IMPLEMENTATION AND ANALYSIS OF SMART HELMET

Rashmi Vashisth, Sanchit Gupta, Aditya Jain, Sarthak Gupta, Sahil, Prashant Rana
Department of Electronics and Communication
Amity School of Engineering & Technology
New Delhi, India

***Abstract* -Currently, accidents are a serious problem for everyone. Accidents are increasing day by day, so efforts are made to avoid them to minimize their consequences. We live in a world where the rules of the road have no importance for people and they are regularly violated. In addition, its human nature to resist what is imposed on them. Thus, using a different perspective, we provide safety with luxurious and intelligent features using a smart helmet. Two modules one on the helmet and bike each will work in synchronization, to ensure that the biker is wearing the helmet .A radio frequency module is responsible for the wireless communication between the helmet and the bike circuit. The Piezo electric buzzer is used to detect speeding and this feature is extended by limiting the speed of the user. The ALCHO-LOCK function is used to prevent drink and drive scenarios Accelerometer detects accidents, and this is extended by employing GSM module in our circuit, which is designed to automatically send one message to one personal contact and one concerned authority that the person has been into an accident and a fog sensor for increasing visibility in case of fog or smog are also used. Another feature known as E-HELMET allows for automatic deduction of the required amount from the users virtual wallet wirelessly preventing the rider to stop and pay for it.**

Keywords: RF module; accelerometer; MQ-6, LDR; microcontroller 89S52; Arduino

I. INTRODUCTION

It is a well-known fact that young generation prefers bikes and motorcycle over four wheelers. A survey indicates that more than 70% of the riders avoid wearing helmet without any specific reason .Moreover speeding and drunk driving have become common issues. Due to lack of experience or focus and violation of traffic rules, result in severe accidents. So with the help of technology we made sure that traffic rules are followed, problems mentioned above are avoided and their effects are minimized.

The idea of developing this work comes from our social responsibility towards society. In many accidents that occur around us, there is a huge loss of life. According to a survey, about "7500" people die on roads per year that occur due to bike accidents.

There are various reasons for accidents such as not having adequate ability to drive, defective two wheelers, rash driving, "drinking and driving", etc. But the main reason was the absence of helmet on that person which leads to immediate death due to brain damage. Therefore, it is important that there should be a facility to minimize the after effects of these accidents. However the main goal of our work is to make it mandatory for the rider to wear a helmet during the ride meanwhile providing solutions to other major issues for accidents. Therefore, this sense of moral responsibility towards society, laid the foundation for our "Smart Helmet" project. So the basic idea for the development of this project "Smart Helmet" is taken from [1] [2] And detail functionality of each of hardware and software components used are, for example, the radio transceiver is taken from [3] and the information and operation of the sensor [4]. The main component used is microcontroller 89S52. The principles of operation of the circuits and connections, etc. are taken from references [5] and [6]. Therefore, all references have contributed to the development of the project.

II. TRADITIONAL PROPOSED SYSTEMS

A simple telemetry system is activated by a pressure that is applied inside the helmet. The technology used is RoHS compliant and is absolutely the same for long-term use. Most of the attention today in helmet innovation is on things like adding an MP3 player or wireless phone or even a flash light on it. But none of these features provide additional safety for the rider and are just meant for amusement.

III. PROPOSED SYSTEM

A. Helmet unit

The helmet unit comprises of an alcohol sensor, helmet on

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detection circuit, a fog sensor, GSM module, LCD display, microcontroller ATMega328-PU, accelerometer for accident detection and a RF module. The sensors installed in the helmet provide analog output. This output is fed to a comparator that acts as an ADC. The output signal from the comparator and the sensor lock is encoded in binary signals, which are transmitted via the RF transmitter. RF Module consists of a transmitter with a 5 meter range. It is used to transmit control signals to the bike module for implementation.

Encoder HT12E is an 18pin chip which is used to encode data, before transferring it through the RF transmitter. Comparators enable all functions to work properly. Comparators have 4 inputs and 4 outputs. Its basic working principle is based on comparing voltages supplied to its positive and negative input pins comparing them and producing output.

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Whenever the rider passes through the range of RF transmitter balance is automatically deducted from its wallet known as E-Wallet.

Also whenever the rider enters the specific range of speed limiter its maximum speed limit is set and whenever that limit is exceeded LCD displays overspeeding and alarm buzzes.

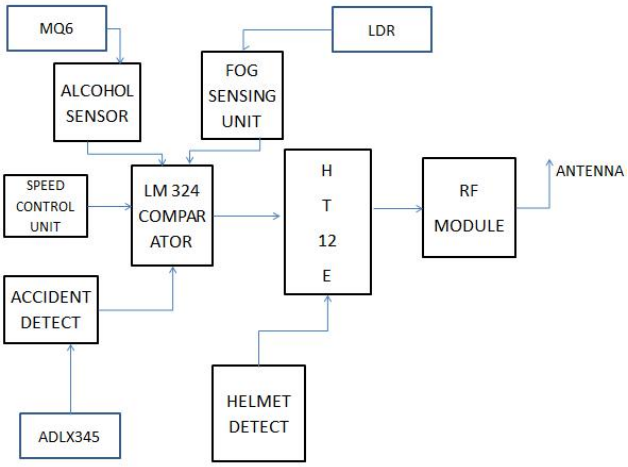

Fig 1. Block Diagram For Helmet Unit

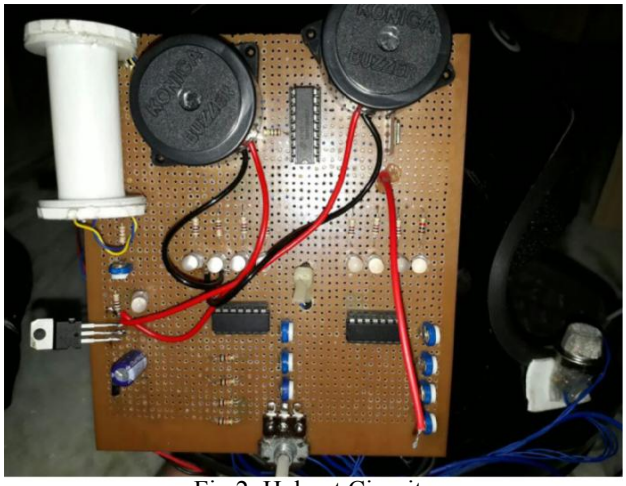

Fig 2. Helmet Circuitry

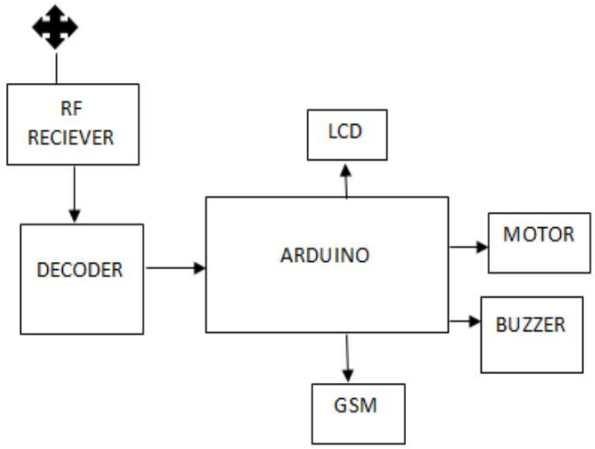

Fig 3. Block diagram for Helmet Unit 2

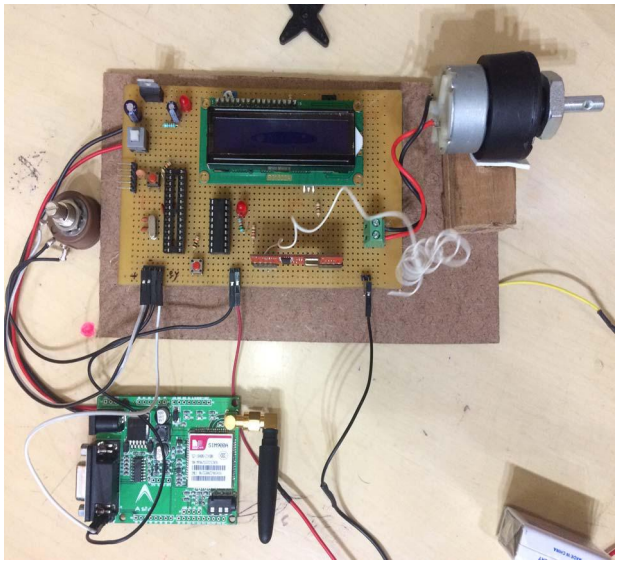

Fig 6. Helmet Circuitry 2

B. Bike Unit

This section consists of a receiving part and a control signal. The receiver section is located on a bike; It consists of radio frequency receiver, decoder, microcontroller, LED as an

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indicator, DC motor. The RF receiver receives the encoded binary data transmitted by the RF transmitter and provides it to the decoder. The decoder decodes the incoming digital data and provides four bits in the MCU, only if the address bit of the encoder and the decoder match. This is done to ensure the safety and security of the system. Thus matching of encoder and decoder increases the security and integrity of the system. The MCU controls the DC motor upon receiving data. If the sensor detects that the rider is wearing the helmet, then the engine is turned on and also if the MQ6 sensor detects alcohol, the module installed on the bike turns off the engine to avoid any accidents and so that the drunken person takes appropriate measures to reach his destination. Decoder HT12D decodes all incoming data and then forwards it to the microcontroller for implementation .The AT89S52 is a programmable microcontroller with a small instruction set. It controls the working of the module by analysing the input data stream and then giving correct control signals. Voltage regulator 7805 is used to regulate the erratic voltage received from the power source. The 7805 voltage regulator gives a 5V output.

The above components together make our helmet smart and work in synchronization to ensure a safe and comfortable experience for the user.

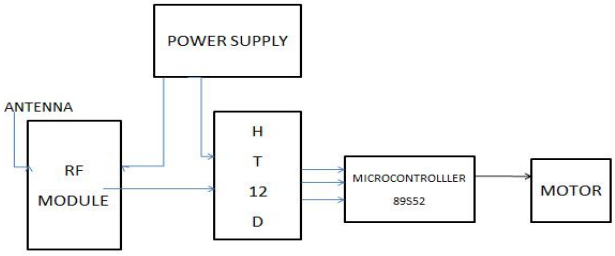


Fig.3 Block Diagram For Bike Unit

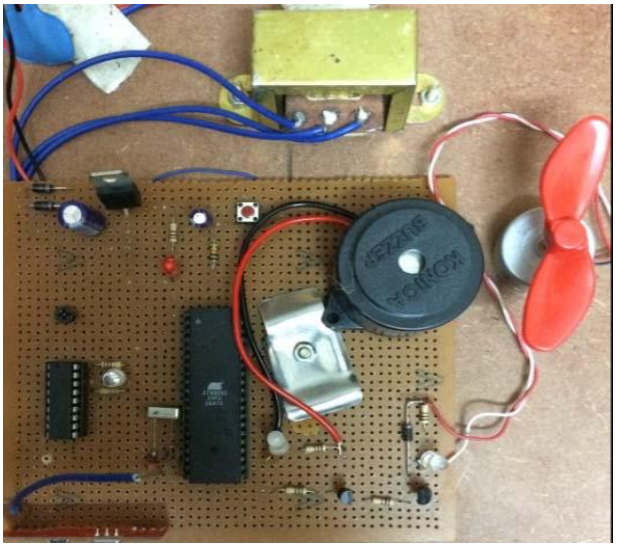
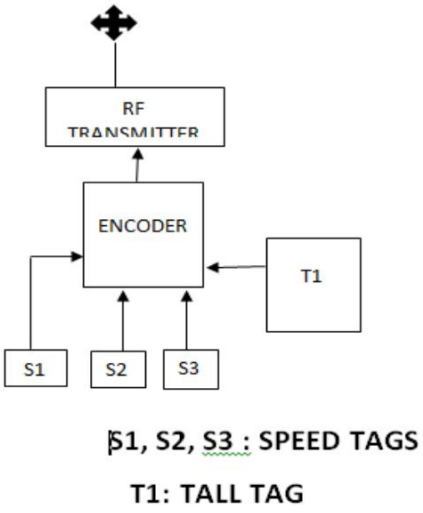


Fig.4 Bike Circuitry

C. *Velocity Limiter and E-wallet*

This unit is the unit that is supposed to be placed on the speed boards to limit the exceeding speed, this will work in a manner that whenever the bike comes in range of the speed board its limit is set according to the speed of the speed board and if the crosses that fixed speed on the board alarm beeps to inform the rider about overspeeding.

This system will also be placed in toll booths and parking areas and similarly when smart helmet comes in the range of the toll booth or parking areas the specific amount required is wirelessly deducted from the wallet of the helmet preventing the riders from stopping specifically for this purpose.



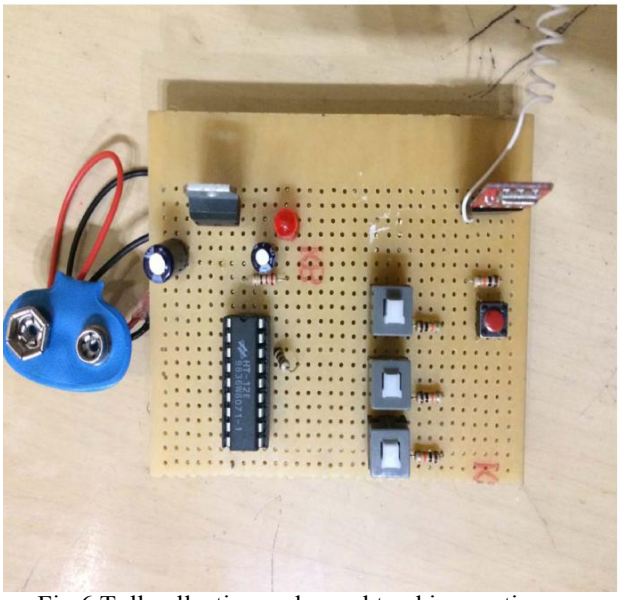


Fig.6 Toll collection and speed tracking section

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IV. PRINCIPLE OF OPERATION

The proposed system works with simultaneous working of the transmitter and receiver section. A magnetic chip connected with the helmet detects if the rider is wearing the helmet or not. The chip sends out an analog signal, signalling the system that helmet is detected and the rider is wearing it. This is determined by a high output received from the chip. A low output is generated when the clip is not connected making the system to turn off the bike.

Another scheme uses a gas sensor (MQ-6), which can detect the presence of alcohol. The surface of the sensor is sensitive to various alcohol concentrations. It detects alcohol in the exhaled air of the rider. The value of the resistance decreases which leads to a change in the voltage. This changed voltage is fed to the comparator, which compares the voltage with the predetermined value, and changes according to the alcohol concentration below the level of illegal consumption. If the sensor voltage exceeds the voltage at the output of the present comparator, the microcontroller performs the appropriate action.

Speed limit sensing element contains a turbine. The moving bike revolves the motor on the turbine which tells us about the speed of the bike and if a predetermined limit is exceeded a buzzer goes off warning the rider of speeding.

Another feature uses a LDR in order to avoid incidents due to low visibility in fog. Fog sensing unit consists of an LDR i.e. Light Dependent Register which detects the light coming from LED. If the presence of fog inhibits the light from the LED to reach the LDR, the fog sensor sounds an alarm , to counter this we employ a bright blinking LED that makes the presence of the rider much more visible.

Accident detection circuitry is made up of an accelerometer and some resistors. The accelerometer checks the tilt of the helmet to determine the occurrence of an accident. If the tilt of the helmet is more than a preset value, which is set in accordance with case of an accident, free-fall sensing concludes that the rider has met with an accident. During an accident the accelerometer discharges a voltage which is read by the unit sending a signal to the bike module to turn off the engine and it sends message to one personal contact and one concerned authority that an accident has occurred.

GSM modem communicates with microcontroller through USART(Universal Synchronous Asynchronous Receiver Transmitter) and microcontroller gives command to GSM modem known as AT(Attention) commands.to send message to one personal contact and one concerned authority.

Vel-Lock and E-wallet section.

Whenever bike comes in the range of the speed limiter it makes contact with the helmet. The board sends the limited speed to the helmet circuitry through RF transmitter on the board. RF receiver on the helmet receives the signal and forwards it to the HD12D decoder. It decodes the signal and passes it to the microcontroller. Microcontroller sets the threshold value of the bike speed in accordance with the value sent by the speed limiter. Whenever the speed of the bike crosses the threshold value it sounds a buzzer on the helmet and a message “OVER SPEEDING” is displayed on the LCD.

Another switch used is for our E-wallet purpose as it automatically deducts the fixed amount from our virtual wallet. Whenever the bike comes in the range of toll plaza it sends the signal to the HD12E encoder, it encodes the signal and transmits it to the bike circuitry through RF transmitter. RF receiver on the bike circuitry receives the signal and sends the signal to the HD12D decoder, it decodes the signal and transmits it to the microcontroller. Microcontroller automatically deducts the balance from the virtual wallet and displays the remaining amount on the LCD, also it displays the message “LOW BALANCE ALERT” when balance is low in the wallet.

V. SYSTEM WORK FLOW

A. Flow of Control and Data Operations

The proposed smart helmet supports variety of functions. First it checks whether the driver is wearing a helmet using a magnetic clip. It also checks if the driver is in an abbreviated state or not. MQ6 sensor is used for this purpose. Only if the driver is sober and wearing a helmet the bike starts. This helps reduce chances of rash and drunk driving.

The helmet also employs various sensors. A LDR(light detection resistor) is used to detect the presence of fog. An accelerometer is employed to detect accidents by measuring the tilt of the helmet. The data from the accelerometer is also transmitted to the Arduino microcontroller. All the data from the sensors is fed into comparators to check against pre-set threshold values. If a breach is detected the microcontroller 89S52 issues commands to switch off the engine in case of an accident otherwise to sound a buzzer to caution the driver.

The other features are implemented via the Arduino Uno microcontroller which is connected to a LCD to provide information to the user. Data from the RF tags of speed boards is fed into the Arduino. These values are used to set threshold values used for speed tracking and keeping a check on speeding on roads in different settings for example highways, alleys etc. If speed values from the potentiometer are found to be exceeding the speed limits a warning sign

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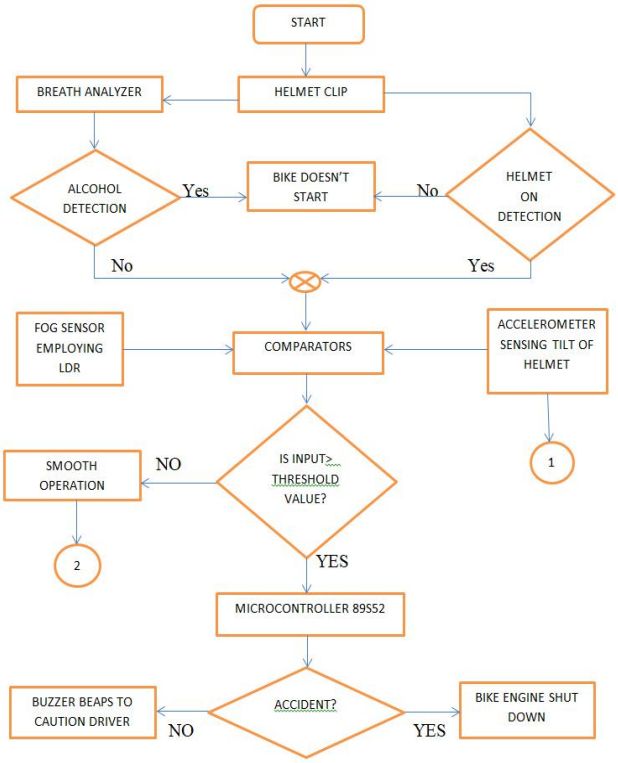
appears on the LCD with sounding of the buzzer. A toll booth is also provided with a unique RF tag. As soon as the helmet comes in range of the booth, toll is deducted from the user's virtual wallet. Arduino has been programmed to show the remaining balance on the screen and give a low balance warning if funds reach a predefined minimum value. A recharge point has also been provided within the circuit to load the wallet with money. The updated value is fed back in the Arduino for future use. In case of accidents a GPS module sends emergency messages to 2 preloaded contacts informing them of the dire situation. This helps in mobilizing quick relief operations for the person involved in the accident.

The proposed system provides a safe, smooth and enjoyable riding experience which it makes it highly desirable in today's conditions.



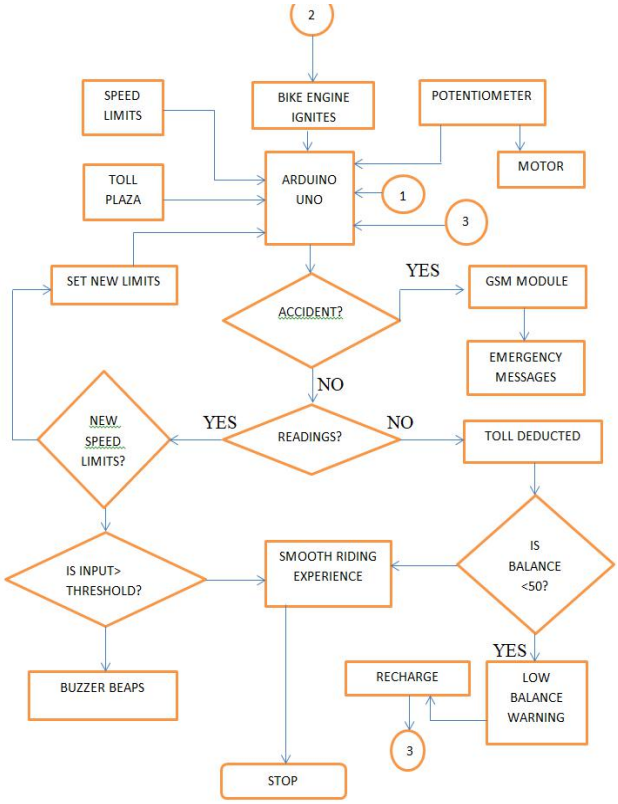


Fig 5. System Flowchart

VI. HARDWARE REQUIREMENTS

MP Lab is used to hardcode the program into microcontroller. Other hardware requirements are given below.

Table 1. Required Components

S.no	Components	Name
1	Microcontroller	89S52,ATMEGA328-PU
2	Alcohol Sensor	MQ6
3	Accelerometer	Triple Axis accelerometer ADLX345
4	Transceiver	RF module 434 MHZ
5	Fog sensor	LDR
6	LCD display	RG1602A
7	Arduino	Arduino UNO
8	GSM	SIM900
9	Encoder/Decoder	HD12E/HD12D

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VII. RESULTS

All the components are assembled and tested successfully. The circuit is designed in such a manner that bike does not start until and unless rider wears the helmet . Also the bike won't start if the rider is drunk, this helmet alarms the rider if he crosses a certain speed limit by buzzing an alarm. If an accident occurs the engine automatically shuts off to avoid further injuries.

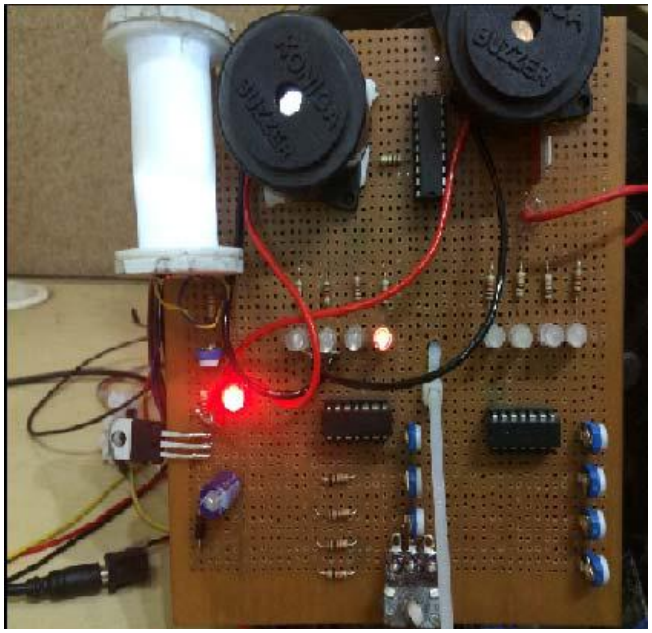

Fig 5. Helmet Unit Prototype

Thus, the experimental phase was completed. This study was conducted in a controlled manner. Thus, there is no pressing need for further experimentation in real life conditions but before full time deployment more simulations need to be performed. In the future, a GSM module and a GPS module can be applied to a system in which the sensor reports an emergency situation to relatives and nearby police personnel. This can be achieved by encoding GSM, GPS modules to transmit the exact GPS coordinates of the accident to responsible authorities making them aware of the dire situation for quick action which may help in saving lives.

Fig 6 and Fig 7 indicate working Bike unit representing two scenarios where Fig 6 is the case in which the rider is not wearing the helmet and fig 7 is the case where the rider wares the helmet.

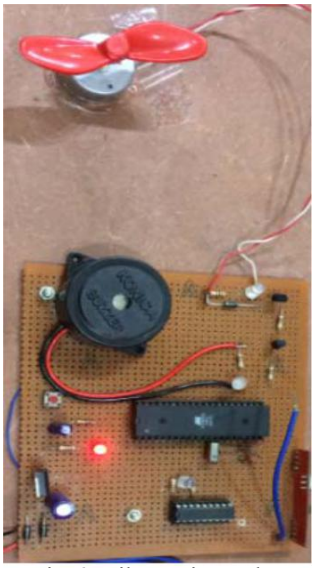

Fig 6. Bike Unit Implementation

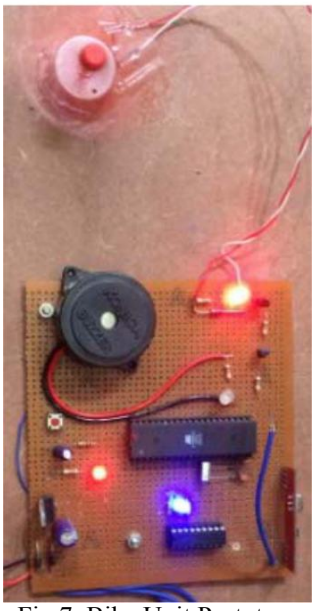

Fig 7. Bike Unit Prototype

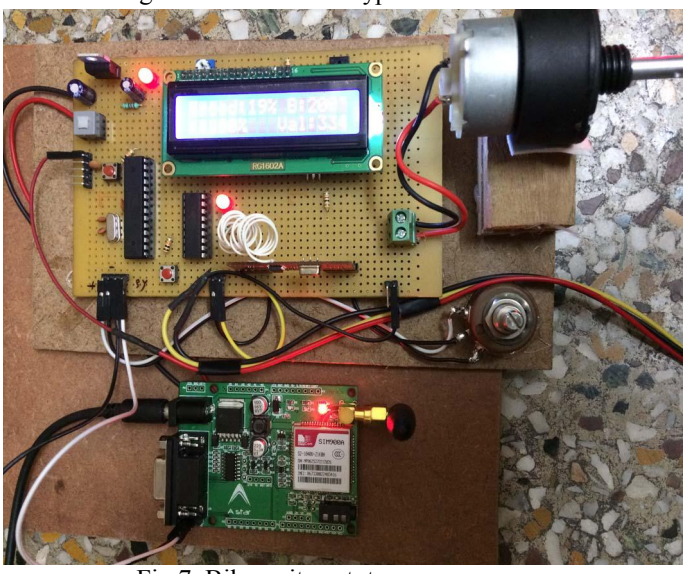

Fig 7. Bike unit prototype

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Thus, the project was successfully completed and all the features were implemented accordingly.

VIII. CONCLUSION

Smart helmet is an effective solution to many problems. Wearing the helmet and being sober are necessary conditions for the bike to start, reducing the possibilities of accidents. Even if a person takes caution sometimes accidents do occur. Here our engine cut off feature reduces the chances of fatalities significantly. The smart helmet acts as a virtual policeman keeping the drivers in check and making roads safer.

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