer motorcycles over the car as it is much cheaper to run, easier to repair, easier to park and flexible in traffic. In India more than 37 million people are using two wheelers. Since usage is high accident percentage of two wheelers are also high compared to four wheelers. Motorcycles have a higher rate of fatal accidents than trucks and buses. According to Ministry of Road Transport and Highways, Government of India there are around 1,44,391 bike accidents occurred in 2015 due to which 1,35,343 were injured and 36,803 were killed. Fatal injuries to the brain are an important reason behind deaths due to the road accidents. Therefore, a person riding a two wheeler must wear a helmet in order to protect his skull. Studies show that usage of helmet can save accident death by 30 to 40 percent. The risk of death is 2.5 times more among riders not wearing a helmet compared with those wearing a helmet. Riders wearing a helmet have a greater probability of survival during an accident. This project aims for accident avoidance, safety and security of bike riders.

Applications: This can be used to minimize the accidents and casualties during riding can be used in broadcasting a message among the youth about the road safety and also a number of cases of violating traffic rules can be reduced.

Keywords: Smart Helmet, RF Module, Encoder/Decoder IC, Bike Authentication, Micro Switches, Keyless Bike, Relay Operation, Motor Driver IC, Bike Theft Prevention.

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1. Introduction

Security and safety is one of the most talked of topics in almost every aspect. In today's era, especially in the young generation, the craze of motorbikes is really remarkable. The middle class families prefer to buy motorbikes over 4-wheelers, because of their low prices, various varieties available in the market, due to cut-throat competitions between 2-wheeler companies and durability. As the bikers in our country are increasing, the road mishaps are also increasing day by day. There has been a sharp rise in the total number of deaths that occur due to road accidents in the past few years. Reckless driving, ignorance of traffic rules and absence of a protective shield have been some of the most important reasons for these deaths. The driver must have a line of defense in case an accident occurs. A survey performed in India confirmed that there were a total of 1,39,671 deaths due to road accidents in India in the year 2014. The number increased to 1,46,133 in the year 2015.

Ninety percent of head injury cases are due to road traffic accidents, about 72 percent are youngsters in the age group of 18 to 40. At least three young men using two wheelers die every ten minutes in India due to head injury. For a young Indian chance of being killed or disabled by road traffic injury is higher than HIV, heart attack or cancer. Head injuries have acquired the status of a public health problem. These scenarios grabbed our interest over this paper in order to ensure safe bike riding.

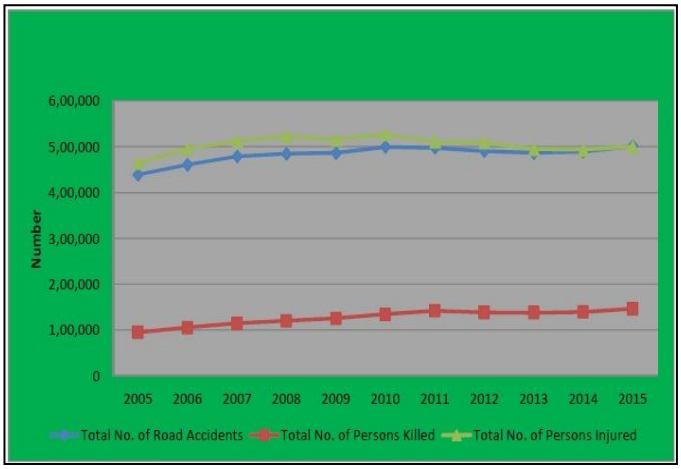

Figure 1. Total No. of Road Accidents, People Injured and Killed (During 2005-2015)

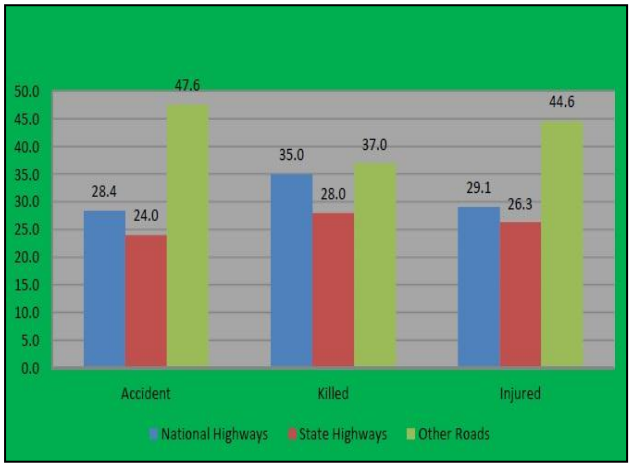

Figure 2. Percentage Share of Accidents, Persons Killed and Injured as per Road Classification (2015)

2. Literature Review

In this age of technology the transportation system is also blessed by its power as a result, many high tech automobiles are developed in terms of speed and comfort but the most important part is the safety of the driver. Due to the reckless driving many riders suffer serious injuries in the accident and even lost their lives. So, in order to minimize those accidents, many people come with different ideas and we have also made an effort to give the best of our ability in the area of safety.

A group of students from the College of Engineering, Roorkee made their effort in ensuring the safety of bike riders by making a helmet safety system prototype based on the microcontroller. Also from the Hindustan University, Chennai two students made a helmet for road hazard warning with wireless bike authentication and traffic adaptive mp3 player.

3. Proposed System and Setup

The proposed system is a simple telemetry system, which is activated by means of a pressure that is applied to the helmet's interior when the rider wears it and when the buckles tie up. The whole system is based on RF Module. Once activated the transmitter sends a control signal to the receiver circuit and activates the relay which is connected to the bike's ignition circuit's power supply.

So if it can be made mandatory to make the people wear the helmet when they ride the bike then the rates of these accidents can be expected to fall. Until now only the laws have been formed but no technological work has been done in this regard. The helmet described here once installed with any bike forces the rider to wear it while riding so law or no law the biker will have to wear the helmet ensuring his/her own safety.

We developed a prototype for our proposed solution. The prototype consisted of two parts. The protective guard or the helmet (transmitter section) that was worn by the people that were sitting on the two wheeler and the bike (receiver section) that initiated motion as soon as the helmet was worn by the user. The main idea behind our proposal is to prevent a driver from riding a 2-wheeler unless he/she does not wear a helmet.

3.1 *The Helmet (Transmitter Section)*

The first step in running this system is to wear the helmet, so that the micro switches will sense the head pressure and the transmitter being embedded in the helmet itself transmits this signal to the receiver end.

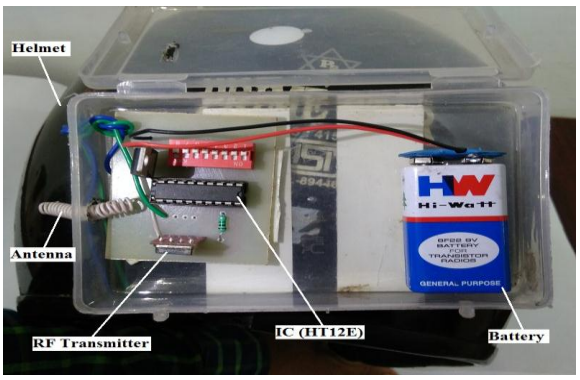

Figure 3. The Proposed System on Helmet

3.2 The Bike (Receiver Section)

The signal being transmitted by the transmitter section will receive here and accordingly relay will operate in order to switch ON/OFF the ignition of the bike.

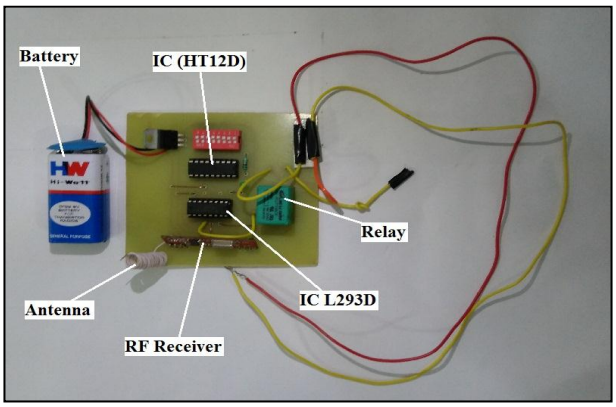

Figure 4. The Proposed System on Bike

4. Proposed Topology

4.1 *RF Module*

An RF (radio frequency) module is a small electronic device used to transmit and/or receive radio signals between two devices. For many applications the medium of choice is RF since it does not require line of sight. RF communications incorporate a transmitter and/or receiver. Depending upon the type of application, the RF module is chosen. For short range wireless control applications, an ASK RF Transmitter-Receiver Module of frequency 315 MHz or 433 MHz is most suitable. They are quite compact and cheap. They are sometimes used to replace older infrared communication designs as they have the advantage of not requiring line of sight operation.

4.2 Encoder/Decoder IC

4.2.1 HT12E IC: HT12E is an encoder integrated circuit of 2^{12} series of encoders. They are paired with 2^{12} series of decoders for use in remote control system applications. It is mainly used in interfacing RF and infrared circuits.

Simply put, 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.

4.2.2 HT12D IC: HT12D is a decoder integrated circuit that belongs to 2^{12} series of decoders. In simple terms, HT12D converts the serial input into parallel outputs. It decodes the serial addresses and data received by, say, 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.

4.3 Motor Driver IC

L293D is a dual H-bridge motor driver 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 supply voltage in the range of 4.5 V to 36 V.

4.4 Relay and Micro Switches

4.4.1 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.

4.4.2 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.

5. Working Approach

The approach of this system is very simple and dynamic. The working of smart helmet will be such that when driver wears the helmet the micro switches equipped inside it get sensed by the pressure of head. Thereafter the process is completed by the following two approaches:

5.1 *Detection/RF Transmitter Section*

In this section, after detecting the head pressure 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. Transmission is enabled by providing ground to pin 14 which is active low. The control signals are given at pins 10-13 of HT12E. The serial data is fed to the RF transmitter through pin 17 of HT12E.

5.2 Signal Reception and 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. A valid transmission in indicated by a high signal at VT pin and then relay goes on. 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 wearing the helmet the switch will remain ON and actuates the vehicle and as soon as the helmet keep out from the head the bike stopped working. This means that the bike works properly till helmet is placed on the head.

5.3 Block Diagram

The block diagram which clarifies the concept of this project is as given below:

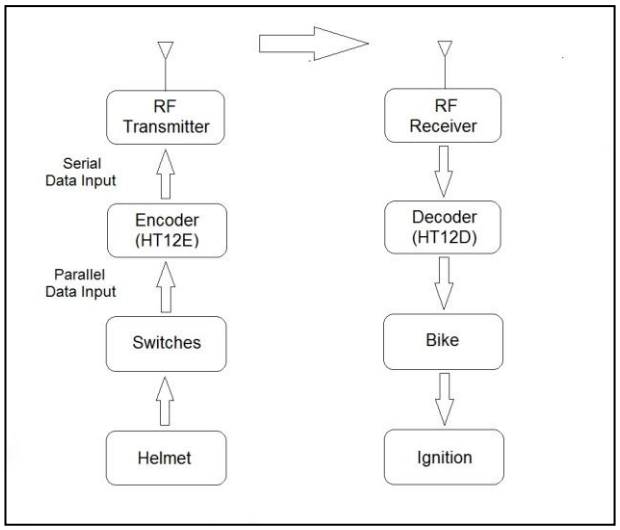

Figure 5. Block Diagram

6. Proposed Circuit

The proposed circuits for transmitting and receiving of signals are as given below:

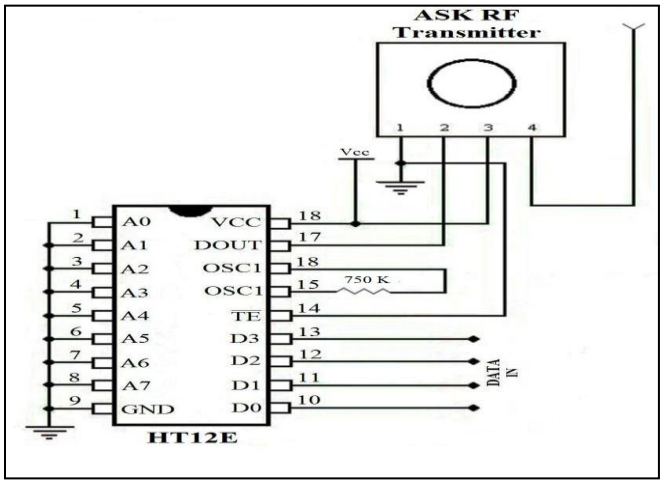

Figure 6. Connection of HT12E IC with Transmitter Module

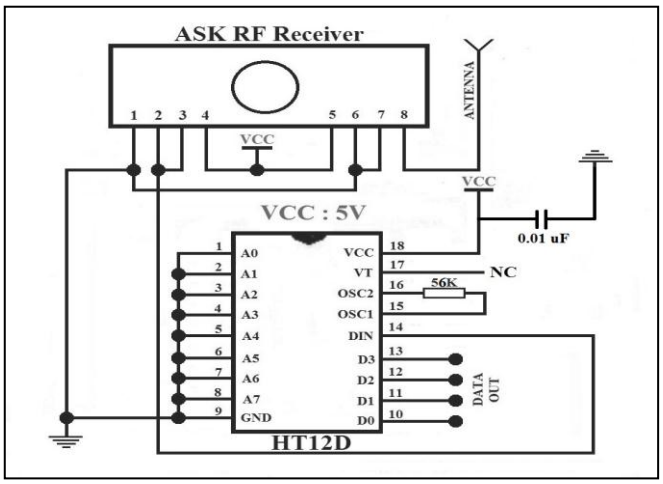

Figure 7. Connection of HT12D IC with Receiver Module

7. Future Prospects

The modification and development of a project never stops after its initial start and in this project also we will add certain systems in the near future which have been discussed below:

a. Incorporating an Alcohol Detector

A large number of road accidents occur due to excess alcohol consumption of drivers. Adding an extra alcohol detector to the helmet would ensure that the vehicle does not start if the driver has consumed a large amount of alcohol.

b. Adding an Emergency GPS cum GSM System

In case an accident does occur, there is need for the installation of an additional GPS cum GSM security feature that notifies the nearest hospital and police station about the location of the place where the accident has taken place.

c. Use of a Speed Restrictor

In case the helmet is broken or lost, there is a need to incorporate a speed restrictor in the two wheeler that prevents the driver to drive at a high speed.

d. Obstacle Detection

If further modified the system can senses the obstacles in front of the vehicle and so that the accidents due to static obstacles could be avoided. This is greatly helpful to avoid accidents which happen during the night time.

e. Incorporating Bluetooth Device

If the driver receives any call during driving then he can receive it via Bluetooth which can avoid many fatal accidents on the road.

f. Safety Zone Indication

In this part the bike rider will get an alert if any vehicle comes too close through LED and Buzzer.

8. Result

The concept of this project is very simple and dynamic. This system can be used to minimize many lethal accidents on the road. This can avoid many serious injuries of the drivers especially to the brain injuries which are very dreadful.

Thus to ensure bike rider's safety we have designed this project. This system is based on radio frequency link, as user wear the helmet an RF signal radiate from transmitter and these RF signal get sensed and synchronized with the help of address matching by the receiver section placed in the ignition switch of the bike and bike get started and as soon as the helmet keep out from the head the bike stopped working. This means that the bike works properly till helmet is placed on the head.

Hence we concluded with the result that the whole system is based on wearing the helmet as it acts as a key required to start the bike because until and unless drivers wears the helmet he/she will be unable to start the bike.

9. Conclusion

A helmet may not be a full proof but is definitely the first line of defense for the rider in case of an accident to prevent fatal brain injuries. Therefore it is extremely vital for the people on a two wheeler to wear helmets. Our 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. Also as a future scope it can be combined with many existing technologies to provide guidance and on road tracking facilities.

By seeing those many benefits and other factors, we came to the conclusion that it is the best alternate in order to reduce the number of head injury happening. This being a very innovative idea should be developed on production basis.

10. Acknowledgement

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Lastly, we feel immense moved in expressing our indebtedness to our revered parents whose sacrifice, guidance and blessings helped us to complete our work.

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