Vehicle Security System using Helmet

Vasantha Laxmi C. B[1] Manivannan.R[2]
[1,2]P.G. Scholar
[1,2]Department of Electrical & Electronics Engineering
[1,2]Bannari Amman Institute of Technology, Sathyamangalam, Erode, tamil nadu, india

Abstract— *Injuries to the skull and neck are the main causes of death and disability among users of motorcycles and bicycles. Wearing a helmet is the single most active way of reducing head wounds and fatalities resulting from motorcycle and bicycle crashes. Even though rules are there to enforce helmet wearing, most of us are not willing to obey. In a country with 75 % of vehicles being two wheelers, it is essential to promote helmet use among all motorcyclists. The main objective of the project is to make sure that every person riding a bike is wearing a helmet. The vehicle will turn on only if the rider puts on the helmet. When the helmet is worn, the key inside will be triggered and radio waves (which are not harmful) are transmitted. This in turn triggers the starting circuit of the vehicle. The rider should wear the helmet throughout the journey. However, provisions are made for him to remove it for a short duration of time while riding, if the situation demands. The helmet serves another purpose as well; it prevents vehicle theft to a greater extent. Each helmet-vehicle pair will have a unique code and frequency. Hence hacking can be prevented to a great extent. However, the helmet must be provided by the bike manufacturer.*

Keywords— Helmet, Two Wheelers, Safety, Head Injuries, Vehicle Theft

I. INTRODUCTION

India is experiencing an extraordinary and unparalleled motorization in recent times. The motorization pattern in India shows that nearly three fourths of the total registered vehicles are motorized two wheelers. Even though a significant increase is seen in urban areas, there is a clear increase in rural areas also. Head injury is the main cause of death and disability among the users of motorcycles and bicycles.

Even though helmet wearing has been made mandatory for two wheeler riders, people tend to ignore the same. Considering the benefits of helmets use among motorcyclists, efforts have to be made to encourage motorcyclists to use helmets. In a country with 75 % of vehicles being two wheelers, it is essential to promote helmet use among all motorcyclists.

II. OBJECTIVE

1) To ensure the safety of a rider by making sure he wears a helmet, such that the motorcycle runs only if the rider puts on the helmet.
2) To prevent the vehicle thefts by generating a unique code for a helmet-vehicle pair.

III. PROBLEM DEFINITION

A. Death due to Motorcycle Collisions

Each year nearly 1.2 million people die as a outcome of road accident, and millions more are injured or restricted. In most countries, where motorcycles and bicycles are an gradually common means of transport, users of two-wheelers make up a large ratio of accidents on the roads. Motorcycle and bicycle riders are at an increased risk of being involved in a crash. This is since they often share the traffic space with fast-moving cars, buses and trucks, and also because they are less observable. In design, their lack of physical defence makes them particularly vulnerable to being injured if they are involved in a collision.

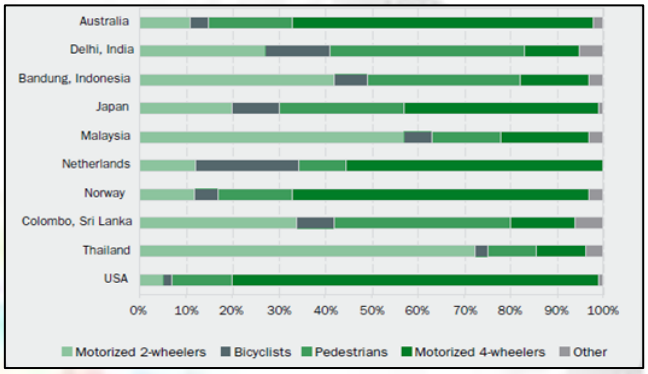

Fig. 1: Road users killed in many modes of transport as a ratio of all road traffic deaths.

For instance, 27% of road deaths in India are mid users of motorized two-wheelers, while this figure is among 70–90% in Thailand, and about 60% in Malaysia. In China, motorcycle tenure between 1987 and 2001 grew rapidly from 23% to 63%, with a resultant increase in the ratio of traffic fatalities constant by motorcyclists increasing from 7.5% to 19% over the same period.

B. Head Injury is a Leading Cause of Death

Globally, there is an rising trend in the number and use of motorcycles and bicycles, both for transport and entertaining purposes. Indeed, most of the growing in the number of vehicles on the world's roads comes from an increasing use of motorized two-wheelers. Asian countries, in exactly, are estimated to experience a considerable rise in the number of motorized two-wheeler vehicles on their roads. This precise growth in the use of motorcycles in many low income and middle-income countries is already being accompanied by a significantly increase in the number of head injuries and fatalities that will continue to increase if present trends continue unchecked.

Fig. 2: Head Injury is a Leading Cause of Death

IV. DESIGN METHODOLOGY

A. Working of a Helmet

A helmet aims to reduce the risk of serious head injury by decreasing the impact of a force or collisions to the head.

A helmet works in three ways:

- The soft material combined in the helmet absorbs some of the control and therefore the head come from to a halt more slowly. This means that the brain does not hit the skull with a great force.
- It spreads the forces of the control over a greater surface area so that they are not focused on specific areas of the skull.
- It prevents straight contact between the skull and the impacting object by acting as a mechanical barrier mid the head and the item.

These three roles are achieved by combining the properties of four basic components of the helmet that are described below:

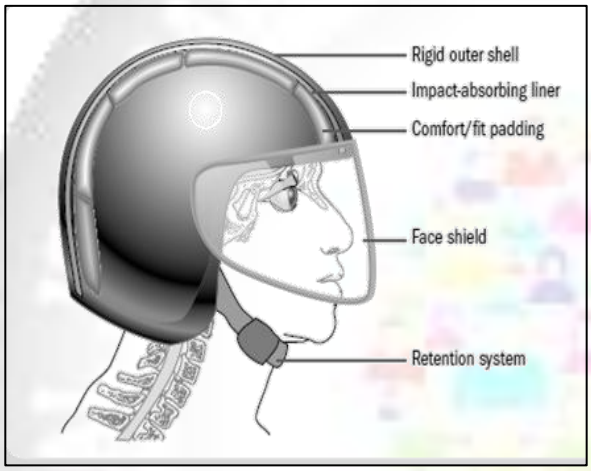

Fig. 3: Components of a Helmet

- The Shell – is the strong outer surface of the helmet that distributes the impact over a large surface area, and therefore lesser the force before it reaches the head. Although the shell is tough, it is designed to compress when it hits anything hard. It provides shield against penetration by small, sharp and high speed objects and also protects the padding inside the helmet from grazes and hits during daily use.
- The Impact-Absorbing Liner – is made of a soft, crushable padded material, usually expanded polystyrene, called as 'Styrofoam'. The dense layer cushion absorbs the shock as the helmet breaks and the head tries to carry on moving.
- The Comfort Padding – is the soft foam-and-cloth layer that sits next to the head. It helps to keep the head comfortable and the helmet fitting snugly.
- The Retention System, or Chin Strap – is the mechanism that keeps the helmet on the head in a crash. A strap is connected to each side of the shell. Chin and neck straps, which are designed to keep the helmet on during an impact, must be correctly used for the helmet to function as it is designed to.

B. Conventional Starting of Vehicle

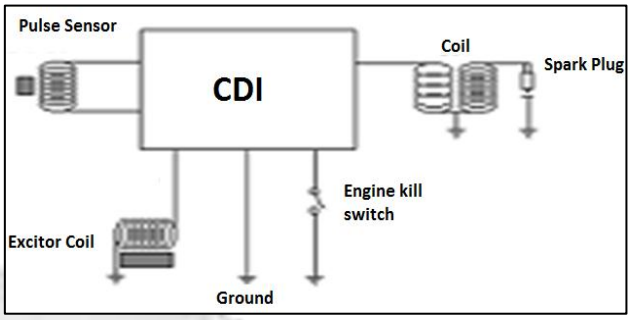

Fig. 4: Conventional Circuit

Normally the vehicle will get started as soon as the key is turned on and ignition is provided. When the key is switched on, the battery will be connected to the capacitive discharge circuit. The CDI circuit steps up the input voltage to the necessary voltage required to induce the spark in the engine. Thus the vehicle gets started.

V. FEASIBILITY STUDY

A. Economic Feasibility

Implementing our project is quite feasible economically. Because the entire set up is achieved from slight modification in the existing system. All components are readily available in the market. Vehicle and helmet costs were covered up since we already have them. Transmitter and receiver with the required fixed frequency were available as built in units and we used the same.

S. No	Component	Type	Number	Cost
1	Microcontroller	AT MEGA 8	2	300
2	Encoder	HT 12E	1	45
3	Decoder	HT 12D	1	45
4	Transmitter, Receiver	-	1	10
5	Relay	5-230V	1	50
6	Battery	9V	1	
7	Battery	12V	1	
8	Buzzer	-	1	15
9	PCB	-	2	300
10	Helmet	-	1	500
	TOTAL			1275

Fig. 5: Cost Feasibility

Total cost of the project is Rs.1275.Excluding the cost of the helmet and battery, the cost will be Rs.775.If the setup is to be implemented in all the vehicles it becomes necessary that the manufacturer provides helmet with the vehicle.Hence the project is economically possible.

B. Operational Feasibility

As the degree of complexity is very less when taken into consideration the greater purpose it serves, the setup is smoothly operated. There is no need to worry about interference of radio waves during signal transmission as each code is unique. Only thing to be cautious about is the battery. It can substituted periodically. Since the whole ciruit is simple we don't have worry much about error rectification. As the timer is set manually for warning

purpose,the setup becomes more flexible. Thus the project can be operated smoothly once the circuit is complete.

C. Technical Feasibility

Technical feasiblity is achieved by the excellent coordination between the transmitter and receiver section (i.e.,) between the helmet and vehicle circuit. Voltage required for actuating the relay needs to be taken from the vehicle and depends on the type of two wheeler chosen. It is to be made sure that introducing relay in the CDI circuit of the vehicle doesn't hinder the proper working of the two wheeler. The number of possible of codes can be varied by altering the type of encoder and decoder chosen(one code for one vehicle). Overall the entire setup is technically feasible and will not create any complex issues.

VI. PROJECT DESCRIPTION

A. Electronic Components Used

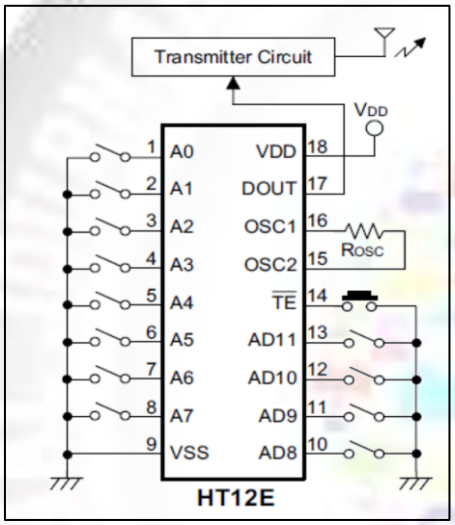

Fig. 5: HT12E (Encoder)

The 2^{12} encoders are a series for remote control system applications. They are capable of encoding information which contains of N address bits and 12-N data bits. Each address/ data input can be set to one of the two logic states. The encoded addresses/data are transmitted together with the header bits via an RF or an infrared transmission medium upon receiving of a trigger signal. The capability to select a TE trigger on the HT12E or a DATA trigger on the HT12A further improves the application flexibility of the 2^{12} series of encoders. The HT12A additionally provides a 38 kHz carrier for infrared systems.

B. Transmitter

A transmitter is an electronic device which, with the aid of an antenna, produces radio waves.

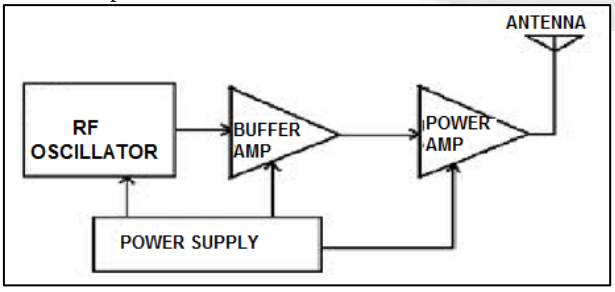

Fig. 7: Simple Transmitter Circuit

A radio transmitter is an electronic device, with the aid of an antenna, produces radio waves. The transmitter creates a radio frequency ac current, which is applied to the antenna. The antenna radiates radio waves when excited by an alternating current source.

1) Radio Wave Transmission

Radio waves are a type of electromagnetic radiation with wavelengths in electromagnetic spectrum longer than infrared light. Like all other electromagnetic waves, they have the speed of light. Manmade generated radio waves are used for fixed and mobile radio communication, broadcasting, radar, navigation systems, satellite communication, computer networks and innumerable other applications. Radio frequency is a rate of swinging in the range of about 3 kHz to 300 GHz, which corresponds to the frequency of radio waves, and the ac currents which carry radio signals.

2) Receiver

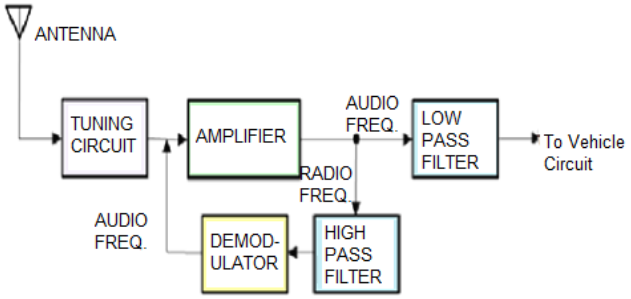

Fig. 9 Receiver Circuit

A receiver converts signals from an antenna to a usable form. Here the encoded signal with the waves is received by the receiver via frequency modulated transmission.

C. HT12D (Decoder)

Decoder converts transmittable signal to understandable signals. The 2^{12} series of decoders provide various combinations of addresses and data pins in different packages so as to pair with the 2^{12} series of encoders. The decoders receive data that are transmitted by an encoder and interpret the first N bits of code period as addresses and the last 12-N bits as data, where N is the address code number. A signal on the DIN pin activates the oscillator which in turn decodes the incoming address and data.

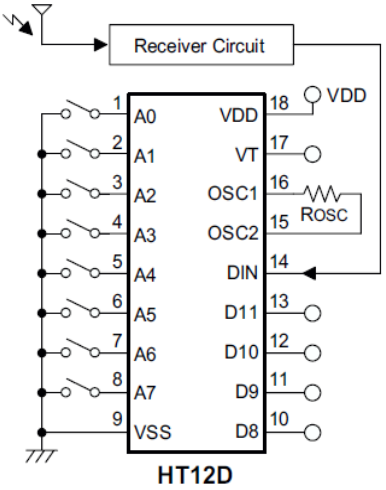

Fig. 10: Decoder

The decoders will then check the received address three times continuously. If the received address codes all match the contents of the decoders local address, the 12-N bits of data are decoded to activate the output pins and the VT pin is set high to indicate a valid transmission. This will last unless the address code is incorrect or no signal is received. The output of the VT pin is high only when the transmission is valid. Otherwise it is always low.

1) ATMEGA-8

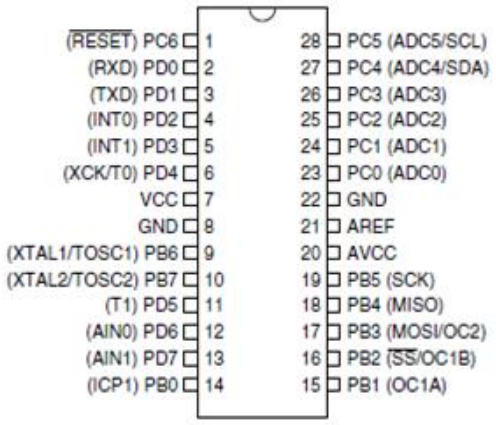

Fig. 11: ATMEGA-8

A microcontroller is a small computer on a single integrated circuit containing a processor core, memory, and programmable input/output peripherals.High-performance, low-power AtmelAVR8-bit microcontroller is used here. The ATmega8 is a low-power CMOS 8-bit microcontroller based on the AVR RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega8 achieves throughputs approaching 1 MIPS per MHz, allowing the system designer to optimize power consumption versus processing speed.

2) Pin Descriptions

- VCC: Digital supply voltage.
- GND: Ground.

D. Relay

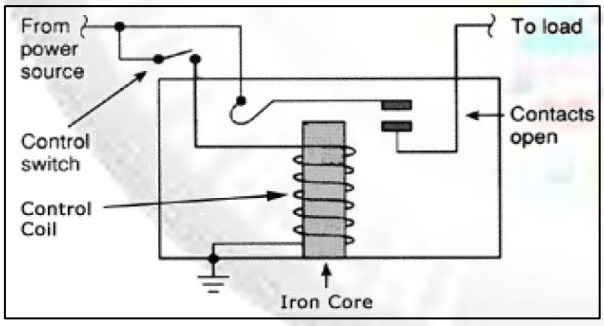

Fig. 12: Relay

A relay is an electrically operated switch. Many relays use an electromagnet to operate a switching mechanism mechanically, but other operating principles are also used. 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.

VII. CIRCUIT DESIGN AND WORKING:

A. Helmet Circuit

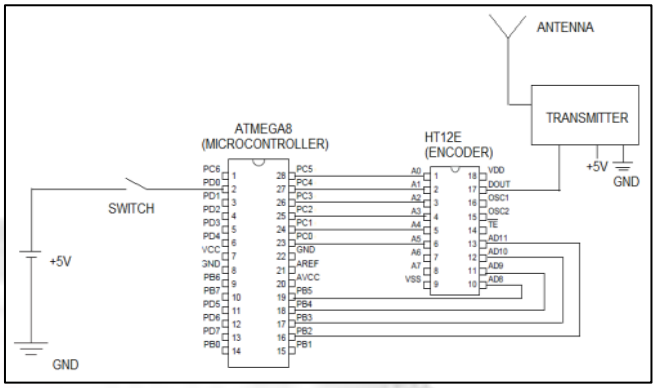

Fig. 13: Helmet Circuit

The switch is present inside helmet, such that it closes when pressed against the head. To ensure proper working as long as the helmet is on more switches can be added in parallel at different parts of the helmet; however for our simplicity only one switch is used to provide supply to the encoder. When the rider puts on the helmet the switch closes and the signal is encoded by the encoder and gets transmitted. Since HT12E is used 2^{12} distinct codes can be generated. Thus uniqueness of code for each vehicle is ensured. Hence safe and interference free transmission is possible. Radio wave transmission is employed here.

B. Vehicle Circuit

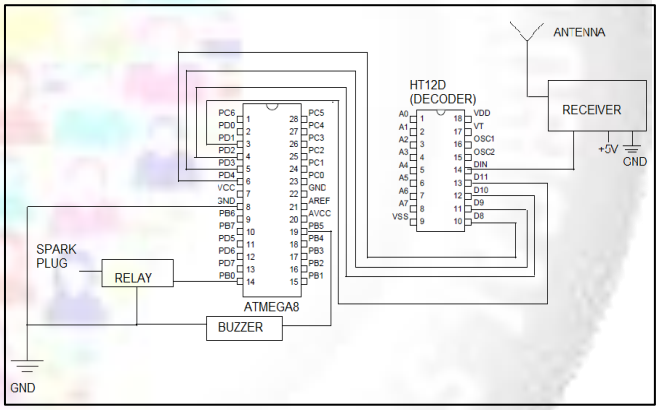

Fig. 14: Vehicle Circuit

The receiver in the vehicle receives the signal of particular frequency transmitted from the helmet. The received signal is decoded using a decoder. The decoded signal is sent to the microcontroller. When the signal matches with the pre-determined signal, relay will be turned on. This in turn turns on the vehicle by connecting the battery with the spark plug. A breathing time of ten seconds is provided to the rider. This will make sure that even when the helmet is not worn, vehicle will be in ON condition for the preset timing.

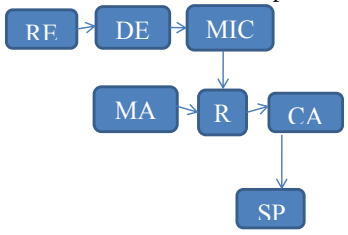

Fig. 15: Modified Starting Circuit Block Diagram in Vehicle

Flowchart

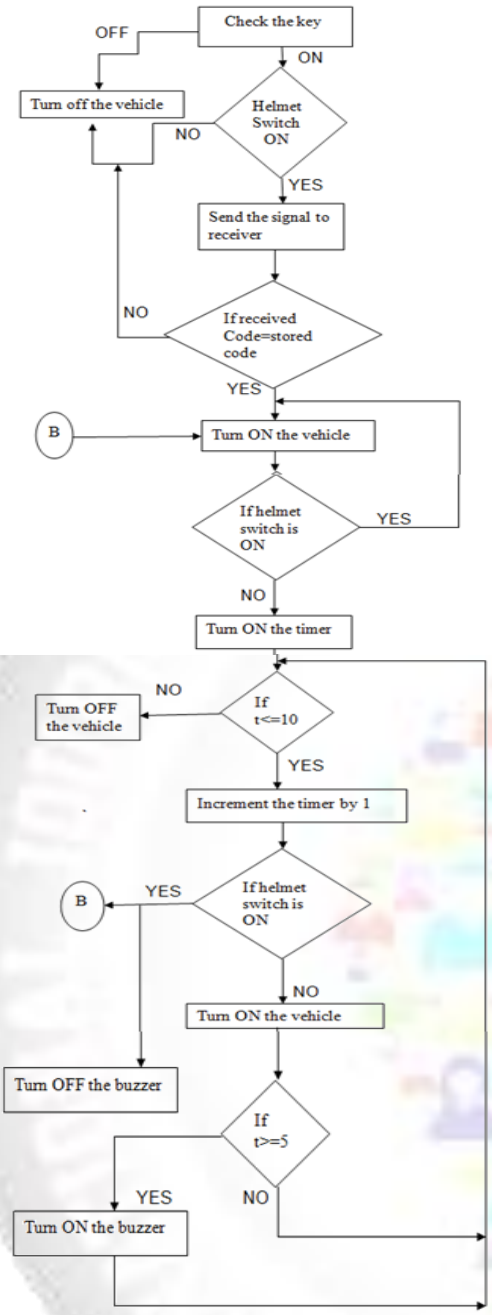

Fig. 16: Flowchart

The program for the above flow chart has been burned into ATMEGA8.The same is simulated using PROTEUS software and is shown below.

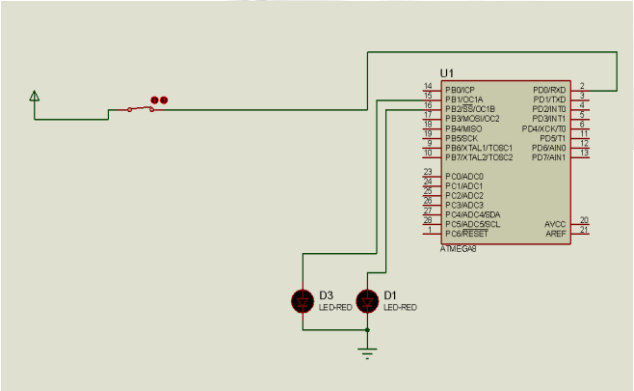

Fig. 17: Circuit Simulated in Proteus

C. *Snap Shots of the Project*

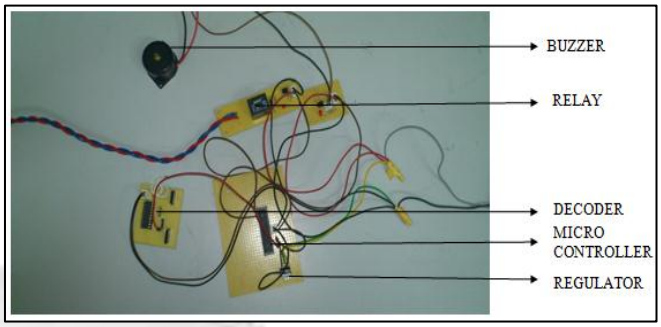

Fig. 18: Vehicle Circuit

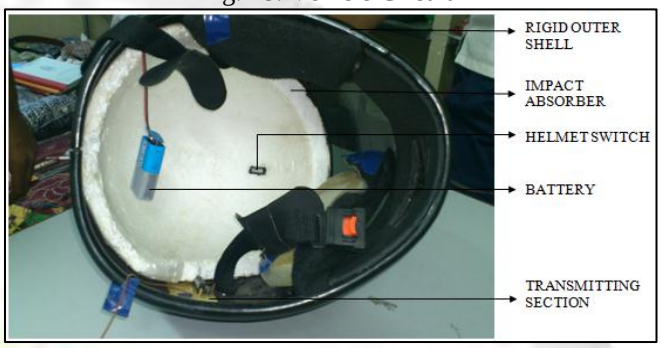

Fig. 19: Helmet Circuit

D. *Advantages*

- Rider safety is ensured.
- Two wheeler thefts are minimized.
- Reduces the burden of a traffic police since there will be no need to check whether the rider is wearing the helmet or not.

E. *Constraints*

- Helmet is to be kept safe.
- Battery is needed for supply to the encoder.
- Hacking is difficult but possible.
- Helmet should be provided by the manufacturer.

VIII. CONCLUSION

In a country with 75 % of vehicles being two wheelers, it is essential to promote helmet use among all motorcyclists. Implementing this project ensures the safety of these motorcyclists by making sure that they wear helmets, such that the vehicle starts and runs only if they wear their helmet. The status whether the helmet is worn or not is continuously checked and the signal is given to the microcontroller. Based on the status, the controller switches the vehicle on or off. A breathing time of ten seconds (or more) is given to the rider to make sure that the vehicle remains in on state even if he is not wearing the helmet. This project also makes sure that the vehicle is safe. Thus this project ensures not just the safety of the rider but also the safety of the vehicle.

A. *Future Enhancements*

- The current set up consists of only one switch inside the helmet and the rider experiences certain degree of discomfort. Though the rider wears the helmet he has to be cautious whether the switch is pressed or not. By

including more switches in different locations inside the helmet, this problem can be overcome.

- To prevent hacking to certain extent instead of having unique codes for each vehicle we can generate pseudo codes. Pseudo codes are random numbers that can be generated by micro controller.

REFERENCES

[1] S.Salivahanan, N.SureshKumar, A.Vallavaraj, "Electronic Devices and Circuits", Second Edition, 2008, page no. 666-686.
[2] M.Morris Mano, "Digital design", Fourth Edition,2007, page no. 166-174
[3] R.K.Rajput, "Thermal Engineering", Eighth Edition, page no.1083-1084
[4] Dr. Kirpal Singh, "Automobile Engineering", Volume-2, Twelfth Edition, 2008, Page no. 419 – 438.