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"Smart Helmet Kavach" Based On Radio Frequency Technology

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Abstract

In present time many cases of bike accident can be seen around us. People get injured or might die and one of the reasons is not wearing helmets.

Many people could save their life in accident cases if they wore helmet at the time of accident. Continuously road rules are violated.

So as to overcome these problems, a Smart helmet is proposed having a control system built inside a helmet Smart Helmet for Motorcyclist is a project undertaken to increase the rate of road safety among motorcyclists.

The idea is obtained after knowing that the increasing number of fatal road accidents over the years is cause for concern among motorcyclists.

It consists of an RF transmitter and an RF receiver system. The bike will not get started without wearing helmet by the user, as user wearing helmet a rf signal radiate from transmitter and once these rf signal get sensed by the receiver placed in the ignition switch of the bike, bike will get start.

The security system applied in this project meets the characteristics of a perfect rider and the application should be highlighted. The project is expected to improve safety and reduce accidents, especially fatal to motorcyclists.

Index Terms** – **Helmet, Rf Transmitter/Receiver, Micro switch Encoder/Decoder Ic, Relay Switch.

1. INTRODUCTION:

In today's era, especially in the young generation, the craze of motorbikes is remarkable.

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, due to which many deaths occur, most of them are caused due to most common negligence of not wearing the helmets, also many deaths occur due to lack of prompt medical attention needed by the injured person.

This motivates us to think about making a system which ensures the safety of bikers, by making it necessary to wear a helmet, as per government guidelines, also to get proper and prompt medical attention, after meeting with accident. The project aims at the security and safety of bikers against road accidents. The circuit is so designed that the bike won't start without wearing a helmet.

It introduced a security system on the rider with the perfect helmet usage before riding.in this system no advanced concepts of JAVA Programming (JavaScript, j2me) and Microcontroller 8051 based circuitry is used. It is based on RF link simple working and operation. By using RF transmitter and RF receiver, the motorcycle can be moved it receive signal from the helmet. Here our main object is to

design the circuit that can improve the safety of motorcyclists. The statics of law breakers are depicted below in the table.

Law breakers	Two wheelers	Four wheelers
Signal jumping	2,20,859	1,46,945
Drunken Driving	36,727	17,237

1.2 Current Scenario:

Helmets for riders are extremely important and many lives can be saved by the use of these Helmets in the event of accidents. Motorcyclists have a perception that wearing a helmet causes discomfort and they do not appreciate its importance, especially the youth. And perhaps the most misleading idea is that short trips do not involve any risk. Smart helmet helps to curb "riding without helmet" by ensuring that the rider mandatorily wears the Helmet while driving.

The system is designed in such a way that if the rider does not wear his/her helmet the bike's ignition is turned off. It also has emergency features which come in need during mishaps.

With the implementation of this concept, we would like to make commuting safe and reduce the number of motorcycle accidents. The design also has pollution information gathering technology where the sensor records the "ppm" of various greenhouse gases and with respect to the location, the information is updated on the cloud. Wearing a helmet reduces the risk and increases the chances of survival. A helmet is lined with polystyrene and, on hard impact absorbs the shock. The government has been working on this situation and has come up with road laws. The domain of safety has a wide scope for development and a number of research papers have been published and has built a system using encoders, RF transmitters and receivers to improve the safety and use of a helmet while commuting on a two-wheeler. This was further improvised by where the safety helmet system included a vibration sensor, GSM and GPS modules that could track the person and send a distress call upon hard impact.

1.3 Objective of Project:

The objectives of this project are:

I. To design a circuit that can improve the safety of motorcyclists.

II. To develop a Smart safety helmet for the complete riders.

III. To study and understand the concept of RF Transmitter and RF Receiver circuit in implementing the project.

2. LITERATURE SURVEY:

2.1 Introduction:

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 reckless driving many riders suffer serious injuries in accidents and even lose their lives. So, in order to minimize those accidents, many people come up 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 Hindustan University, Chennai two students made a helmet for road hazard warning with wireless bike authentication and traffic adaptive mp3 player.

2.2 Previous Work:

1. Bayly et al. (2006) have proposed Intelligent Transport Systems and Motorcycle Safety. They investigated the extent to which ITS have been applied to motorcycles (including both existing and emerging technologies) and have discussed these ITS according to their likely safety benefits to motorcycle safety. The potential to adapt emerging and existing ITS from other vehicles to motorcycles is also highlighted in their experiment.

2 Microcontroller based smart wear for driver safety -In this paper the author has discussed the speed of the vehicle. In this application the project will be monitoring the areas in which the vehicle will be passing. On entering any cautionary areas like schools, the speed of the vehicle will be controlled to a predefined limit. He worked on the phenomenon of speed of vehicles along with some security factors.

3 Smart Helmet (March 2015) - In this paper the prime objective of author is to force the rider to wear the helmet throughout. Considering the increasing number of motorcycle riders in our country and the number of accidents happening each year. In this competitive world one of the surveys says that the death tolls due to motor bike accidents are increasing day by day out of which most of these casualties occur because of the absence of helmet. Traffic police cannot cover remote roads of the city. That's why over primary target is to make the usage of the helmet for two wheelers" compulsory ". Thus, no one other than the owner himself, who doesn't have "password" which would have been created by the owner, can use the bike. In this author has proposed the feature that the bike will not start unless the

helmet is not worn by the rider.

The other this module basically deals with the checksum of rider if he is wearing the helmet or not on first place to achieve this ultrasonic sensor has been used, based on this the signal are being sent to the next module voice recognition module use for authentication purpose. Arduino is also used in this project which is an opensource tool for making computers that can sense and control more of the physical world than your desktop computer. Hence they have to use ultrasonic sensors it is very expensive and the microcontroller has been used. It may have major drawbacks in the future as it is not able cope with a highly updated world in future.

4 Smart Helmet (May 2016) - In this project the author has proposed the smart helmet because of growing bike accident now a days. People get injured or might be dead and one of the reasons is not wearing helmets. Continuously road rules are violated. so as to overcome this problem this helmet is been proposed. The craze of motor bike is really remarkable. The middle-class families prefer to buy motor bike over four wheelers, because of the low prices, various variety available in the market ,due to cut-throat completion between two-wheeler company and durability. Author has also used encoder IC receives parallel data in form of address bits and control bits the other author has used smart system for helmet

5 Smart Helmet Using GSM and GPS Technology- The Author has discussed safety and security of the bikers against road accidents. Smart helmets have a special idea which makes motorcycle driving safety than before, this is implemented using GSM and GPs technology. Another advantage of this project is to measure the alcohol level of the drunken people who is riding the bike. Whenever the alcohol level crosses the predefined value, the alarm starts and get notification about the drunken driver. As they have used microcontrollers for controlling their overall operation due to that the project might fail to upgrade to newer versions.

3. PROPOSED SYSTEM:

3.1 Introduction:

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.

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.

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.

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.

The Delay Circuit In case of parking of vehicle where helmet is not required, a delay timer circuit is used to bypass the helmet and turn on the vehicle for specific time.

3.2 Technical Description:

This radio frequency (RF) transmission system employs Amplitude Shift Keying (ASK) with transmitter/receiver (Tx/Rx) pair operating at 434 MHz The transmitter module takes serial input and transmits these signals through RF. The transmitted signals are received by the receiver module placed away from the source of transmission.

The system allows one way communication between two nodes, namely, transmission and reception. The RF module has been used in conjunction with a set of four channel encoder/decoder ICs. Here HT12E & HT12D have been used as encoder and decoder respectively.

3.3 Rf Circuits Working:

Transmitter Section

When Rider wears the helmet, the pressure switch gets closed, and 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 pin14 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 pin17 of HT12E. The signal is transmitted through copper antenna to the receiver section.

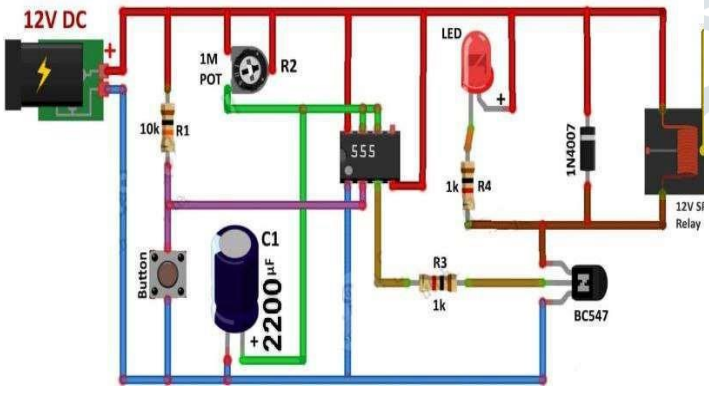
Receiver Section

At the receiver section the signal received from the transmitter i.e. helmet is sent to decoder IC HT12D, it 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 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 is indicated by a high signal at VT pin and then relay goes on. A string of address and data bit is used to prevent false triggering. As relay goes on the green led turns on and the gear motor starts to rotate indicating engine is ON.

3.4 Delay Timer circuit

A 555 timer IC-based timer circuit is a commonly used electronic circuit that utilizes the versatile 555 timer integrated circuit (IC) to generate precise timing intervals. Here is a brief description of how it works:

The 555 timer IC acts as a stable and accurate timing source for the circuit. It consists of various components, including resistors, capacitors, and comparators, which work together to produce specific timing intervals. Applications of 555 timer IC-based timer circuits include timing and control functions in various electronic systems, such as pulse generation, timing delays, frequency generation, and PWM (Pulse Width Modulation) signal generation.



4. Implementation and Working Details

4.1 Introduction:

Testing the smart helmet involves examining its different functionalities and components. This includes verifying the performance of the RF transmitter, RF receiver, lithium polymer battery, solar cell, and copper antenna, among others. Through testing, we can evaluate the range and quality of wireless communication, battery life and charging efficiency, solar cell output, and antenna reception capabilities.

Calculation plays a role in designing and optimizing various aspects of the smart helmet system. For example, calculating the timing intervals of the 555 timer IC based circuits helps determine the duration of specific operations, such as LED flashing or alarm activation. By conducting thorough testing and calculations, we can ensure that the smart helmet project meets the desired objectives of providing enhanced safety features and reliable wireless communication. These processes help validate the functionality, efficiency, and overall performance of the smart helmet, providing confidence in its effectiveness and usability for the intended application.

4.2 Helmet Battery Charging:

The Helmet is embedded with a 3.7 Volt 250 MAh battery, which can be charged with a standard 5 V 10 W phone charger and also with installed 4 Volt Solar panels.

The charging time can be estimated based on the charging current set by the module. The TP4056 module typically has a charging current setting range of 100mA to 1000mA (0.1A to 1A).

1. Charging using 5 Volt Phone charger

Determine the Charging Current:

The charging current is determined by the current setting of the TP4056 module. Let's assume you set it to 500mA (0.5A).

Calculate the Charging Time:

charging time can be estimated by dividing the battery's capacity by the charging current:

Charging Time (T) = Battery Capacity (C) / Charging Current (I)

C = 250mAh (milliampere-hours) = 0.25Ah (ampere-hours)

I = 500mA (0.5A)

T = 0.25Ah / 0.5A

T = 0.5 hours = 30 minutes

Therefore, with a TP4056 module set to a charging current of 500mA (0.5A), it would take approximately 30 minutes to charge the 3.7V 250mAh battery.

2. Charging using on board 4 Volt Solar panels

Determine the Charging Current:

The charging current is determined by the TP4056 module and can be set by adjusting the current sense resistor. Let's assume you set the charging current to 100mA (0.1A) using the module.

Calculate the Charging Time:

To estimate the charging time, you need to consider the available power from the solar cell. Since the solar cell has a maximum output of 4V and 100mAh (0.1A), we can use this value as the charging current (I).

C = 250mAh (milliampere-hours) = 0.25Ah (ampere-hours)

I = 100mA (0.1A)

T = 0.25Ah / 0.1A

T = 2.5 hours = 150 minutes

Therefore, when using a 4V 100mAh solar cell connected to a TP4056 module with a charging current of 100mA (0.1A), it would take approximately 150 minutes to charge the 3.7V 250mAh battery.

4.3 Helmet Range:

For a basic estimation, let's assume a transmit power of 100 milliwatts (mW) and a typical receive sensitivity of -100 dBm for the RF receiver module.

The range can be roughly estimated using the formula:

Range = (Power Transmit / Power Receive) ^ (1/4) * Constant

Where the constant varies based on environmental conditions and antenna efficiency.

Assuming a constant value of 0.1, the range calculation for the 27 MHz RF system would be:

Range = (100 mW / 10^ (-100 dBm/10)) ^0.25 * 0.1

Range ≈ (100 mW / 10^ (-10)) ^0.25 * 0.1

Range ≈ (100 mW / 0.1) ^0.25 * 0.1

Range ≈ (1000) ^0.25 * 0.1

Range ≈ 10 * 0.1

Range ≈ 1 meter

Hence, helmet transmission range is approx 1 meter.

4.4 Delay Timer Calculation:

According to our delay timer circuit, the time duration is equal to the time taken for the capacitor to charge from 0V to 2/3rd of the input voltage, and theoretically, the value is equal to:

T (in seconds) = 1.1 * R (in ohm) * C (in Farad)

[in the circuit, R is R2, and C is C1]

T = 1.1*20000*0.0022

T = 48.4 sec

T ≈ 60 sec

Practically, the delay time will be higher than the calculated value due to the leakage of the capacitor (C1).

5. FUTURE SCOPE:

5.1 future Scope

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 by 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 driving at a high speed.

d. Obstacle Detection:

If further modified the system can sense the obstacles in front of the vehicle and so that accidents due to static obstacles could be avoided.

This is greatly helpful to avoid accidents which happen during the nighttime.

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.

6. CONCLUSION:

In conclusion, the smart helmet project incorporates RF-based technology to enhance safety and functionality. The helmet is equipped with an RF transmitter, RF receiver, and various sensors to provide real-time data and communication capabilities. The RF transmitter enables the helmet to send crucial information, such as the wearer's location and vital signs, to a central monitoring system or other connected devices. The RF receiver allows for the reception of important commands or alerts, enhancing the helmet's responsiveness to external stimuli. By integrating RF technology into the smart helmet, it becomes a powerful tool for improving safety, communication, and monitoring in various applications such as industrial work, sports, or emergency response. Through careful design, construction, and testing, the smart helmet project offers a promising solution to enhance personal safety and situational awareness for helmet users.

To enhance rider safety and streamline vehicle activation, the smart helmet project, featuring an RF transmitter and receiver system, offers significant benefits. These include improved adherence to legal requirements, heightened convenience, and an additional layer of security against unauthorized vehicle use. While challenges like limited compatibility and potential reliability concerns exist, the project's potential for real-time monitoring and integration with emergency response systems demonstrates its potential impact.

With careful attention to implementation, user education, and cost considerations, the smart helmet project has the potential to revolutionize motorcycle safety and bolster the overall riding experience.

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