SMART HELMET USING IOT

Gulshan Kumar Sharma, 1716110074
Raghav Kalra, 1716110157
Rishi Gaur, 1716110165
Roshni Kumari, 1716110169

A report presented for the degree of
Bachelor of Technology

Department of Computer Science and Engineering

Dr. A.P.J. Abdul Kalam Technical University, Lucknow
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Preface

We the students of Krishna Engineering College are pursuing B.Tech course. And towards the partial fulfillment of it, We have undergone a project. We have put our endeavor to make the objective accomplished. Despite all the limitations, obstacles, hurdles and hindrances we have toiled our hands to achieve the goal desired. We have come across difficulties to make the objective a reality. Anyhow with kind help and genuine interest formally supported by extreme support of our guide and college authorities, we are presenting this hand carved efforts. The purpose of this project is to test the level of knowledge of students. Our efforts comprises the kbnowledge, skills, values and attributes demonstrated through behaviour that results in our performance.

If anywhere something is found unacceptable or unnecessary to the theme you are welcomed with your valuable suggestions.

Undertaking

We hereby declare that the work presented in this dissertation entitled **"Smart Helmet"**, in partial fulfillment of the requirement for the award of the degree of Bachelor of Technology in Computer Science and Engineering, submitted to Dr. A.P.J. Abdul Kalam Technical University, Lucknow, is our work carried out during the period from 25/07/2020 to 30/06/2021 under the guidance of **Mr. Ashish Patel, Asst. Professor**, *Krishna Engineering College, Ghaziabad*. The work reported in this dissertation has not been submitted by us for award of any other degree or diploma.

Date:

Place: Ghaziabad

(Gulshan Kumar Sharma, 1716110074)
(Raghav Kalra, 1716110157)
(Rishi Gaur, 1716110165)
(Roshni Kumari, 1716110169)

Certificate

This is to certify that the Project report entitled **"Smart Helmet"** done by Gulshan Kumar Sharma (1716110074), Raghav Kalra (17161101), Rishi Gaur (1716110165), Roshini Kumari (17161101) is carried out by them at *Krishna Engineering College, Ghaziabad* under my guidance. The matter embodied in this project work has not been submitted earlier for the award of any degree or diploma to the best of my knowledge and belief.

Date:

Prof. (Dr.) Pramod Kumar
Head
Department of Computer Science and Engineering

(Gulshan Kumar Sharma, 1716110074)
(Raghav Kalra, 1716110157)
(Rishi Gaur, 1716110165)
(Roshni Kumari, 1716110169)

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There is always a sense of gratitude which one expresses to other people for their helpful and needy service they render during phases of life . We too would like to do the same as we really wish to express our gratitude to those who have been helpful to us in gettting this project completed.

Inrepresenting this report we would like to express our gratitude to **Mr. Ashish Patel, Asst. Professor**, *Krishna Engineering College, Ghaziaba*d for providing us with his able guidance and inspiration for the completion of research report.

Lastly, we would also like to thank our parents and friends who helped us a lot in finalizing this project within the limited time frame.

(Gulshan Kumar Sharma, 1716110074)
(Raghav Kalra, 1716110157)
(Rishi Gaur, 1716110165)
(Roshni Kumari, 1716110169)

Abstract

As we already know that India is the second largest most populated country in the world. In India there is a large youth population. In this generation youths are very much fond of bikes. Because of style and new fashion many bikers don't want to wear helmet and their fashion causes deaths which increasing day by day. And it had been found that major deaths are because of head injuries which can be stop by wearing helmet. More cases are about drunk and drive and it causes accidents. So to reduce these incidents we made a smart helmet using IoT which will help us to reduce the risk of deaths and accidents. In this there are following features if the rider wears helmet then only bike will start and if rider is drunk then the ignition will be automatically off. The GSM Modem will send the message if any accident occurs to the registered contact number by using sim card.

Contents

List of Figures

List of Tables

Chapter 1

Introduction

1.1 Introduction

Road traffic injuries are a major public health problem and a leading cause of death and injury around the world. Each year nearly 1.2 million people die as a result of road crashes, and millions more are injured or disabled. In many low-income and middle-income countries, where motorcycles and bicycles are an increasingly common means of transport, users of two-wheelers make up a large proportion of those injured or killed on the roads. Motorcycle and bicycle riders are at an increased risk of being involved in a crash. This is because they often share the traffic space with fast-moving cars, buses and trucks, and also because they are less visible. In addition, their lack of physical protection makes them particularly vulnerable to being injured if they are involved in a collision.

In most high-income countries, motorcycle fatalities typically comprise around 5% to 18% of overall traffic fatalities. This proportion reflects the combined effect of several important factors including the relatively low ownership and use of motorcycles in many developed countries, and the relatively high risk of these motorcycles being involved in crashes involving fatalities. Typically, these risks are much higher for motorcycle than for vehicle travel.

In low-income and middle-income countries, car ownership and use rates are generally much lower than in high-income countries. However, the ownership and use of motorcycles and other two-wheelers is generally relatively high.

In India 69% of the total number of motor vehicles are motorized two-wheelers, considerably higher than in high-income countries. Reflecting this difference, the levels of motorcycle rider fatalities as a proportion of those injured on the roads are typically higher in low-income and middle-income countries than in high-income countries. For instance, 27% of road deaths in India are among users of motorized two-wheelers, while this figure is between 70–90% in Thailand, and about 60% in Malaysia. In China, motorcycle ownership between 1987 and 2001 grew rapidly from 23% to 63%, with a corresponding increase in the proportion of traffic fatalities sustained by motorcyclists rising from 7.5% to 19% over the same period. However, in other low-income and middle-income countries, a lack of high quality road safety data means that precise levels of motorcycle rider fatalities are still not known.

Traffic accidents in India have been increased every year. As per Section 129 of Motor Vehicles Act, 1988, every single person riding a two-wheeler is required to wear protective headgear following the standards of BIS (Bureau of Indian Standards). Also drunken driving under the influence is a criminal offence according to the Motor Vehicle act 1939, which states that the bike rider will get punishment. Currently bike riders easily escape from the law. These are the three main issues which motivates us for developing this project.

Major reason for accidental deaths on roads are injuries to the head and neck. In European countries, head injuries contribute to around 75% of deaths among motorized two-wheeler users; in some low-income and middle-income countries head injuries are estimated to account for up to 88% of such fatalities.In 2017, 48,746 road users on two-wheelers lost their lives in road accidents, which is the single largest category. Of those who died, 73.8 percent weren't wearing helmets. The social costs of head injuries for survivors, their families and communities are high, in part because they frequently require specialized or long term care. Head injuries also result in much higher medical costs than any other type of injury, such that these injuries exert a high toll on a country's health care costs and its economy. Globally, there is an upward trend in the number and use of motorcycles and bicycles, both for transport and recreational purposes. Indeed, most of the growth in the number of vehicles on the world's roads comes from an increasing use of motorized two-wheelers.

What is helmet?

A helmet is a form of protective gear worn to protect the head. More specifically, a helmet complements the skull in protecting the human brain. Ceremonial or symbolic helmets without protective function are sometimes worn too. Soldiers wear combat helmets, often made from Kevlar or other lightweight synthetic fibers.

Why are helmets needed?

considerable rise in the number of motorized two-wheeler vehicles on their roads. This rapid growth in the use of motorcycles in many lowincome and middle-income countries is already being accompanied by a considerable increase in the number of head injuries and fatalities that will only continue to increase if present trends continue unchecked.

1.2 Can a helmet protect your head?

The technical expertise behind the design of high quality helmets is based on an understanding of what happens to the head in the event of a motorcycle crash. This section describes what happens in the event of a motorcycle crash, and then explains how a helmet works to reduce this effect.

1.2.1 The mechanism of head injuries

the important anatomical information about the head to note is the following:

- The brain is enclosed within a rigid skull.
- The brain "sits" on bones that make up the base of the skull.
- The spinal cord passes through a hole in the underside of the brain.
- Under the skull, adhering to the bones, is a tough tissue called the dura that surrounds the brain.
- Between the brain and the dura is a space containing cerebrospinal fluid that protects the brain tissue from mechanical shock.
- The brain "floats" in the cerebrospinal fluid but it can only move about 1 millimetre in any direction.
- The skull is covered by the scalp, which provides some additional protection.

Figure 1.1: Structure of Head.

During a motorcycle or bicycle crash there are two principal mechanisms of injury to the brain: through direct contact and through acceleration–deceleration. Each mechanism causes different types of injuries.

When a motorcycle or bicycle is involved in a collision, the rider is often thrown from the cycle. If the rider's head hits an object, such as the ground, the head's forward motion is stopped, but the brain, having its own mass, continues to move forward until it strikes the inside of the skull. It then rebounds, striking the opposite side of the skull. This type of injury can result in anything from a minor head injury, such as concussion, to a fatal head injury.

Head injuries that result from either contact or acceleration–deceleration injuries are themselves divided into two categories: open or closed head injuries. Most traumatic brain injuries are the result of closed head injuries – that is, there is no open wound to the brain

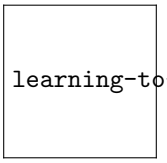

Figure 1.2: Types of head injuries.

Motorcycle riders who do not wear a helmet run a much higher risk of sustaining any of these head and traumatic brain injuries, or a combination of them. Helmets create an additional layer for the head and thus protect the wearer from some of the more severe forms of traumatic brain injury

1.2.2 How a helmet works

A helmet aims to reduce the risk of serious head and brain injuries by reducing the impact of a force or collision to the head.

- It reduces the deceleration of the skull, and hence the brain movement, by managing the impact. The soft material incorporated in the helmet absorbs some of the impact and therefore the head comes to a halt more slowly. This means that the brain does not hit the skull with such great force.
- It spreads the forces of the impact over a greater surface area so that they are not concentrated on particular areas of the skull.
- It prevents direct contact between the skull and the impacting object by acting as a mechanical barrier between the head and the object.

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

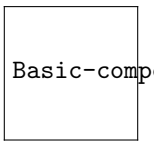

Figure 1.3: Components of a helmet.

The shell

This is the strong outer surface of the helmet that distributes the impact over a large surface area, and therefore lessens the force before it reaches the head. Although the shell is tough, it is designed to compress when it hits anything hard. It provides protection against penetration by small, sharp and high speed objects and it also protects the padding inside the helmet from abrasions and knocks during daily use. These requirements mean that the shell must be hard, usually with a smooth exterior finish.

The impact-absorbing liner

This is made of a soft, crushable padded material – usually expanded polystyrene, commonly called "styrofoam". This dense layer cushions and absorbs the shock as the helmet stops and the head tries to continue moving.

The comfort padding

This is the soft foam-and-cloth layer that sits next to the head. It helps keep the head comfortable and the helmet fitting snugly.

The retention system, or chin strap

This 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 specifically designed to keep the helmet on during an impact, must be correctly used for the helmet to function as it is designed to.

1.2.3 Motorcycle helmet design

In addition to meeting the previously described functions and conforming to standards, a helmet needs to be designed to suit the local weather and traffic conditions. The following are some of the considerations usually addressed by helmet designers:

- Materials used in the construction of a helmet should not degrade over time, or through exposure to weather, nor should they be toxic or cause allergic reactions. Currently, the plastic materials commonly used are Expanded Poly-Styrene (EPS), Acrylonitrile Butadiene Styrene (ABS), Poly Carbon (PC) and Poly Propylene (PP). While the material of the helmet shell generally contains PC, PVC, ABS or fibre glass, the crushable liner inside the shell is often made out of EPS – a material that can absorb shock and impact and is relatively inexpensive. However, helmets with EPS liners should be discarded after a crash, and in any case users should replace such helmets after 3–5 years of use.
- Standards often set the minimum coverage of a helmet (see Module 3). Half-head helmets offer minimal coverage. Full-face helmets should ensure that the wearer's peripheral vision and hearing are not compromised.
- To ensure that a helmet can absorb the shock of a crash, the crushable liner should be between 1.5 cm and 3.0 cm in thickness.

In addition to the previously mentioned design issues, there are also various styles of helmets which afford different protection. The most common types are:

- **Full-face helmets**

  A full face helmet covers the entire head, including the base of the skull to the rear. The face and chin are also protected by a section of material which typically also cradles the visor. These are the most common type of helmet you'll see in the streets and take their styling (though muted somewhat) from Moto GP helmets. Safety-wise, these are the best helmets you can buy for road riding. 35% of all crashes show major impact in the chin bar area. In the absence of this protective plastic/carbon/fibreglass, your face takes all that damage.:

  shark_s900_special-min-300x300.jpg

Figure 1.4: Full-face helmet.

- **Modular/Flip-Up Helmets**

  Modular helmets attempt to give you the best of both worlds. They include a hinge, allowing the chin bar to be raised and lowered according to the wearer's needs (even removed in some cases). After full face helmets, these are the next most common type of helmet worn by commuters. When checking the safety rating of a modular helmet, remember that ratings for the helmet in the open and closed position may be stated. If safety ratings only exist for the closed position, the manufacturer doesn't intend for the helmet to be used while open. In such cases, the 'open' feature has been included as a quality of life addition. The convenience of opening the front of your helmet to have a chat or order a coffee is nice, but many people prefer flip ups because they find them quieter. A modular helmet is put on in the open position, meaning the opening at the bottom can be much smaller than a full face face helmet. This results in less air getting into the bottom opening and therefore a quieter experience.

  helmet_caberg_flip-front_duke_2_matt-black_detail2-300x300.

Figure 1.5: Modular/Flip-Up Helmet.

- **Off Road/Motocross**

  Motocross is a physically demanding activity. Riders engaged in this sport need to vent heat much more rapidly than a typical commuter. The chin bar and visor are therefore elongated away from the face, allowing better circulation of air and the use of protective goggles. The visor protects from the sun, but also helps to shield the eyes and face from debris. Paired with a good set of goggles, a quality off-road helmet can offer comparable protection to a full face helmet.

  
  bell_helmets_moto-3_blackout-300x300.jpg

Figure 1.6: Off Road/Motocross.

- **Open-face helmets**

  These helmets, as the name suggests, are open to the front with no chin bar – more common in hotter climates. In tropical conditions, a full face helmet (no matter how good the vents) can be really uncomfortable. Most open face helmets will include a snap-on visor to prevent insects from entering the users eyes. Protection to the head and base of the skull can be equal to that of a full face helmet, but the face is completely unprotected.

  
  word-image-6-300x300.jpeg

Figure 1.7: Open face helmet.

- **Half Helmet/Pudding Basin**

  These look just like they sound. Popular with "bikers", rockers and street racers, this helmet style has thankfully fallen out of favour in recent years. They can offer some protection from brain injury, but absolutely none to the face. They perform so poorly in both safety tests and real life that many UK manufacturers have stopped producing them.

  
  RB-100-MATT-SCHWARZ_ml-300x270.jpg

Figure 1.8: Half Helmet/Pudding Basin.

- **Adventure/Dual Sport**

  Adventure/Dual Sport helmets are designed with both on and off-road riding in mind. A boom in adventure riding in the last decade means most major manufacturers offer a few helmets in this category. Common features include a wider face opening for better peripheral vision, enough space to wear goggles, a visor to block the sun/debris and good ventilation. These helmets are equally at home on the road or on a trail. Some high end models have a kind of goggle/visor hybrid that actually works really well. Many offer multiple configurations, removable cold weather features and are suitable for just about any conditions you can throw at them.

- **Smart Helmets**

  This is a pretty new addition to the family, and we haven't seen any for sale. That said, it's only a matter of time.The working of smart helmet is very simple, sensors are placed in different places of helmet which are connected to microcontroller board.It is the helmet that works with the help of transmitter and receiver circuit and the microcontroller.

1.3 Helmet use is effective at reducing head injuries

Wearing a helmet is the single most effective way of reducing head injuries and fatalities resulting from motorcycle and bicycle crashes. Motorcyclists who do not wear helmets are at a much higher risk of sustaining head injuries and from dying from these injuries. In addition, the disability that results from these head injuries incurs costs at an individual, family and societal level. There is considerable research that has been conducted

arai_tour-x4_diamond-white-300x300.jpg

Figure 1.9: Adventure/Dual Sport Helmet.

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Figure 1.10: Smart Helmet.

on the effects of wearing a helmet on the risk of a head injury as a result of a collision. The results show slightly different effects, depending on the study type, population, situation etc. Consequently it is useful to examine this research collectively – in what is known as a systematic review on the topic of interest. Systematic reviews of studies are a means of objectively examining the evidence for a particular claim (in this case, helmet use in reventing head injury) and combining the results in a way that minimizes any bias. Reviewers conducting such reviews search widely for all the studies on the topic and include those of a sufficiently high methodological quality. When the data from all the studies included in the review are summarized, the result should provide a more accurate estimate of the effect of the intervention than is possible from individual studies.

Systematic reviews have been published examining the effectiveness of both motorcycle helmets and bicycle helmets. The review on motorcycle helmets included 53 studies, and summarized the current available evidence on helmets and their impact on mortality, as well as on head, face and neck injuries, following motorcycle crashes. Table 1.1 provides a summary of the main results of this review.

Table 1.1: Summary of systematic review of effectiveness of motorcycle helmets.

Not wearing a helmet	**Wearing a helmet**
•increases the risk of sustaining a head injury	•decreases the likelihood of death by up to 39%
•increases the severity of head injuries	•decreases the risk and severity of injuries by about 72%

The following are the main conclusions of this research:

- Motorcycle helmets reduce the risk of mortality and head injury in motorcycle riders who crash, although the effect on death may be modified by other factors surrounding the crash, such as the speed the motorcyclist was travelling at when the crash occurred. Crashes at higher speeds may result in multiple injuries likely to cause death, regardless of how well the head is protected.
- There was not enough evidence to determine the effect of motorcycle helmets on face or neck injuries, although some studies suggest that helmets have no effect on the risk of neck injuries but are protective for face injuries.
- There was insufficient evidence to demonstrate whether differences in helmet types (full-face versus open-face) confer more or less advantage in injury reduction. Further research should be conducted to determine the effectiveness (and cost effectiveness) of different helmet types – especially those used in low-income and middle-income countries – on mortality and on head, neck and face injuries.
- Increasing motorcycle helmet use in countries where such use has been low is likely to dramatically reduce head injury and death. Policy-makers would do well to consider measures to increase helmet use, such as legislation for compulsory helmet use and its enforcement, along with community education campaigns.

1.4 Need Of Project

Motorcycle safety related to different features of the vehicle such as equipment model, design of the vehicle and as well as operator skill is special for motorcycle rider has towards the motorbikes. But they are the most unsafe road users, without a protective body, even the slightest careless can have serious injuries or may lead to the death of the rider. Not only because of the careless, but the death of the people may occur due to over speed, rash driving, over consumption of alcohol and violation of traffic rules. But the main reason for brain damage and this leads to immediate death, was the absence of helmet on the person. If the rider wears the helmet, 80% chances for avoiding head injuries and we can save a life from accidents. With the help of new technologies such as IoT, dangerous traffic situations will not occur. And modelling the motorcycles with the sensors, alert system to the rider and surroundings by a sending message, and to make it mandatory for the bike rider to wear a helmet during his/her ride. In a recent survey, every hour 4 people die in road accidents, 70% due to not wearing a helmet.

Objective

The main objective of this project is to design a helmet that provides safety to bike riders and to prevent over a drink and drive cases. It detects whether the rider met with an accident if he meets, then it alerts the guardian about the accident and sends SMS.

Chapter 2

Research

2.1 Proposed System

We are developing a smart helmet using the internet of things (IoT) technology, in which we ensure the safety of the bike rider. by avoiding road accidents of the bikers by following ways:

- The system detects whether the rider is wearing a helmet or not if he wears then only the vehicle will start.
- It detects the amount of alcohol consumed by the rider, if the rider has over drunk, the bike engine will not start.
- When the bike rider meets with an accident it detects it and gives the notification to the registered contact with a location.

For the safety of the bike rider, we are using the latest technology IoT, this technology provides the advance techniques for alerting the rider and ensures that rider follows the rules and regulations. For two-wheeler rider, Helmet is the most basic protection device and it is necessary for every bicycle or motorbike riders. But it does not ensure the safety of the rider and the rider wont follow the traffic rules. Most of the people use ordinary helmet just to avoid giving challan to the traffic police, these helmets do not ensure the safety of the driver. So, to overcome these problems we need to use the smart helmet.

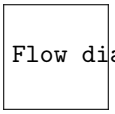


Figure 2.1: Flow diagram of the proposed system.

2.2 System Design

Systems design is the process of defining elements of a system like modules, architecture, components and their interfaces and data for a system based on the specified requirements. It is the process of defining, developing and designing systems which satisfies the specific needs and requirements of a business or organization.

In this case our system is smart helmet and this system has two sections namely,

- Helmet section
- Bike section

2.3 Helmet Section

The Helmet Unit consists of different sensors which collect the required information from the surrounding and then send it to the microcontroller for processing.

Figure 2.2: Helmet unit.

The Helmet Unit is battery-powered. Battery supplies the power to the whole circuit.

- The buckle is used to secure the helmet on the head of the rider in order to protect him from the accident. The buckle system uses a Single Pole Double Throw switch to provide the guarantee that the buckle is effectively clasped before the riding of the two-wheeler by the rider.
- The alcohol detector is a Gas Sensor for the detection of the presence of alcohol in the rider's breath and for determining his sobriety. An appropriate threshold value is set according to the laws of road safety.
- The microcontroller section is where the microcontroller is encased. The microcontroller is used for capturing the signals from presence detector and alcohol detector. It processes the data and then generates a desirable output. This output is then sent to the vehicle unit for further functionality.
- Then the analysis of combined outputs from all the subsystems and sensors is done. Depending on the three primary conditions which needs to be checked, the microcontroller then generates a Boolean value. That value is transmitted over to the Vehicle Unit.

The elements in Fig are explained as follows:

2.3.1 MQ3 Alcohol Sensor

MQ3 is one of the most commonly used sensors in the MQ sensor series. It is a Metal Oxide Semiconductor (MOS) type of sensor. Metal oxide sensors are also known as Chemiresistors, because sensing is based on the change of resistance of the sensing material when exposed to alcohol. So by placing it in a simple voltage divider network, alcohol concentrations can be detected.

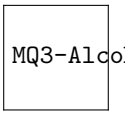


Figure 2.3: MQ3-Alcohol-Sensor

MQ3 alcohol sensor works on 5V DC and draws around 800mW. It can detect Alcohol concentrations anywhere from 25 to 500 ppm.

Factor	Value
Operating voltage	5V%
Load resistance	200 K Ohm
Heater resistance	33 Ohm ± 5%
Heating consumption	Less than 800mw
Sensing Resistance	1 M Ohm – 8 M Ohm
Concentration Scope	25 – 500 ppm
Preheat Time	Over 24 hour

Table 2.1: Here are the complete specifications of MQ3 Alcohol Sensor.

2.3.2 Internal structure of MQ3 Alcohol Sensor

MQ3 is a heater-driven sensor. That's why it is enclosed in two layers of fine stainless steel mesh called an Anti-explosion network. It ensures that heater element inside the sensor will not cause an explosion, as we are sensing flammable gas (alcohol).

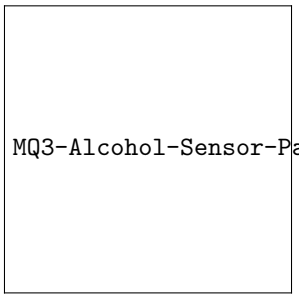


Figure 2.4: MQ3 Alcohol Sensor Upper Section.

It also provides protection for the sensor and filters out suspended particles so that only gaseous elements are able to pass inside the chamber.

Figure 2.5: MQ3 Alcohol Sensor Pin Section.

2.3.3 How MQ3 Alcohol Sensor Works?

When SnO2 semiconductor layer is heated at high temperature, oxygen is adsorbed on the surface. In clean air, electrons from the conduction band in tin dioxide are attracted to oxygen molecules. This form an electron depletion layer just below the surface of SnO2 particles and forms a potential barrier. As a result, the SnO2 film becomes highly resistive and prevents electric current flow.

In the presence of alcohol, however, the surface density of adsorbed oxygen decreases as it reacts with the alcohols; which lowers the potential barrier. Electrons are then released into the tin dioxide, allowing current to flow freely through the sensor.

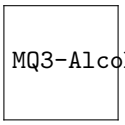


Figure 2.6: MQ3 Alcohol Sensor.

2.3.4 MQ3 Alcohol Sensor Module Pinout

Now let's have a look at the pinout.

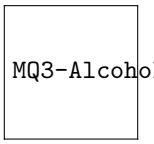


Figure 2.7: MQ3 Alcohol Sensor Pin Diagram.

VCC supplies power for the module. You can connect it to 5V output from your Arduino.
GND is the Ground Pin and needs to be connected to GND pin on the Arduino.
D0 provides a digital representation of the presence of alcohol.
A0 provides analog output voltage in proportional to the concentration of alcohol.

2.3.5 Limit Switch

In electrical engineering a limit switch is a switch operated by the motion of a machine part or presence of an object.

They are used for controlling machinery as part of a control system, as a safety interlocks, or to count objects passing a point.[1] A limit switch is an electromechanical device that consists of an actuator mechanically linked to a set of contacts. When an object comes into contact with the actuator, the device operates the contacts to make or break an electrical connection.

Limit switches are used in a variety of applications and environments because of their ruggedness, ease of installation, and reliability of operation. They can determine the presence or absence, passing, positioning, and end of travel of an object. They were first used to define the limit of travel of an object; hence the name "Limit Switch".

Standardized limit switches are industrial control components manufactured with a variety of operator types, including lever, roller plunger, and whisker type. Limit switches may be directly mechanically operated by the motion of the operating lever. A reed switch may be used to indicate proximity of a magnet mounted on some moving part. Proximity switches operate by the disturbance of an electromagnetic field, by capacitance, or by sensing a magnetic field.

it41m01.jpg

Figure 2.8: Limit Switch.

2.3.6 RF Transmitter

This little module is a transmitter among two. It is really simple as it looks. The heart of the module is the SAW resonator which is tuned for 433.xx MHz operation. There is a switching transistor and a few passive components, that's it.

When a logic HIGH is applied to the DATA input, the oscillator runs producing a constant RF output carrier wave at 433.xx MHz and when the DATA input is taken to logic LOW, the oscillator stops. This technique is known as Amplitude Shift Keying, which we will discuss in detail shortly.

512k5yca6zl-_sl1280_-500x500.jpg

Figure 2.9: RF Transmitter.

2.3.7 ASK – Amplitude Shift Keying

For sending the digital data over radio, these modules use a technique called Amplitude Shift Keying or ASK. In Amplitude Shift Keying the amplitude (i.e. the level) of the carrier wave (in our case it's a 434MHz signal) is changed in response to the incoming data signal.

This is very similar to the analog technique of amplitude modulation which you might be familiar with if you're familiar with AM radio. It's sometimes called binary amplitude shift keying because there are only two levels we are concerned with. You can think of it as an ON/OFF switch.

- For **Digital 1** – This drives the carrier at full strength.
- For **Digital 0** – This cuts the carrier off completely.

This is how the Amplitude modulation looks like:
434MHz RF Transmitter Amplitude Shift Keying ASK Waveform Amplitude Shift keying has the advantage of being very simple to implement. It is quite simple to design the decoder circuitry. Also ASK needs less bandwidth than other modulation techniques like FSK (Frequency Shift Keying). This is one of the reasons for being inexpensive.

The disadvantage however is that ASK is susceptible to interference from other radio devices and background noise. But as long as you keep your data transmission to a relatively slow speed it can work reliably in most environments.

This is how the Amplitude modulation looks like:

2.3.8 433MHz RF Transmitter Pinout

Let's have a look at the pinout of 433MHz RF Transmitter Module. **DATA** pin accepts digital data to be transmitted.

VCC supplies power for the transmitter. This can be any positive DC voltage between 3.5V to 12V. Note that the RF output is proportional to the supply voltage i.e. the higher the Voltage, the greater the range will be.

GND is a ground pin.

Antenna is a pin for external antenna. As discussed earlier, you will want to solder a 17.3 cm piece of solid wire to this pin for the improved range.

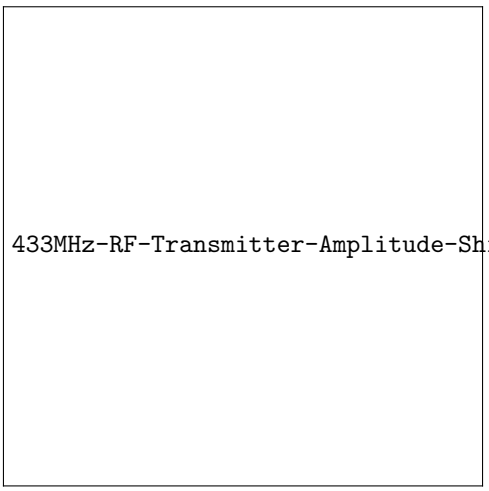


Figure 2.10: Amplitude Modulation.

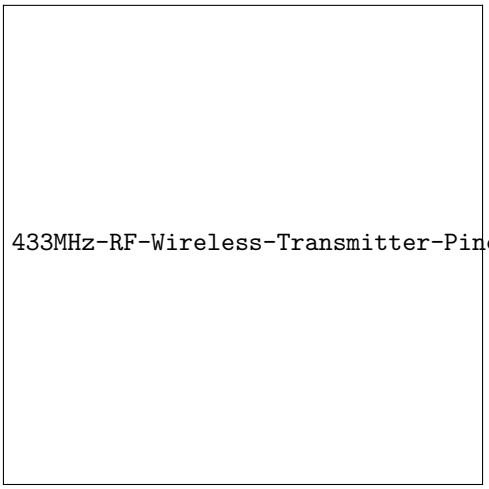


Figure 2.11: RF Transmitter Pin Diagram.

2.3.9 RF Transmitter Circuit Diagram

Figure 2.12: RF Transmitter Circuit Diagram.

Feature	Value
Transmitter frequency range	433.92MHz
Transmitter supply voltage	3V 6V
Transmitter output power	4 12Dbm

Table 2.2: Features of RF Transmitter.

2.3.10 Battery (9 V)

The nine-volt battery, or 9-volt battery, is a common size of battery that was introduced for the early transistor radios. It has a rectangular prism shape with rounded edges and a polarized snap connector at the top. This type is commonly used in smoke detectors, gas detectors, clocks, walkie-talkies, electric guitars and effects units.

The nine-volt battery format is commonly available in primary carbon-zinc and alkaline chemistry, in primary lithium iron disulfide, and in rechargeable form in nickel-cadmium, nickel-metal hydride and lithium-ion. Mercury-oxide batteries of this format, once common, have not been manufactured in many years due to their mercury content. Designations for this format include NEDA 1604 and IEC 6F22 (for zinc-carbon) or MN1604 6LR61 (for alkaline). The size, regardless of chemistry, is commonly designated PP3—a designation originally reserved solely for carbon-zinc, or in some countries, E or E-block.

Most nine-volt alkaline batteries are constructed of six individual 1.5 V LR61 cells enclosed in a wrapper. These cells are slightly smaller than LR8D425 AAAA cells and can be used in their place for some devices, even though they are 3.5 mm shorter. Carbon-zinc types are made with six flat cells in a stack, enclosed in a moisture-resistant wrapper to prevent drying. Primary lithium types are made with three cells in series

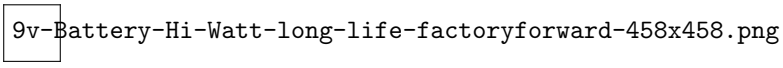


Figure 2.13: 9V Battery.

The battery has both terminals in a snap connector on one end. The smaller circular (male) terminal is positive, and the larger hexagonal or octagonal (female) terminal is the negative contact. The connectors on the battery are the same as on the load device; the smaller one connects to the larger one and vice versa. The same snap-style connector is used on other battery types in the Power Pack (PP) series. Battery polarization is normally obvious, since mechanical connection is usually only possible in one configuration.

2.3.11 Diode

One of the first semiconductor based engineering components, diodes are an indispensible necessity for any current modern gadget or circuit. They are the basic logic block – the most fundamental unit.

These two terminal-ed nonlinear passive elements ideally conduct only one way and hence protect the circuit as well as the source from any damage. Diodes are widely used in rectifier circuits, limiters, communication circuits, multiplier circuits and signal clippers as well as clamper circuits. This Insight will give an in depth view of a diode's physicality.

The core of the diode is enclosed in an epoxy that protects the semiconductor from ambient adversities. This epoxy molding is black colored, marked with the diode number on the center and a silver colored band at one end – the band labeling that end to be the diode's cathode. Connected to the epoxy at both the ends are two electroplated leads. These leads are able to withstand high temperatures and provide good soldering properties.

Figure 2.14: Diode.

2.3.12 Capacitor

Capacitor is a passive component used to store charge. The charge (q) stored in a capacitor is the product of its capacitance (C) value and the voltage (V) applied to it. Capacitors offer infinite reactance to zero frequency

so they are used for blocking DC components or bypassing the AC signals. The capacitor undergoes through a recursive cycle of charging and discharging in AC circuits where the voltage and current across it depends on the RC time constant. For this reason, capacitors are used for smoothing power supply variations. Other uses include, coupling the various stages of audio system, tuning in radio circuits etc. These are used to store energy like in a camera flash.

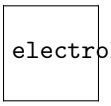


Figure 2.15: Capacitor.

Capacitors may be non-polarized/polarized and fixed/variable. Electrolytic capacitors are polarized while ceramic and paper capacitors are examples of non polarized capacitors. Since capacitors store charge, they must be carefully discharged before troubleshooting the circuits. The maximum voltage rating of the capacitors used must always be greater than the supply voltage. Click to learn more about working of a capacitor along with its internal structure.

2.3.13 HT12E

HT12E is an encoder IC for RF and IR modules mostly. It is a 12-bit decoder that uses 8-bits for address and 4 for data. RF and IR modules can interface with microcontrollers directly which requires a little bit complex programming. In addition, This encoder IC is easy to implement and simple to use. It comes in 18 and 20 pins. Both packages have only 18 functional pins. Furthermore, This encoder will use the logic states as data and address inputs. HT12E doesn't work alone. It's only an encoder and one side of communicator. On the contrary, the second part of the communicator uses an HT12D decoder. In short, HT12D is the most suitable decoder for HT12E because both are 12-bits and have the same number of address and data pins.

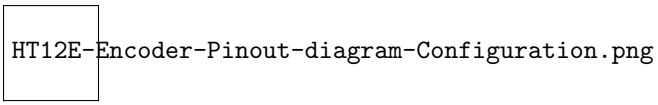


Figure 2.16: HT12E Pinout Diagram.

2.4 Bike Section

The Vehicle Unit is a part of the actual two-wheeler. It is wirelessly connected to the Helmet Unit and it can be placed anywhere on the motor-bike preferably at a position which is less prone to the damage.

The Vehicle Unit is also powered with the battery with the recharging capacity. The unit comprises a section for keeping the battery and a USB port so that it will provide the recharging sobriety to the unit as shown. It also includes a battery level indicator which actually indicates the amount of charge which is left in the unit to operate. The microcontroller is connected to the battery for the supply of the power. This microcontroller receives the signals from the microcontroller in the Helmet Unit and then it further processes the received information. The microcontroller and the ignition key switch are connected to each other via a relay module (1 channel 5V relay module) which actually controls the ignition of the vehicle which is based on the values received from the controller.

Figure 2.17: Proposed Bike Section.

The elements in bike section are explained as follows:

2.4.1 RF Receiver

This one is a receiver module. Though it looks complex, it is as simple as the transmitter module. It consists of a RF tuned circuit and a couple of OP Amps to amplify the received carrier wave from the transmitter. The amplified signal is further fed to a PLL (Phase Lock Loop) which enables the decoder to "lock" onto a stream of digital bits which gives better decoded output and noise immunity

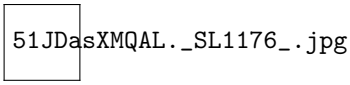


Figure 2.18: RF Receiver.

Feature	Value
Receiver frequency	433MHz
Receiver typical frequency	105Dbm
Receiver supply current	3.5mA

Table 2.3: Features of RF Reciever.

2.4.2 RF Reciever Circuit Diagram

2.4.3 Reed Switch

The reed switch is an electrical switch operated by an applied magnetic field. It was invented at Bell Telephone Laboratories in 1936 by W. B. Ellwood.

Reed Switch Principle

It consists of a pair of contacts on ferrous metal reeds in a hermetically sealed glass envelope. The contacts may be normally open, closing when a magnetic field is present, or normally closed and opening when a magnetic field is applied.

Figure 2.19: RF Receiver Circuit Diagram.

The switch may be actuated by a coil, making a reed relay, or by bringing a magnet near to the switch. Once the magnet is pulled away from the switch, the reed switch will go back to its original position.

Figure 2.20: Reed Switch.

2.4.4 Reed switches Operation

The simplest magnetic-field sensor is a reed switch. It contains two ferromagnetic nickel and iron reed elements in an evacuated, hermetically sealed glass tube to minimize contact arcing.

When an axially aligned magnet approaches the switch, its magnetic force closes the reeds. The magnet typically generates at least a 50 Gauss force to overcome the return force or spring of the reed elements.

Reed switches are inexpensive, require no standby power, and can function with both ac and dc electrical loads. However, they are relatively slow, so they may not respond fast enough for some high-speed applications.

Since the switches are mechanical devices with moving parts, they have a finite number of operating cycles before they eventually fail. Switching high-current loads can further reduce life expectancy.

Also, low-cost reed switches occasionally deliver unwanted, multiple switching points as the twin lobes of certain magnets pass by.

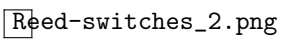


Figure 2.21: Reed Switch Working.

2.4.5 Sim 800L GSM Module

GSM/GPRS module is used to establish communication between a computer and a GSM-GPRS system. Global System for Mobile communication (GSM) is an architecture used for mobile communication in most of the countries. Global Packet Radio Service (GPRS) is an extension of GSM that enables higher data transmission rate.GSM/GPRS module consists of a GSM/GPRS modem assembled together with power supply circuit and communication interfaces (like RS-232, USB, etc) for computer. The MODEM is the soul of such modules.
Sim800L Module is low cost, low form factor GSM module based on Simcoms SIM800L chipset. Sim800L module supports quad-band GSM and GPRS network. This breakout board is perfect for application where size and cost is a constraint. Sim800l gsm module also supports quad band which means that it can work anywhere in the world. This low cost module is perfect for launching your next IoT project. Using this module you can almost make your own cellphone.

Using this module you can:-

- Send Text Messages (SMS)
- Make or receive Phone calls
- Connect to Internet via GPRS
- TCP/IP

The main drawback of this module is works on 3.7 to 4.2 volts so you cannot power it directly through Arduino or Raspberry Pi. Moreover the sim800L GSM and GPRS module requires upto 2 ampere current so accordingly design your power supply. You can use a 3.7 volt lipo battery to directly power the GSM module.

You can communicate with SIM800l module via UART port, supports command including 3GPP TS 27.007, 27.005 and SIM COM enhanced AT Commands.

Features of SIM800L GSM Module:-

- Quad-band 850/900/1800/1900MHz - connect onto any global GSM network with any 2G SIM (in the USA, T-Mobile is suggested).
- Make and receive voice calls using a headset or an external 8 Ohm speaker and electret microphone.
- PWM/Buzzer vibration motor control
- AT command interface with ”auto baud” detection
- Send and receive SMS messages.
- Send and receive GPRS data (TCP/IP, HTTP, etc.).
- Scan and receive FM radio broadcasts.
- Lead out buzzer and vibration motor control port.
- AT command interface with ”auto baud” detection.
- Onboard IPEX socket that can be connected to external antenna.
- Breakouts for external 8W speaker and electret mic if you don’t want to use a headphone
- Level shifting circuitry so you can run it with 2.8V to 5V logic.
- Vibrational motor (buzzer) driver so you can have noiseless notifications
- uFL or SMA connections for external antenna
- Indicator LEDs for power and network connectivity
- Standard SIM slides into the back

Figure 2.22: SIM 800L GSM Module.

2.4.6 Relay Switch

Relay is an electromagnetic device which is used to isolate two circuits electrically and connect them magnetically. They are very useful devices and allow one circuit to switch another one while they are completely separate. They are often used to interface an electronic circuit (working at a low voltage) to an electrical circuit which works at very high voltage. For example, a relay can make a 5V DC battery circuit to switch a 230V AC mains circuit. Thus a small sensor circuit can drive, say, a fan or an electric bulb.

A relay switch can be divided into two parts: input and output. The input section has a coil which generates magnetic field when a small voltage from an electronic circuit is applied to it. This voltage is called the operating voltage. Commonly used relays are available in different configuration of operating voltages like 6V, 9V, 12V, 24V etc. The output section consists of contactors which connect or disconnect mechanically. In a basic relay there are three contactors: normally open (NO), normally closed (NC) and common (COM). At no input state, the COM is connected to NC. When the operating voltage is applied the relay coil gets energized and the COM changes contact to NO. Different relay configurations are available like SPST, SPDT, DPDT etc, which have different number of changeover contacts. By using proper combination of contactors, the electrical circuit can be switched on and off. Get inner details about structure of a relay switch.

Figure 2.23: Relay Switch.

2.4.7 12 V DC Motor

A DC motor is any motor within a class of electrical machines whereby direct current electrical power is converted into mechanical power. Most often, this type of motor relies on forces that magnetic fields produce. Regardless of the type, DC motors have some kind of internal mechanism, which is electronic or electromechanical. In both cases, the direction of current flow in part of the motor is changed periodically.

The speed of a DC motor is controlled using a variable supply voltage or by changing the strength of the current within its field windrings. While smaller DC motors are commonly used in the making of appliances, tools, toys, and automobile mechanisms, such as electric car seats, larger DC motors are used in hoists, elevators, and electric vehicles.

A 12v DC motor is small and inexpensive, yet powerful enough to be used for many applications. Because choosing the right DC motor for a specific application can be challenging, it is important to work with the right company. A prime example is METMotors, which has been creating high-quality permanent magnet DC motors for more than 45 years.

Figure 2.24: 12V DC Motor.

2.4.8 LED

Light emitting diodes (LEDs) are semiconductor light sources. The light emitted from LEDs varies from visible to infrared and ultraviolet regions. They operate on low voltage and power. LEDs are one of the most common electronic components and are mostly used as indicators in circuits. They are also used for luminance and optoelectronic applications. Based on semiconductor diode, LEDs emit photons when electrons recombine with

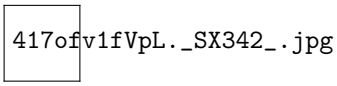


Figure 2.25: LED.

holes on forward biasing. The two terminals of LEDs are anode (+) and cathode (-) and can be identified by their size. The longer leg is the positive terminal or anode and shorter one is negative terminal.

The forward voltage of LED (1.7V-2.2V) is lower than the voltage supplied (5V) to drive it in a circuit. Using an LED as such would burn it because a high current would destroy its p-n gate. Therefore a current limiting resistor is used in series with LED. Without this resistor, either low input voltage (equal to forward voltage) or PWM (pulse width modulation) is used to drive the LED. Get details about internal structure of a LED.

Figure 2.26: LED Pin Diagram.

2.4.9 LCD Display

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments),animations and so on. A 16x2 LCD means it can display 16 characters per line and there are 2

such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the

data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD. Click to learn more about internal structure of a LCD.

Figure 2.27: LCD Display.

Pin Description

Pin No.	Function	Name
1	Ground (0V)	Ground
2	Supply voltage; 5V (4.7V-5.3V)	Vcc
3	Contrast adjustment; through avariable resistor	Vee/Contrast
4	Selects command register when low; and data register when high	Register Select
5	Low to write to the register5; High to read from the register	Read/Write
6	Sends data to data pins when a high to low pulse is given	Enable
7	8-bit data pins	DB0
8	8-bit data pins	DB1
9	8-bit data pins	DB2
10	8-bit data pins	DB3
11	8-bit data pins	DB4
12	8-bit data pins	DB5
13	8-bit data pins	DB6
14	8-bit data pins	DB7
15	Backlight Vcc (5V)	Backlight (+)
16	Backlight Ground (0V)	Backlight (-)

Table 2.4: Pin Description.

Figure 2.28: LCD Display Pin Diagram.

2.4.10 Arduino UNO

Arduino is a prototype platform (open-source) based on an easy-to-use hardware and software. It consists of a circuit board, which can be programed (referred to as a microcontroller) and a ready-made software called Arduino IDE (Integrated Development Environment), which is used to write and upload the computer code to the physical board.

The key features are:

- Arduino boards are able to read analog or digital input signals from different sensors and turn it into an output such as activating a motor, turning LED on/off, connect to the cloud and many other actions.
- You can control your board functions by sending a set of instructions to the microcontroller on the board via Arduino IDE (referred to as uploading software).
- Unlike most previous programmable circuit boards, Arduino does not need an extra piece of hardware (called a programmer) in order to load a new code onto the board. You can simply use a USB cable.
- Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program.
- Finally, Arduino provides a standard form factor that breaks the functions of the micro-controller into a more accessible package.

Figure 2.29: Arduino UNO.

1: Power USB

Arduino board can be powered by using the USB cable from your computer. All you need to do is connect the USB cable to the USB connection (1).

2: Power (Barrel Jack)

Arduino boards can be powered directly from the AC mains power supply by connecting it to the Barrel Jack (2).

3: Voltage Regulator

The function of the voltage regulator is to control the voltage given to the Arduino board and stabilize the DC voltages used by the processor and other elements.

4: Crystal Oscillator

The crystal oscillator helps Arduino in dealing with time issues. How does Arduino calculate time? The answer is, by using the crystal oscillator. The number printed on top of the Arduino crystal is 16.000H9H. It tells us that the frequency is 16,000,000 Hertz or 16 MHz.

5,17: Arduino Reset

You can reset your Arduino board, i.e., start your program from the beginning. You can reset the UNO board in two ways. First, by using the reset button (17) on the board. Second, you can connect an external reset button to the Arduino pin labelled RESET (5).

6,7,8,9: Pins (3.3, 5, GND, Vin)

- 3.3V (6) :- Supply 3.3 output volt
- 5V (7) :- Supply 5 output volt
- Most of the components used with Arduino board works fine with 3.3 volt and 5 volt.
- GND (8)(Ground) :- There are several GND pins on the Arduino, any of which can be used to ground your circuit.

- Vin (9) :- This pin also can be used to power the Arduino board from an external power source, like AC mains power supply.

10: Analog pins

The Arduino UNO board has six analog input pins A0 through A5. These pins can read the signal from an analog sensor like the humidity sensor or temperature sensor and convert it into a digital value that can be read by the microprocessor.

11: Main microcontroller

Each Arduino board has its own microcontroller (11). You can assume it as the brain of your board. The main IC (integrated circuit) on the Arduino is slightly different from board to board. The microcontrollers are usually of the ATMEL Company. You must know what IC your board has before loading up a new program from the Arduino IDE. This information is available on the top of the IC. For more details about the IC construction and functions, you can refer to the data sheet.

12: ICSP pin

Mostly, ICSP (12) is an AVR, a tiny programming header for the Arduino consisting of MOSI, MISO, SCK, RESET, VCC, and GND. It is often referred to as an SPI (Serial Peripheral Interface), which could be considered as an "expansion" of the output. Actually, you are slaving the output device to the master of the SPI bus.

13:Power LED indicator

This LED should light up when you plug your Arduino into a power source to indicate that your board is powered up correctly. If this light does not turn on, then there is something wrong with the connection.

14: TX and RX LEDs

On your board, you will find two labels: TX (transmit) and RX (receive). They appear in two places on the Arduino UNO board. First, at the digital pins 0 and 1, to indicate the pins responsible for serial communication. Second, the TX and RX led (13). The TX led flashes with different speed while sending the serial data. The speed of flashing depends on the baud rate used by the board. RX flashes during the receiving process.

15: Digital I/O

The Arduino UNO board has 14 digital I/O pins (15) (of which 6 provide PWM (Pulse Width Modulation) output. These pins can be configured to work as input digital pins to read logic values (0 or 1) or as digital output pins to drive different modules like LEDs, relays, etc. The pins labeled " " can be used to generate PWM.

16: AREF

AREF stands for Analog Reference. It is sometimes, used to set an external reference voltage (between 0 and 5 Volts) as the upper limit for the analog input pins.

2.4.11 ATmega 328P IC

- ATmega328 is an 8-bit, 28-Pin AVR Microcontroller, manufactured by Microchip, follows RISC Architecture and has a flash-type program memory of 32KB.
- Atmega328 is the microcontroller, used in basic Arduino boards i.e Arduino UNO, Arduino Pro Mini and Arduino Nano.
- It has an EEPROM memory of 1KB and its SRAM memory is 2KB.
- It has 8 Pins for ADC operations, which all combine to form PortA (PA0 - PA7).
- It also has 3 built-in Timers, two of them are 8 Bit timers while the third one is 16-Bit Timer.
- You must have heard of Arduino UNO, UNO is based on atmega328 Microcontroller. It's UNO's heart. :)
- It operates ranging from 3.3V to 5.5V but normally we use 5V as a standard.

- Its excellent features include cost-efficiency, low power dissipation, programming lock for security purposes, real timer counter with separate oscillator.
- It's normally used in Embedded Systems applications. You should have a look at these Real Life Examples of Embedded Systems, we can design all of them using this Microcontroller.

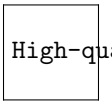


Figure 2.30: ATmega 328P IC.

ATmega328 Pins Description

- Functions associated with the pins must be known in order to use the device appropriately.
- ATmega-328 pins are divided into different ports which are given in detail below.
- VCC is a digital voltage supply.
- AVCC is a supply voltage pin for analog to digital converter.
- GND denotes Ground and it has a 0V.
- Port A consists of the pins from PA0 to PA7. These pins serve as an analog input to analog to digital converters. If analog to digital converter is not used, port A acts as an eight (8) bit bidirectional input/output port.
- Port B consists of the pins from PB0 to PB7. This port is an 8 bit bidirectional port having an internal pull-up resistor.
- Port C consists of the pins from PC0 to PC7. The output buffers of port C has symmetrical drive characteristics with source capability as well high sink.
- Port D consists of the pins from PD0 to PD7. It is also an 8 bit input/output port having an internal pull-up resistor.
- All of the AVR ports are shown in the figure given below.

Figure 2.31: ATmega 328 Ports.

The following table shows the complete features of ATmega328:

Feature	Description
1	Ground (0V)
No. of Pins	28]
CPU	RISC 8-Bit AVR
Operating Voltage	1.8 to 5.5 V
Program Memory	32KB
Program Memory Type	Flash
SRAM	2048 Bytes
EEPROM	1024 Bytes
ADC	10-Bit
Number of ADC Channels	8
PWM Pins	6
Comparator	1
Packages (4)	8-pin PDIP32-lead TQFP28-pad QFN/MLF32-pad QFN/MLF
Oscillator	up to 20 MHz
Timer (3)	8-Bit x 2 & 16-Bit x 1
Enhanced Power-on Reset	Yes
Power Up Timer	Yes
I/O Pins	23
Manufacturer	Microchip
SPI	Yes
I2C	Yes
Watchdog Timer	Yes
Brownout detect (BOD)	Yes
Reset	Yes
USI (Universal Serial Interface)	Yes
Minimum Operating Temperature	-40 C to +85 C

Table 2.5: ATmega328 Features.

2.4.12 Buzzer

A buzzer is a small yet efficient component to add sound features to our project/system. It is very small and compact 2-pin structure hence can be easily used on breadboard, Perf Board and even on PCBs which makes this a widely used component in most electronic applications.

There are two types are buzzers that are commonly available. The one shown here is a simple buzzer which when powered will make a Continuous Beeeeeeppp.... sound, the other type is called a readymade buzzer which will look bulkier than this and will produce a Beep. Beep. Beep. Sound due to the internal oscillating circuit present inside it. But, the one shown here is most widely used because it can be customised with help of other circuits to fit easily in our application.

This buzzer can be used by simply powering it using a DC power supply ranging from 4V to 9V. A simple 9V battery can also be used, but it is recommended to use a regulated +5V or +6V DC supply. The buzzer is normally associated with a switching circuit to turn ON or turn OFF the buzzer at required time and require interval.

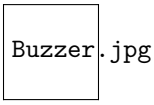


Figure 2.32: Buzzer.

Buzzer Features and Specifications

- Rated Voltage: 6V DC
- Operating Voltage: 4-8V DC
- Rated current: ¡30mA

- Sound Type: Continuous Beep
- Resonant Frequency: 2300 Hz
- Small and neat sealed package
- Breadboard and Perf board friendly

Pin No.	Pin Name	Description
1	Positive	GroundIdentified by (+) symbol or longer terminal lead. Can be powered by 6V DC
2	Negative	Identified by short terminal lead. Typically connected to the ground of the circuit.

Table 2.6: Buzzer Pin Configuration.

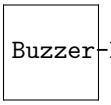


Figure 2.33: Buzzer Pinout.

2.4.13 Zero PCB Board

Zero PCB is basically a general-purpose printed circuit board (PCB), also known as perfboard or DOT PCB. It is a thin rigid copper sheet with holes pre-drilled at standard intervals across a grid with 2.54mm (0.1-inch) spacing between holes. Each hole is encircled by a round or square copper pad so that component lead can be inserted into the hole and soldered around the pad without short-circuiting the nearby pads and other leads. For connecting the lead of component with another lead, solder these together or join these using a suitable conducting wire.

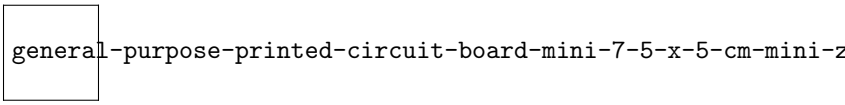


Figure 2.34: Zero PCB Board.

2.4.14 HT12D

HT12D IC is a CMOS series 12-bit RF decoder. Mostly remote control applications have this technology. It gets to interface with the third device and helps it to decode 12-bits data. In this decoder, only 4-bits are data the remaining part is the address. The address will describe the location but 4-bits combination could make 16 types of different combinations. The HT12D decoder can not work alone. It works with another counterpart called an encoder. To receive the data between encoder and decoder address bits should be matched. The encoder can with any CMOS technology. Most modern applications use the encoder for decoding due to its simplicity and efficiency.

HT12D-pinout-diagram.jpg

Figure 2.35: HT12D Pinout Diagram.

Chapter 3

Assembling

3.1 Getting Started With Arduino

- Connect your Arduino Nano board to your laptop and open the control panel. in the control panel, click on Hardware and Sound. Now click on Devices and Printers. Here, find the port to which your microcontroller board is connected.

Figure 3.1: Devices and Printers.

- We will have to include a library to use the GSM Module. Go to Sketch ¿ Include Library ¿ Add .ZIP Library.
- Click on the Tool menu and set the board to Arduino Nano.

Figure 3.2: Setting Up Arduino Nano.

- In the same Tool menu, Set the Processor to ATmega328P (Old Bootloader).

Figure 3.3: Setting Up ATmega 328P.

- Pin 19 of ATmega 328 is connected to pin 13 of Arduino.
- Pin 18 of ATmega 328 is connected to pin 12 of Arduino.
- Pin 17 of ATmega 328 is connected to pin 11 of Arduino.
- Pin 1 of ATmega 328 is connected to pin 10 of Arduino.
- Pin 7 of ATmega 328 is connected to Vcc of Arduino.
- Pin 8 of ATmega 328 is connected to GND of Arduino.
- Pin 9 and 10 of ATmega 328 are connected together with 16 MHz crystal.
- In the same Tool menu, set the port to the port number that you observed before in the Devices and Printers.
- After that code attached below is pasted into Arduino IDE, the upload button is clicked to burn the code on microcontroller board.

Figure 3.4: Project Code In Arduino IDE.

3.2 Code

```
#include <LiquidCrystal.h>
LiquidCrystal lcd(3, 13, 9, 10, 11, 12);
int buz = 5; //
int alc = 2 ; //0;
int sw = 4 ; //1;
int mt = 8; //
int mag = 6;


    void setup()
{

    pinMode(buz,OUTPUT);
pinMode(alc,INPUT);
pinMode(sw,INPUT);
pinMode(mt,OUTPUT);
pinMode(mag,INPUT);
Serial.begin(9600);


    lcd.begin(16, 2);
// Print a message to the LCD.
lcd.setCursor(0, 0);
lcd.print("Smart bike");
lcd.setCursor(0, 1);
lcd.print(" helmet");



    digitalWrite(buz,HIGH);
digitalWrite(mt,LOW);


    delay(1000);
digitalWrite(mt,HIGH);
digitalWrite(buz,LOW);
delay(1000);


    lcd.clear();
lcd.setCursor(0, 0);
lcd.print("PLEASE PUT");
lcd.setCursor(0, 1);
lcd.print(" HELMET");
while(digitalRead(sw)==HIGH);
digitalWrite(buz,HIGH);
lcd.clear();

    }

    //Main Loop To Calculate RPM and Update LCD Display
void loop()
{
    if(digitalRead(sw)==LOW)
{

    lcd.clear();
digitalWrite(mt,LOW);
lcd.setCursor(0, 0);
lcd.print("IGNITION ON");
while( digitalRead(alc)==HIGH && digitalRead(sw)==LOW)
```

```
{
    if(digitalRead(mag)==HIGH)
{
    lcd.clear();
lcd.setCursor(0, 0);
lcd.print("BIKE GOT IN");
lcd.setCursor(0, 1);
lcd.print("ACCIDENT");
init_sms();
send_data(" YOUR BIKE GOT INTO THE ACCIDENT ");
send_sms();


    delay(5500);
}
    else
{
    }
    }
    }
    if(digitalRead(sw)==HIGH)
{ lcd.clear();
lcd.setCursor(0, 0);
lcd.print(" ");
lcd.setCursor(0, 0);
lcd.print(" NO HELMET ");


    digitalWrite(buz,HIGH);
delay(500);
digitalWrite(buz,LOW);
delay(500);
digitalWrite(buz,HIGH);
delay(500);
digitalWrite(buz,LOW);
delay(500);
digitalWrite(buz,HIGH);
delay(500);
digitalWrite(buz,LOW);
delay(500);
digitalWrite(buz,HIGH);
delay(500);


    if(digitalRead(sw)==HIGH)
{
    digitalWrite(mt,HIGH);
while( digitalRead(alc)==HIGH && digitalRead(sw)==HIGH)
{
    if(digitalRead(mag)==HIGH)
{
    lcd.clear();
lcd.setCursor(0, 0);
lcd.print("BIKE GOT IN");
```

```
lcd.setCursor(0, 1);
lcd.print("ACCIDENT");

    init_sms();
send_data(" YOUR BIKE GOT INTO THE ACCIDENT ");
send_sms();

    delay(5500);
}

    else
{

    }

    }

    }

    }

    if(digitalRead(alc)==LOW)
{ lcd.clear();
lcd.setCursor(0, 0);
lcd.print(" ");
lcd.setCursor(0, 0);
lcd.print("ALCOHOL DETECTED");

    digitalWrite(buz,HIGH);
delay(500);
digitalWrite(buz,LOW);
delay(500);
digitalWrite(buz,HIGH);
delay(500);
digitalWrite(buz,LOW);
delay(500);
digitalWrite(buz,HIGH);
delay(500);
digitalWrite(buz,LOW);
delay(500);
digitalWrite(buz,HIGH);
delay(500);

    if(digitalRead(alc)==LOW)
{

    digitalWrite(mt,HIGH);
while( digitalRead(alc)==LOW )
{

    if(digitalRead(mag)==HIGH)
{ lcd.clear();
lcd.setCursor(0, 0);
lcd.print("BIKE GOT IN");
lcd.setCursor(0, 1);
lcd.print("ACCIDENT");
init_sms();
send_data(" YOUR BIKE GOT INTO THE ACCIDENT ");
send_sms();

    delay(5500);
}
```

```
    else
{

    }

    }

    }

    }

    }

    void init_sms()


    Serial.println("AT+CMGF=1");
delay(200);
Serial.println("AT+CMGS=\"+91XXXXXXXXXX\"");
delay(200);


    void send_data(String message)
 Serial.println(message);

delay(200);


    void send_sms()


    Serial.write(26);
```

Chapter 4

Working

- 9V Battery is connected to the helmet section. After successful connection LED on the helmet unit will turn on.
- Power adapter is used to power up the bike section. Whereas in case of its connection with bike it will be connected to the ignition switch in the bike which look like as image shown below.

ignition-switch-lock-1-500x500.jpg

Figure 4.1: Ignition Switch.

- Red colour led glowing on Alchohol sensor(MQ3) indicates that the sensor is active.
- If the helmet is buckled up and the Limt Switch is on then the RF Transmitter will start communicating with the RF Reciever.
- The signal is encoded by HT12E encoder in the helmet unit and decoded by HT12D decoder in the RF Receiver circuit.

IMG_20210617_140308604 - Copy.jpg

Figure 4.2: RF Receiver Section.

- In RF Receiver section 5th LED will turn on after recieving power (either by bike or power supply) whenever the helmet unit is in range of communication with bike unit.
- 1st LED will turn on or off if the limit switch is pressed or not.
- 2nd LED will turn on and off as per the signal from alchohol sensor.
- 3rd LED will turn on and off as per the 12V DC Motor relay circuit.
- 4th Led will turn on as per the GSM Module.
- Received signal is transferred to ATmega328 for processing.

IMG_20210617_140313983.jpg

Figure 4.3: Heart Of System.

- Atmega 328 IC is the heart and brain of this system. It manages all the other devices.
  - It manages relay circuit as per the signal received from helmet unit, and relay manages the 12V motor.
  - GSM Module is triggerred by the action of reed switches
- Current status of system will appear on LCD display.

▫IMG_20210617_140318107.jpg

Figure 4.4: Relay Circuit.

▫IMG_20210617_140708629.jpg

Figure 4.5: Helmet Unit.

4.1 Working Conditions

4.1.1 Pressence Of Alchohol

- When MQ3 sensor detects alchohol then a green LED in the MQ3 sensor glows up and it sends a signal to the HT12E encoder.

▫IMG_20210617_140538144.jpg

Figure 4.6: MQ3 Sensor.

- HT12E sends the encoded signal to RF transmitter.
- Then at bike end RF receiver recieves signal and send it to HT12D decoder.
- The decoded message is then fed to ATmega328 which acts on the message.
- ATmega328 sends a signal to relay circuit to stop the ignition and send on message to the buzzer unit.
- LCD display will show message that "ALCOHOL DETECTED".

Figure 4.7: Buzzer Circuit.

4.1.2 Rider Wearing Helmet Or Not?

- We are using limit switches to detect the pressence of helmet on rider.

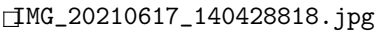


Figure 4.8: Limit Switch.

- Limit switch will be installed at the inner top of the helmet so that the switch will be pressed whenever rider wears the helmet.
- Helmet unit will function properly till the limit switch is pressed or we can simply say ON.
- Whenever rider remove the helmet limit switch will break the circuit and send signal to HT12E encoder which will transmit data to bike unit via RF receiver.
- In bike, signal fro RF receiver will be send to ATmega328 which will send signal to buzzer unit to alarm.
- If the rider still doesn't put up the helmet then the ignition will turn OFF

4.1.3 Rider Got Into An Accident

- For this purpose we have used Reed Switches
- When the bike will meet an accident then the glass tube of reed switch will break which will break the entire reed switch section circuit.
- When ATmega328 will realise about it then it will send signal to GSM Module to turn ON
- GSM Module will send a message that " YOUR BIKE GOT INTO THE ACCIDENT " to the emergency contact which is saved in the code in ATmega328.

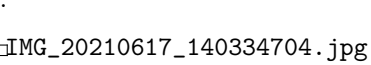


Figure 4.9: GSM Module.

- It will keep sending messages until the reed switch section turn on back or the balance of the sim in GSM Module expires.

Chapter 5

Conclusion

The designed Smart helmet ensures the safety of the rider by making it necessary to wear helmet, and also ensures that the rider hasn't consumed alcohol more than the permissible limit. If any of these prime safety rules are violated, the proposed system will prevent the biker from starting the bike. The system also helps in efficient handling of the aftermath of accidents by sending a SMS . This ensures that the victims get proper and prompt medical attention, if he/she met with an accident.

It is very useful as it has following benefits:

5.1 Driver Safety

Smart helmets have upgraded hardware. They mostly use EPS padding in the inner lining that is more shock-proof.

Smart software allows for SOS buttons, tracking riders, and sending automatic alerts to emergency contact during an accident.

5.2 Enhanced Driving Experience

- Enjoy the benefits of voice assistants while driving.
  - See the rearview video in the HUD display. Listen to audio alerts for turn-by-turn navigation.
  - Stay connected with multiple riders with smart helmets.
  - Experience a great music system in the helmets.

5.3 Protection Against Head Injuries

Hard hats type safety helmets are designed specifically to provide protection to the workers from injury penetration, electric injuries and strong head impacts, which can be caused because of flying or falling objects. These safety helmets also provide protection against fixed objects and electrical conductors that may lead to injury. You can easily buy such kind of safety helmets online at very affordable price.

5.4 Protection Against Slips And Fall

Wearing safety helmets while working in a liquid based FMCG or a chemical unit ensures that even if the work slips or falls accidentally the chances of causing a head injury will be minimal.

5.5 Increases Chances of Survival In Accidents

If a work unit faces accidental situations like rolling over of a truck or mishandling of any industrial equipment, in such scenario if workers is wearing safety helmet his chances of getting hurt will remain minimal.

5.6 Flying Objects

A motorcycle helmet shields the eyes and face from flying objects like rocks, gravel and twigs. It also protects the rider from insects.

5.7 Weather

A motorcycle helmet offers protection from the weather. For instance, it has a visor that cuts down the glare from the sun. It also keeps the face warm in frigid weather and keeps water out when it rains.

Chapter 6

Suggestions

Smart helmets have added features that can help riders drive safer, more efficiently and enhance their driving experience.

Smart helmets can include some or all of these features:

6.1 Bluetooth connectivity

- **Hands-free communication.** When you're riding a motorcycle, it's vital to keep your eyes on the road and your hands on the bars. The best motorcycle helmets with Bluetooth let you interact with electronic devices while staying focused on the riding experience.
- **Reduced distraction.** A Bluetooth-integrated motorcycle helmet makes using a smartphone, GPS navigation system, or other electronic devices safer than trying to manipulate these devices while you're in traffic.
- **Convenience.** Bluetooth technology is easy to use, and it doesn't consume a lot of power. You can listen to your favorite songs, answer phone calls, or converse with riding companions by simply hitting a switch.

6.2 WiFi Connectivity

- **Social connections:** Like the phone and other cutting-edge communication channels at the time, the Internet is invaluable for keeping the world connected. To be fair, you probably won't miss a whole lot without the Internet in your car, but having a consistent connection still pays off.
- **Remote work:** Without a doubt, the bulk of demand for WiFi on the road comes from people who work remotely.

6.3 Voice assistance

- Make a phone call
- Ask for direction
- Send a text
- Start playing music
- Ask about restaurants
- Start playing radio stations
- Control smart home devices

6.4 Make, Accept and Reject Calls

- If your phone has Bluetooth enabled on it, it will easily connect to any hands-free device. This means that you have the ability, at the very least, to talk on your mobile phone while driving. If your device has voice activation capabilities, modern day wonders make it possible for you to give commands to your phone via your Bluetooth hands-free device which allows for you to make, accept and reject calls

6.5 Connect with smart devices

- **Security:** Connected vehicles come equipped with several critical security features such as real-time location sharing/tracking, emergency SOS calls in case of an accident, roadside assistance in case of vehicle breakdown and much more. Apart from the onboard safety equipment, these smart safety features come in handy during tricky situations.
- **Vehicle to Vehicle Communication:** Vehicle-to-vehicle connectivity technology allows connected vehicles to communicate with each other. The V-2-V enables the sharing of vital information such as traffic movement, road conditions, speed limits and much more. V-2-V technology will be a critical part of autonomous vehicles, which are deemed as the future of mobility.
- **Hands-free communication.** When you're riding a motorcycle, it's vital to keep your eyes on the road and your hands on the bars. The best motorcycle helmets with Bluetooth let you interact with electronic devices while staying focused on the riding experience.
- **Social connections:** Like the phone and other cutting-edge communication channels at the time, the Internet is invaluable for keeping the world connected. To be fair, you probably won't miss a whole lot without the Internet in your car, but having a consistent connection still pays off.

6.6 Connect with other smart helmets and riders

- **Vehicle to Vehicle Communication:** Vehicle-to-vehicle connectivity technology allows connected vehicles to communicate with each other. The V-2-V enables the sharing of vital information such as traffic movement, road conditions, speed limits and much more. V-2-V technology will be a critical part of autonomous vehicles, which are deemed as the future of mobility.

6.7 FM radio

- A FM Radio system allows you to listen to your favorite music whilst you are driving.

6.8 Intercom

- Improved Communication
- Versatility

6.9 Heads-up Display

- Significant increase in the time the driver spends "eyes out"
- Simplifies the combined tasks of driving safely, monitoring the vehicle speed and performance and navigating to the destination
- Reduced driver fatigue in managing vehicle information while paying attention to the outside world
- Unique HUD capabilities enable the display of information coherent (conformal) with the outside world
- A HUD close to the driver's line of sight enables the intuitive display of enhanced features and dynamic real-time data

6.10 Emergency Buttons

- Emergency Buttons can alert appropriate authorities in the event of a suspected wrongful behavior on the part of the driver, or an accident causing fatalities. So passengers can rest assured for a safe and secure commute

6.11 Tracking systems

- **Improve Safety:** Not only will drivers be more responsible because they are aware of the monitoring, but fleet managers will know exactly where a vehicle is if it requires any assistance. Whether it's a broken down engine or any emergency situation, fleet managers can send roadside assistance to help their driver.
- **Minimize Fuel Costs:** No one can control the price of gas, but one of the best benefits of tracking systems is the ability to observe a vehicle's fuel consumption. The monitoring software will cut down on the amount of money spent on fuel by eliminating vehicle idling, driver speeding, any unauthorized usage, and gives fleet managers the ability to optimize driving routes.
- **Theft Recovery:** In the case of a vehicle theft, a tracking system is the best tool for any fleet company. Be notified with alerts and mapping data to help you identify whether the vehicle has been stolen and inform the authorities of its location to enable a quick recovery.
- **Lower Operational Costs:** Using tracking software allows fleet managers to see who is taking inefficient routes or using a vehicle for unauthorized purposes. Not only will it solve on the road issues, but it provides an accurate readout of the hours that drivers claim to have worked.
- **Increase Productivity:** Because of the ability to track drivers' hours worked, this also allows fleet managers to make better use of an employee's time. The tracking software shows exactly where your drivers are at all times and keeps record of what work they are doing at that time.

6.12 Cameras

- **Record Your Favourite Rides**

  Wearing a helmet camera is a great way to record your favourite motorbike rides. Upload the video to your computer or media player or create a youtube motorcycle channel even and you will be able to enjoy and share all of the excitement all over again. Watching the rides back from the comfort of your armchair will also allow you to appreciate some of the things that you might not have had chance to dwell on during the continued journey.

- **Improve your skills**

  Having the ability to review your riding when you are off of the bike can give you the opportunity to improve your skills. Re-watching your rides will allow you to see what you have done well and what you may be able to improve on. Picking up on problems when you are sat in the house will allow you to make a conscious effort to correct those problems once you are back in the saddle. It is also possible to show your videos to an instructor so that they can comment on anything else that you might have missed when re-watching.

- **Share Your Rides**

  Recording videos of your rides will also give you the opportunity to share your rides with other. Motorbike riding can be a solitary experience, because no other rider will have exactly the same experience as you, even if you are riding along the same stretch of road at the same time. Being able to share your rides with others can also help you to develop your role in the motorcycle riding community.

- **Lower Insurance Costs**

  Some insurance providers are prepared to offer motorcycle riders lower insurance premiums if they are prepared to record all of their rides with a helmet camera. A helmet camera should be able to provide evidence if the rider is involved in any incidents whilst they are out on the road. The evidence which is recorded by these cameras can be used to help to find out who was at fault for a crash or accident. The insurance provider can also provide your footage to the defendant's insurance provider if there are any disputes over who is responsible. In general, insurance providers also believe that people ride more safely when they are wearing helmet cameras for insurance purposes.

- **Protect Yourself**

  Wearing a helmet camera can help you to protect yourself from other drivers. Many car drivers do not give motorcycle riders enough space when they are on the roads and inattentive drivers can fail to spot bikers in their wing mirrors. However, bikers often get the blame for these incidents. Footage from a helmet camera can be used to protect you from these types of allegations and help to prove or disprove who was at fault in a personal injury claim.

  You can also submit your footage to the police if you are involved in any incident where another road user commits an offence and does not stop. Taking these users off of the road, even for a short amount of time can help to protect other motorcycle riders. Most helmet cameras also come with audio recording technology, so that you can get a record of any verbal altercations that occur whilst you are riding.

- **Deter Bad Behaviour**

  The simple presence of a visible helmet camera can help to deter some bad behaviour from other road users. When people see your camera they will realise that there is the possibility that their behaviour may be captured on camera. They will then modify their normal behaviour so that the footage will not end up showing them in a bad light. Riders with helmet cameras often find that other road users become less aggressive towards them.

6.13 Audio Alerts

- Improved focus (due to localization of sound)
- Ability to multitask (due to separation of sound)
- Better situational awareness
- Faster response and reaction times
- Less need to take eyes off road to view display prompts
- More intuitive reactions requiring less concentration
- Greater passenger awareness
- Enhanced input when visibility is limited
- Optimized sound placement for hearing impaired
- Enhanced audio experience and “cool-factor”

6.14 GPS Connectivity

- **Improved productivity and fewer calls to drivers**
  Whilst it’s important to be able to contact drivers about changes in pickups, deliveries and service calls, the frequent calls asking “Where are you now?” is highly distracting to the driver and is also a very inefficient use of the driver’s time and the time of your head office staff. Imagine the time wasted with a fleet of business vehicles.

  This greatly improves productivity, improves your profitability and reduces unnecessary phone calls to drivers.

- **Improved customer service with GPS vehicle tracking devices**
  Rather than giving customers approximate times, the main office can easily see exactly where the driver is now, and how far away from the customer they are. This makes it very easy for the business to inform customers about pickup, delivery or service arrival times down to 5 minutes accuracy, if required.

- **OH&S: health and safety of field staff and drivers**
  The whereabouts of your field staff especially during bad weather can be a real concern.

  Also too is not being able to reach a particular driver after a long period of time. By seeing their location on a map from the data from the GPS vehicle tracking device and how long their vehicle has been stationery can at least make it easier and more timely to respond to any potential safety issue for the driver.

- **Fast vehicle recovery**
  If the unfortunate happens and one of your fleet vehicles is stolen, knowing it's exact location using the GPS vehicle tracking device allows you (or the police) to recover your vehicle quickly thereby reducing vandalism and damage. Also, quick response to theft greatly increases the likelihood of the vehicle's recovery before it's stripped down.

- **Reduce insurance costs**
  Insurance companies know the benefits listed above in regards to fast vehicle recovery so most of them will give you a insurance premium discount. These savings can be significant.

- **Automatic theft / unauthorised use notification**
  If your vehicles are left at your work premises, yard, depot or some other frequent parking spot, you can receive instant, automatic notification by SMS text or email if your vehicle leaves that area. That way you quickly know if one of your staff have moved the vehicle without your permission or if it is being stolen.

- **Reduced administration paperwork and other productivity benefits**
  As GPS vehicle tracking devices send frequent 3-4 minute location logs, key on and key off information is very simple with the report function to know the kilometres travelled each day – effectively replacing paper-based log books

- **Maximise your business vehicle assets**
  Using such reporting functionality you can see if any vehicles are being over or under utilised and make better business decisions of the use of these assets. This is another efficiency boost for your business.

6.15 Better Hardware

- **Protection Against Head Injuries**

  Hard hats type safety helmets are designed specifically to provide protection to the workers from injury penetration, electric injuries and strong head impacts, which can be caused because of flying or falling objects. These safety helmets also provide protection against fixed objects and electrical conductors that may lead to injury. You can easily buy such kind of safety helmets online at very affordable price.

- **Protection Against Slips And Fall**

  Wearing safety helmets while working in a liquid based FMCG or a chemical unit ensures that even if the work slips or falls accidentally the chances of causing a head injury will be minimal.

- **Increases Chances of Survival In Accidents**

  If a work unit faces accidental situations like rolling over of a truck or mishandling of any industrial equipment, in such scenario if workers is wearing safety helmet his chances of getting hurt will remain minimal.

Published Research Paper 1

A Review on Smart Helmet

Gulshan Kumar Sharma, Raghav Kalra, Rishi Gaur, Roshni Kumari, Dr. Shikha Saxena
Department of Computer Science and Engineering
Krishna Engineering College, Mohan Nagar, Ghaziabad, Uttar Pradesh, India
{ gulshansharma011, raghavkalra3151, rishigaur12rg, sroshni24699, shikhasaxena83 }
@gmail.com

Abstract: Road accidents is one of biggest causes of deaths that exist in today's scenario. The major causes of it comprises of drunk driving, rash driving and not to follow the traffic rules. In this paper, through a newly built system named "A Smart Helmet", a solution to this problem has been suggested. The aim of this work is to suggest a user-friendly and low-cost protection system for the safety of the rider. Only when the rider is not- drunk and is wearing helmet, he will be able to ride his two-wheeler. The main purpose is to reduce the injuries happened to the rider during the accident and to provide immediate help and medical aid.

Keywords: Road accidents, drunk driving, safety, healthcare, 2-wheeler helmet unit, helmet, vehicle unit.

1. INTRODUCTION

Now, the road safety is the biggest cause of concern for the society. Drunk driving, rash driving and unwillingness to follow the traffic rules are the major causes of road accidents. A per the reports of the leading daily of September 2019, one death is being reported in every 4 minutes in India due to the road accidents. Not wearing the helmet is one of the major causes of two wheeler's road accidents. In 2018 approximately 43600 riders died in road accident due to not wearing of the helmets. Drunk driving is another major concern of road accident.

In the present era, the invention of safety and smart helmets has become so important. With the technological development and better and powerful engines, the safety of the rider is of the top most concern. For 2-wheelers, helmet is the most important accessory of safety. But still a lot needs to be done in this area to provide a safe and the most comfortable travel to the riders of the two-wheeler.

2. RELATED WORK

Researchers and engineers have proposed many designs for providing the safety system to the 2-wheeler riders. For the detection of a road accident, smart helmets with vibration sensors have been designed. But installation of the vibrating sensing devices in the internal area of the helmet is always not a good idea for detecting an accident as even the system can consider the accidental fall of the helmet to be an accident and unnecessarily send the notification.

Designing an accident alert system is very much required for providing immediate first-aid and medical help to the injured rider. Force sensing resistor FSR and BLDC Fan has been designed for detecting the riders head the motorcycle's speed respectively. When the helmets strap is buckled the two-wheeler gets started. While riding wearing a wrist watch is not suggested. In this paper, a system named "A Smart Helmet" has been suggested. It helps in the detection of the efficiency of the driver's sobriety and its presence. The system is well managed and is user friendly.

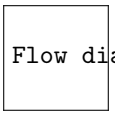
3. METHODOLOGY

"A Smart Helmet" has been made in order to save the rider. This Helmet is made in such a way that if any of the above 3 condition's is met, the Vehicle will not start. The only purpose for making this Helmet System is to save as many lives during road accidents.

- The following 3 conditions are:

  1. Helmet is must to be worn by the rider,
  2. Strap of the Helmet must be Buckled
  3. Rider must be sober

- All 3 conditions mentioned above are continuously monitored just to confirm, will the riding rules be followed or not.
- It comprises of smart accident detection system which helps in the detection of an accident.
- It automatically sends the message in case of an accident to the given contact.
- The System is easy to handle, user friendly and is very cheap.



Flow diagram of the proposed system.

After the rider put on the Helmet, only then the above 3 conditions are being checked. After their fulfilment, the Vehicle get start. After then, 3 parameters will gets monitored continuously. If any of the parameters are not met at any time, the Vehicle will get stop. All these functions are reached by dividing the System into 2 parts:

1. Helmet Unit
2. Vehicle Unit

Helmet and the Vehicle Units are connected with each other. Microcontroller is used for the system.

The Helmet Unit is kind of a transmitter circuit. It collects information required for the module to function from the number of sensors. The Vehicle Unit is dependent on the information received from the helmet. The functionality of the system is described below:

A. Helmet Unit

The Helmet Unit is made up of various sensors which collect the required information from the surrounding and then process it to the microcontroller for processing.

It is rechargeable and battery-powered. Rechargeable battery supplies power to the whole circuit. The battery level indicates the available power and it indicates the rider when empty. USB type charging port is used to charge the battery.

Proposed Design Of The Helmet Unit.

The buckle is used as a security measure for the head of the rider in order to protect him from any accident. It uses a Single Pole Double Throw switch to provide enough security to the rider.

Flow diagram demonstrating the working of helmet unit.

The Alcohol detector is a Gas Sensor for the detecting presence of alcohol (if any). An appropriate threshold value is set according to the laws of road safety.

The microcontroller section is where the microcontroller is placed. It is used for capturing the signals from the detectors. Data is processed and output is generated. This output is then sent to the vehicle unit for further functionality.

Then the analysis of combined outputs from all the subsystems and sensors is done. Depending on the three primary conditions which needs to be confirmed, the microcontroller then generates a Boolean value. That value is transmitted over to the Vehicle Unit.

i) Buckle System:

- A buckle strap which is seen hanging from the head of the helmet. In case of an accident, if the buckle is not in place, the helmet might come off the rider's head causing serious injuries to the rider.
- The buckle is kind of an automatic switch by which the transmission circuit in the helmet is turned on. This helps in saving power by keeping the transmission unit off, when it is not in use. It ensures that the vehicle's ignition is not on unless the strap is buckled. If the strap is not buckled, then there is no power to the transmission system.
- A Single Pole Double Throw switch is used for achieving this functionality. The buckle system is diagrammatically demonstrated in below:

A simple diagram demonstrating working of buckle system.

ii) Microcontroller System:

Once the user buckled up the strap then transmission circuit which includes the microcontroller, is powered on. Then firstly the wireless communication with the Vehicle Unit is established. It further captures signals from the detectors.

- a) Presence Detection: The presence detection system makes it clear that the vehicle is not going to start unless the rider is wearing the helmet. The system must be able to differentiate between a living and non-living object. The placement of the system is critical in order to eliminate any false alarms and to limit the sensor range. A PIR sensor used in this module actually generates a simple digital high or digital low value on detecting the human presence or not respectively. A buzzer, in the Vehicle Unit, buzzes a warning whenever the helmet is not worn by the rider.
- b) Alcohol Detection: Checking that the rider is sober or not is the third primary condition. The MQ-3 sensor is a gas sensor which checks for the alcohol content. When the rider's breath falls on it, it tries to detect the presence of the alcohol in it above the threshold value which is set beforehand. It gives a Boolean False output if no alcohol is being detected and a True value if the alcohol is detected.

The placement of alcohol sensor is important as the driver's breath should repeatedly fall on it for the detection purpose. If the rider is not drunk, the microcontroller receives a Boolean 1 from the alcohol sensor. Following this, the microcontroller then transmits a Boolean 0 value to the vehicle unit which stops the vehicle from starting. A buzzer blows again in order to signify non- sobriety of the driver.

The presence detection and sobriety detection are done simultaneously by the controller. If both the constrains are met, then Boolean 1 signal is sent to the Vehicle Unit in Boolean form from the controller in the Helmet Unit in order to start the vehicle.

Proposed design for the system to be installed on vehicle.

iii) Battery:

The system utilises a battery having max power requirement of Five Volt to start the transmission unit. The buckle works as a key between the power supply and the rest of the system. The transmission unit gathers to the point data and transmits it to the vehicle unit which performs the next suitable actions based on this data. The Vehicle Unit processes this data and takes suitable actions.

B. Vehicle Unit

The Vehicle Unit is a part of the 2-wheeler. It is remotely paired to the Helmet Unit and it can be placed anywhere on the vehicle by selecting a position which is less prone to the accidents. The Vehicle Unit manages the ignition system of the vehicle. It is connected to the ignition system as shown in the figure. Nearly all vehicles work on two-wire or four-wire ignition key switches and the "Smart Helmet" System is suitable with both.

The Vehicle Unit is powered with the battery of the vehicle unit as it is rechargeable. The microcontroller is attached to the battery for the transmission of the power. This microcontroller accepts the signals from the microcontroller in the Helmet Unit and then it further processes the accepted data. The microcontroller and the ignition key switch are attached to each other through a relay module (one channel five Volt relay module) which generally controls the ignition of the vehicle which is based on the values accepted from the controller.

The Alert system includes an accident detection and a messaging system which in case of critical situations and accidents gets provoked. In case of the event of any mishappening, the GSM unit is used to generate an emergency message and send it to the emergency contact of the rider.

The buzzer blows to indicate an action or an warn in case of absence detection and alcohol detection system.

Flow diagram demonstrating the working of vehicle unit.

Microcontroller System:

This sub-part manages the most important functions of the Vehicle Unit. The reception unit accepts a value from the transmission unit and it then chooses on the actions to be taken afterwards. If the value accepted is 1 in Boolean, it means that all primary 3 constrains are met. On accepting 1 value from the Helmet Unit, the controller switches on the relay and the power is permitted to flow through the ignition system and then the vehicle ignites. If a Boolean 0 value is accepted, it means that some constrains from the 3 primary constrains are not satisfied. So, the switch of the relay remains tuned off and the vehicle doesn't ignite. If at some point during the trip, the rider removes the helmet or some constrain goes to 0 then, the bike will automatically stop after giving a fair alert of 120 to 300 seconds. This is sufficient time for the driver for reaching a safer place and to stop the vehicle.

C. Communication Protocols

As discussed above, the Helmet and the Bike System communicate with each other remotely. Since both the Helmet and the Bike Systems are not more than five hundred centimetres aside, a short-range wireless communication protocol can be used.

Transceiver: R-F Transmitter on Helmet Unit sends Signals to R-F Receiver on Vehicle Unit. As soon as R-F Transmitter gets power supply from Batteries, it will send Signals to R-F Receiver and fifth led on R-F Receiver will be on and finally, a Connection will be set up in between Helmet and Vehicle Unit.

4. RESULTS AND DISCUSSION

A. Smart Helmet System

A good quality Helmet is used for this project. R-F Transmitter with Alcohol Detector System along with Batteries are fitted inside the Helmet.

"Smart Helmet" System.

B. Installation of Vehicle Unit on two-wheeler

GSM System along with R-F Receiver has been fitted on Bike's tank.

Vehicle unit installed in bike.

C. Presence and Alcohol detection in the system

The serial monito r's output is shown in Fig 9 shows that first the buckle system switches on the "Smart I met" System. Then, if the rider is wearing the helmet and he is sober, then the Hel met Unit detects. Depending on these values, it then sends a confirmation to the Vehicle Unit. This action is performed several times in a loop till the system is on .

Status of Serial monitor when rider wears the helmet.

The alcohol detection system determines the sobriety of the rider. When the helmet is worn, the alcohol sensor checks the breath of the individual. As shown in Fig 9, if the value received from the sensor is '0' then the ride is sober or vice versa.

D. Accident Detection System

When a vehicle met with an accident, a message is being sent to the given emergency contact.

E. Power System of Vehicle Unit

To control the Vehicle Unit, prototype a 9V rechargeable battery is used.

5. CONCLUSION

"A Smart Helmet" System can be considered as a magnificent system in order to bear safety to the drivers of the 2-wheelers. The system doesn't allow the driver to drive his/her bike without wearing his/her helmet. The driver can only drive his/her vehicle when he/she is not drunk and has strapped his/her helmet. The system is very user-friendly and easy to use.

As future implementation a system that uses power straight away from the vehicle or flexible solar panels can be used for well-planned usage of the power. A mobile sensor that doesn't allow the driver from using his/her phone while driving his/her vehicle can be used for secure travel. A camera can be mounted to record the emergencies and accidents when SOS key is pressed. On the event of failure of system of any kind, a back-up alternative in the form of a mobile application can be provided.

Pricing policies play the most exclusive role in the development of the item and makes business practice more stable and natural. Eventually, the Smart Helmet will put a figure around Rs.5500-6500/- including microcontrollers, sensors, transportation, and work cost. It can be further reduced by 40% with mass production.

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Sent Message to Given Emergency Contact.

Vehicle unit with rechargeable battery

Remarks

This research paper is published in IJARESM, February 2021 issue.

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- Arduino Software (IDE)
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- Microsoft Paint
  Steps To Open
  - Click on start → Go to search → Search Paint → Open it.
  - Click on start → Scroll down to "Windows Accessories" (In case of Windows older than Windows 10 first click on "All Programs" then scroll to "Accesssories") → Click on Paint.
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