# Mandatory Helmet Protection System with Inbuilt Sobriety Test Sensor and Exhaust Checking for Two Wheelers

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*Abstract*—This paper aims at implementing mandatory helmet protection system for two wheeler vehicles and an inbuilt sobriety test system in the helmet which allows us to test the alcohol content in the driver. We aim at inhibiting the driver to start the bike without helmet or with alcohol being tested positive. Also in this paper work is done to implement easy way of detecting the blockage in the air filter at the exhaust without the need for emission test and notifying the driver about cleaning the filter. So we try to achieve strict following of traffic rules and saving fuel and control of air pollution can be achieved.

*Key words:* IR sensor, Gas sensor, Pressure sensor, Arduino Uno, ATMega8, vehicle exhaust, Sobriety test.

## I. INTRODUCTION

Nowadays road accident is a major problem all over the world. The recent report says that annual average of 1,700,000 road accidents, 10 percentages occur in India which has overtaken China. The latest annual statistics revealed by the World Health organization[1] (WHO) in its first Global status report on road safety, 80,000 people are killed on Indian roads due to speeding, drunken driving, less usage of helmets, seat belts and child restraints in vehicles. According to the WHO, road traffic injuries caused an estimated 1.24 million deaths worldwide in the year 2010, down from 1.26 million in 2000. Half of all road traffic deaths are among pedestrians, cyclists and motorcyclists, and adults aged between 15 and 44 years account for 59% of deaths. 3 out of 4 road deaths are among men. The average rate was 18 per 100,000 people (down from 20.8 in 2000). 92% occurred in low and middle income countries, with South-East Asia and Africa having the highest rates. Another latest report[5] of National Crime Records Bureau or NCRB says that 40 people under the age of 25 die in road accidents all around the world in a day. It states that the drunken driving is a major factor for the rising of death on roads. It shows that the problem of drunk driving is far from over. In the 2012 DUI national statistics released by the NHTSA (National Highway Traffic Safety Administration) 11,773 people died in alcohol-related crashes. Most of the accidents occur outside the cities are due to drunken driving and no testing methodology is adopted to avoid these fatalities in highways.

About half of the head injuries result from motor vehicle crashes, falls and mishaps. Accidental injury is one of the leading causes of mortality and morbidity in India. India has overall 1% of total vehicles in the world but accounts for 6% of total road accidents. Head is the major part in the human body. Any injury to head can lead to serious circumstances. So the government has made the helmet compulsory while riding two wheelers. But we can see that this rule is not followed seriously. So implementation of mandatory helmet protection rule is carried in the project. Drinking and driving is also the major cause of accidents. So we check for the presence of alcohol in the driver before allowing him to turn on the vehicle. Finally, this last application is for pollution control. A driver can know if the bike's filter is clean and not emitting harmful gases only by emission test. Instead, by checking exhaust pressure we can notify the driver about filter blockage so that he can know, when to clean the air filter. This also aids for efficient fuel burning.

## II. RELATED WORK

The three applications in this paper is implemented as follows.

### *A. Helmet Checking Application:*

IR Transmitter is placed on the helmet and it will emit pulses of IR. An IR Receiver is placed on the bike which is in line of sight with the transmitter. IR Rx is connected to the microcontroller. Now when the bike key is turned on, the microcontroller switches on taking the supply from the bike's resident battery. If the helmet is in the proper position, IR receiver must have voltage output. The microcontroller checks for the IR Rx output and if it is high it indicates the presence of helmet and tests for alcohol content. Microcontroller will not move to the next condition until it senses high output on the IR Rx. The message "Wear the Helmet" will be continuously displayed on the LCD. Also multiple IR Tx can be used and directed at the IR Rx for improved accuracy of Helmet detection.

### *B. Sobriety Test Application:*

If the helmet's presence is detected, then the microcontroller will display "Blow into the Alcohol sensor" on the LCD. Then the driver has to blow into the sobriety test sensor placed in the helmet. The sensor's output will be given to the comparator circuit shown in Fig 1. There are two outputs from the comparator circuit. RX Transmitter is used to send the results wirelessly to the microcontroller. RX Receiver's output is connected to the microcontroller to check the presence of alcohol content in the rider. If microcontroller detects high on D1 of RX receiver, indicates that the driver tested negative for alcohol content. Then the microcontroller turns on the relay which is connected between the igniter and the spark plug. The "bike can be started" message is displayed on the LCD. If the microcontroller detects high on D4 pin of RF Receiver indicates the presence of alcohol content in him. Then the microcontroller displays a message "Do not ride the bike" on the LCD and bike cannot be started.

### *C. Exhaust Checking Application:*

During the normal working of the bike, we can check for the blockage of air filter as there will be increase in exhaust pressure beyond certain limit. A threshold of maximum pressure at exhaust is determined at the maximum gear and maximum acceleration for the bike. Pressure sensor will be kept at the exhaust pipe just before the air filter and when

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there is blockage in the air filter there will be rise in the pressure in the exhaust pipe beyond the threshold, as the air flow reverses into the engine. The pressure sensor detects this change in pressure and its output will be sensed by microcontroller. This blockage will be notified to the driver by displaying a message "Clean the Air Filter" on the LCD. Also when the blockage in air filter increases, the exhaust gases may reverse to the engine and there will not be efficient fuel burning in the chamber. This also helps to keep track of efficient usage of fuel.

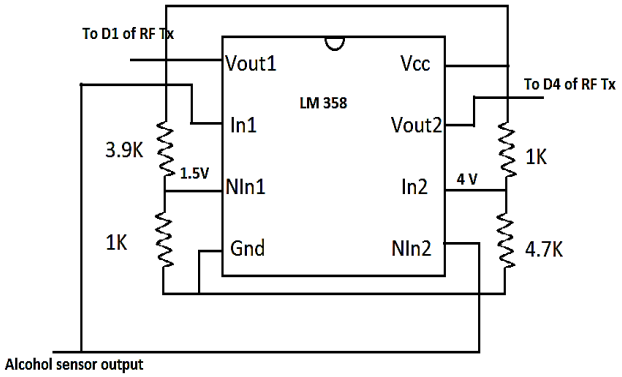


Fig. 1: Comparator circuit

## III. EXPERIMENTAL SETUP

The model is used on top of the bike and helmet. Usually operated in outer conditions like high temperature, rain and dust. By embedding the model in the helmet with proper outer covering makes it to resist extreme conditions like high temperatures, rain, dust snow and fog. This project has two sets of modules. One module on the helmet as shown in Fig 2. It consists of IR Transmitters, Alcohol Sensor, Comparator circuit, an RF Transmitter and a battery source.

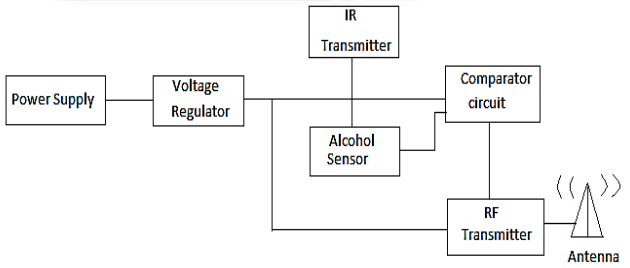


Fig. 2a: Module on the Helmet

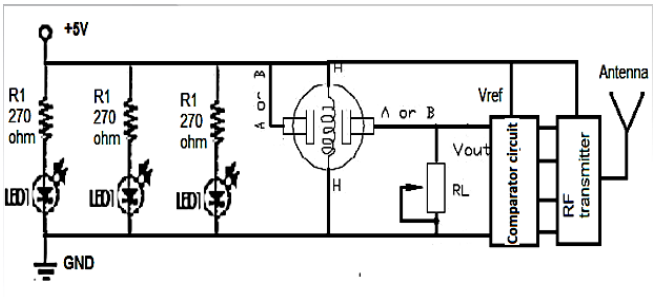


Fig. 2b: Circuit on the Helmet

On the bike, another module as shown in Fig 3a, is placed at appropriate position so that, IR sensors are in line of sight. The circuit is as shown in Fig 3b. It consists of Arduino Uno board with ATMega8 microcontroller, LCD, RF Receiver, IR Rx, Pressure sensor and a Relay. Model of helmet is as shown in Fig. 4a and hardware model on the petrol tank is as shown in Fig. 4b.

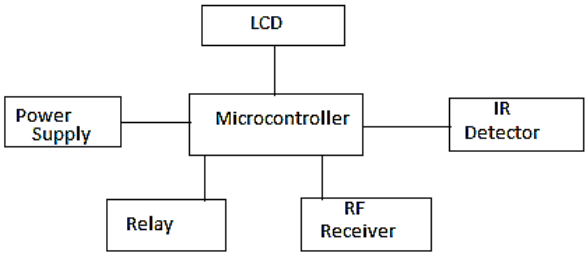


Fig. 3a: Module on the bike

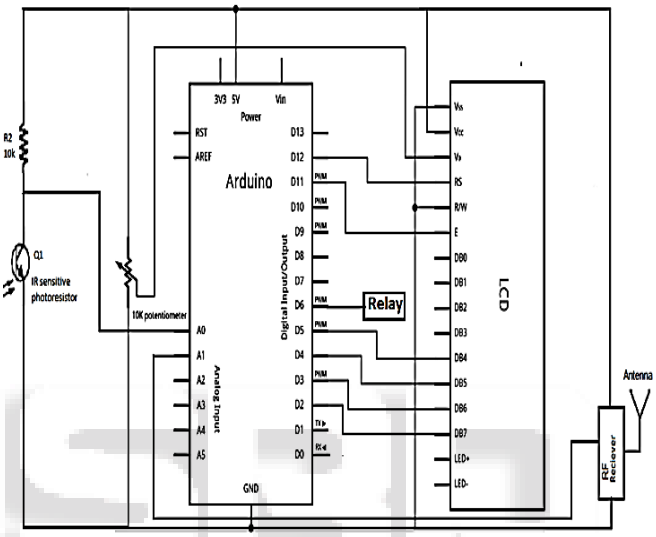


Fig. 3b: Circuit on the bike

– *Hardware and Software Tools Used:*

1) Pulsed IR sensors
2) Alcohol sensor
3) Relay
4) Arduino Uno
5) Arduino 1.0 development environment
6) Helmet for implementation
7) LCD (16X2)
8) Microcontroller(ATmega8)
9) RF transceiver
10) Voltage regulator
11) Comparator Circuit

*Alcohol sensor (MQ3):*

The sensor will then analyze the amount of alcoholic vapors and offer the user some indication of the amount of alcohol present. This device is more commonly referred to as a breathalyser; as it analyzes the alcohol content on a person's breath. The device is mostly used by law enforcement to determine whether an individual has been driving under the influence of alcohol. Police Breathalyzer measures the Blood Alcohol Content, or BAC, of an individual. The unit designed for this project is a simpler version of the Breathalyzer used by police. It will not accurately determine the BAC level of a person; however it will provide a guide as to whether or not you should operate a motor vehicle after drinking alcohol.

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Fig. 4a: Alcohol sensor (MQ3)

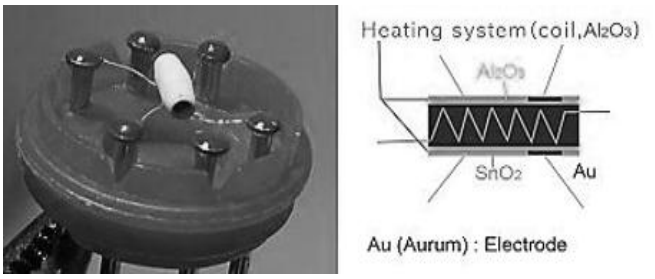


Fig. 4b: Alcohol sensor (MQ3) inside view and construction

A person's BAC must be below 0.35mg/L in order to operate a motor vehicle legally in India. When a user exhales into a Breathalyzer, an alcoholic sensor detects the ethanol vapors present. Through a chemical reaction, the ethanol is oxidized into an acetic acid ("Oxidation/Reduction Reactions"). The overall reaction will produce an electrical current which is detested using a comparator, and the information converted into an approximation of a person's BAC.

– *Hardware Snapshots:*

Fig. 5a: Model of helmet

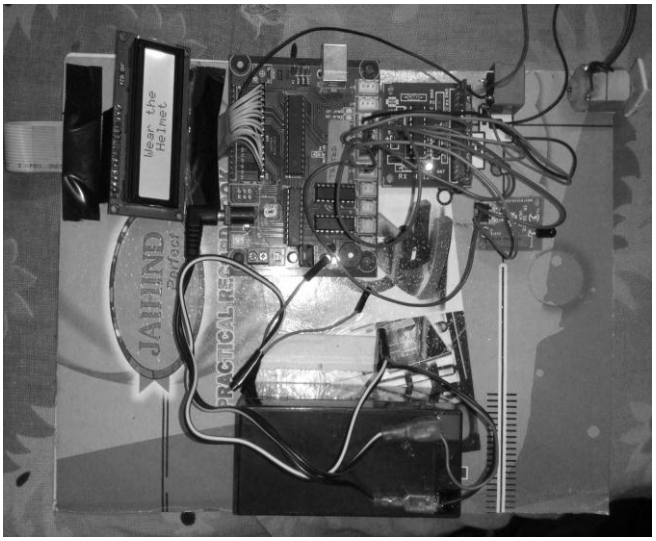


Fig. 5b: Model on petrol tank

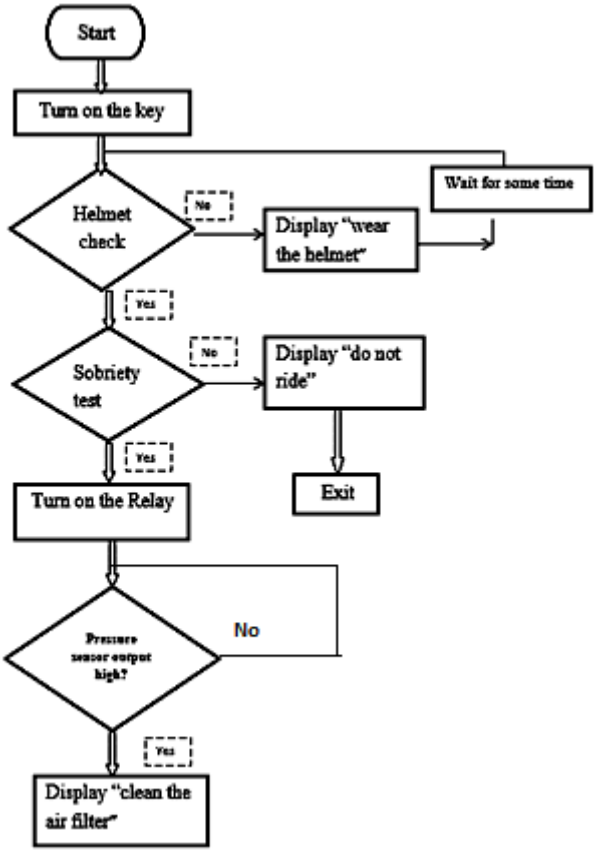


Fig. 6a: Process flowchart

## IV. RESULTS

The obtained results were as per the expectations. Microcontroller was able to perform its tasks in reactive and real time environment. The model is able to meet its design metric constraints, i.e. it can be manufactured at low cost, it has good performance evaluation, is able to work at low powers because of microcontroller's power saving modes and it responds in a reactive and a real time environments. It is also capable of working at extreme environmental conditions.

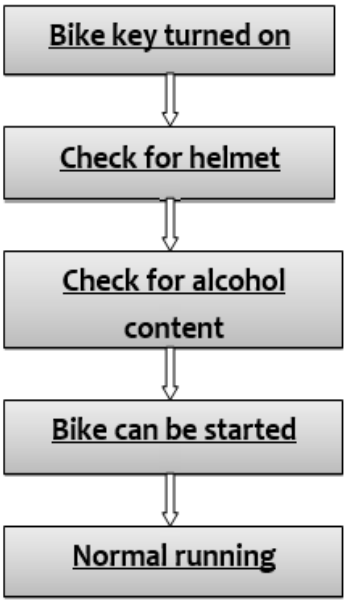


Fig. 6b: Process Flow

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Microcontroller checks effectively the presence of helmet on the rider and tests if the rider is sober. Only if both conditions evaluate to true then user is allowed to start the bike. This process is efficiently controlled and spark plug switch is monitored. The whole process is explained in the Fig.6.

The practical result obtained was same as the expected result. Microcontroller based Helmet detection and sobriety test was able to perform the following operations successfully.

- Once the bike key is turned on, microcontroller draws power from the battery resident on the bike.
- Display "Wear the Helmet" message.


Fig. 7a: LCD showing a "Wear the Helmet" message.

- Then IR detector on the petrol tank checks for the presence of helmet.
- If the presence of helmet is successfully detected, then microcontroller moves to the next case and a message "Blow into the Alcohol Sensor is displayed".


Fig. 7b: LCD showing a "Blow into sensor" message

- The rider has to blow inside the alcohol sensor, if the presence of alcohol is not detected, then a message "You can start the bike" is displayed and simultaneously microcontroller turns on the relay.


Fig. 7c: LCD showing a "Can start" message.

- If the presence of alcohol is detected, then a message "You can't start the bike" is displayed and the relay remains in off state.


Fig. 7d: LCD showing a "Can't start" message.

## V. FUTURE IMPROVEMENTS

Research is being done to implement this project in a very efficient manner by reducing its size, power consumption and at a low price. Instead of electrically chargeable batteries solar chargeable batteries can be used. Driver license detection system can be added to the above implementation. Research on Pressure sensors which work efficiently under high temperatures in the exhaust pipes is also being carried out. Also work is being done to detect the helmet and alcohol when the vehicle is moving at particular intervals and if the test fails, inform the police about the violation using GSM and GPS.

## VI. CONCLUSION

This project has a wide real life scope, if implemented by the government. It can reduce lot of road accidents of two wheelers as it is the major cause of deaths in the world. It can also prevent the damage occurred to the vehicles by the accidents. So this helps in curbing the road accidents by implementing mandatory Helmet protection and detection of alcohol content during the turn on of the bike. This project is undertaken keeping in view of traffic, traffic rules and safety of people. Implementation of this project by the government saves a lot of time for the traffic police and most importantly saves the precious life of a person as one cannot run a motor vehicle once he is drunk and if the helmet is not present. Also conservation of fuel can be achieved.

## ACKNOWLEDGEMENTS

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