International Journal of Research in Engineering and Science (IJRES)
ISSN (Online): 2320-9364, ISSN (Print): 2320-9356
www.ijres.org Volume 10 Issue 4 ǁ 2022 ǁ PP. 45-52

Smart and Secure Helmet

Ramesh M. Kagalkar1
[1]*Department of Computer Science and Engineering,*
KLE College of Engineering and Technology, Chikodi, Karnataka, India.

Abstract. *Life is becoming more fast and hazardous while driving. Moreover life is more valuable so, we need to have some automation techniques to secure life. In this paper we attempted to plan our thought in which the system that can recognize the person worn or not the helmet, spot accident place and immediate response, finding whether the person consumed liquor while riding, identify petroleum level of tank and predicting the crash or collision between the vehicles in order to avoid road side accidents. The interaction between bike and helmet part takes place wirelessly by making utilization of RF transmitter and receiver. RF transmitter is appended at helmet and receiver at bike.*

Keywords:*Wireless communication, Road side accidents, RF transmitter and receiver*

Date of Submission: 06-04-2022 Date of acceptance: 22-04-2022

I. Introduction

Road accidents are incredibly increasing day by day, and in countries like India where bikes are more in use due to low price when compared to other vehicles many people die due to carelessness by not wearing helmet. Even though there have been continuous awareness program from the government authorities regarding helmets and seat belts a majority of the riders not follow the rules.In order to put an end to accidents of bike we have planned to develop the smart helmet for bike, in which the helmet not allow rider to ride the bike without wearing helmet. This is the best way to make helmet is compulsory for bike riders. Other than this there are four more features alcohol detection, identifying accidents, petrol level indication, and obstacle detection to avoid the collision between the vehicles.

Common accident scenarios include:

- Drunk and driving: Nearly a third of all fatal bike accidents happen after riders have been drinking.
- Head-on collisions: More than 75% of all motorcycle crashes due to head on collision.
- Exciding speed of limit: Some 32% of motorcycle accidents that resulted in death involved speeding.
- Left turns: The road can turn into a danger zone when a car makes a left-hand turn. In 42% of all fatal car accidents, the other vehicle was turning left while the biker was either heading straight, passing or overtaking.
- Running into objects: In some cases accident happen without knowledge of rider due to objects or vehicles around bike.

II. Literature Survey

[1] Their aim is to provide a in time treatment to person by making use of ambulance. Many a times when the rider needs an ambulance that time ambulance may not be available and no one available at the time of accident it often causes deaths. So present system is prepared in such a way that it gives the notifications at the earliest so the any responsible person may take any required action for this Aurduino used ad micro-controller.[2] Authors's aim is to save the people when the rescue workers get harm in the disaster the Smart helmet respond to the current accident. Using TCP and UDP socket connection communication is made between Smart helmet and the device. It provides the disaster safety and secure helmet for the workers. In real time problems the Smart helmet is useful through which the other person can get the rescue worker location at the time of disaster event occur.[3] Author's aim at building a shield which ensures safety of the rider by implementing feature such as alcohol detection, accident identification, location tracking and fall detection.Force sensing resistor is used to sense the actual human touch, to ensure if the helmet is worn by the rider.Accelerometer ADXL345 is used to measure the static acceleration of gravity. This unit senses if the bike is falling. And bike will take decision that accident has occurred or not.

[4] Their aim is to give solution to help a rider in need, after the rider has met with an accident.Raspberry Pi zero it supports multiple os such as linux based, Raspbian OS, Windows 10 IoT cosre, Google's Android Things, etc. Pressure sensor it measures the pressure with which object falls. MCP 3008 IC it

is a 10-bit analog to digital converter. Google's Firebase Cloud messaging is a crossplatform solution for messages and notifications for Android, iOS and web applications, which is free of cost. E Android is a mobile operating system designed for smart phones.[5] Author's aim is to build protective helmet for miners. The system is used by the miners and this safety helmet is used for detecting the health of the person and also it provides the same information to the central office outside the mines. Helmet consists of the wireless sensor devices which consists of the force sensor and that sensor detects the dangerous load experienced by the miners on his head if that was heavy load then the wireless sensors inform about the danger to the center with the help of the room manager. After knowing the information center can help miners by sending team. The model can be consists of the miners, Room manager and center. The center is connected to the GUI which helps to send/ Receive message from room manager. The sensor node will implement routing protocol in which route is calculated based on distance vectors using the Bellman ford algorithm.

[6] Their aim is to reminding the riders about wearing the helmet properly and also informs about the speeding over speed limit and also detecting the locked buckle of the vehicle. The model consists of the two modules which are mounted on the side of the helmet and also on the motorcycle dashboard. These module are controlled by the Arduino and nRF24L01+ is used for communication between the modules. The response time is calculated on four smart helmet functions which are the helmet usage, helmet strap locking system, speed detection, and shock detection. [7] Author's aim at building safety helmet and wearing detection by detecting a single shot multi-box detector (SSD) using deep learning.In this dataset, image, SSD, detection result, label, feature and safety-helmet precise detecting are used.Here experiments are conducted by using own dataset. Overall testing set contains 1,076 images, validation set contains 1,258 images and training set is divided and contains 2,895 images, then final dataset contains 5,229 images.

[8] Their aim is to propose fall detecting using barometric pressure sensor and whoes accuracy is high. Another goal is implementing IOT app where the person can speak and helps to monitor old age people from anywhere. [9] Author's aim at Microcontroller Arduino NANO this is used to calculate the 'tilt' of the helmet while riding the motorbike. Flex Sensor is used which is a strip attached to the interior of helmet, which bends upon wearing a helmet, to detect if the helmet is worn. Impact sensor detects the vibration when the helmet falls on the ground and the impact is sensed by the impact Sensor.[10] Their aim is to build a model that gives the safety like car for example characters like built-in black box and GSM system, so in emergency time you can find the rider's location easily. The collision sensor is used either the rider met with an accident or drunken driving it will give the alert notification. Here tools used are Aurduino Uno, GSM modem. Considerably the system decreases the death rate and in emergency time the near by hospitals get the alert messages and even ambulances.

III. System Design

3.1. Block Diagram

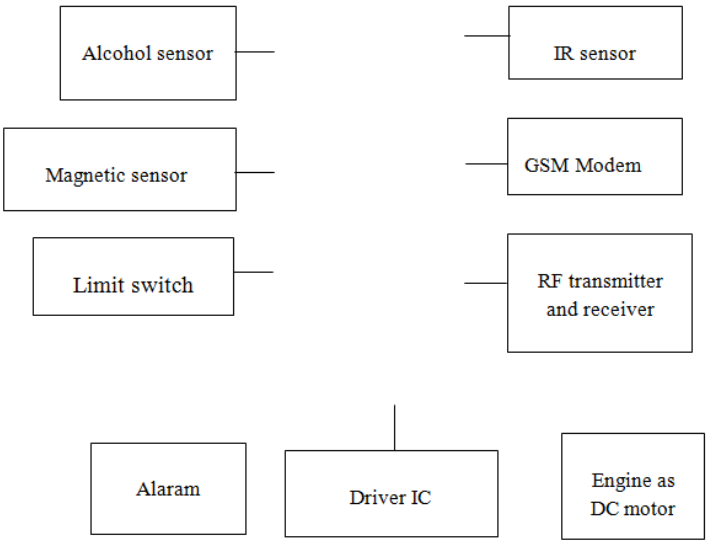


Fig. 1. Block diagram of proposed system

The Fig. 1. represents five modules present in this proposed system. These modules are used for the total functioning of the intelligent helmet system. ATmega328 microcontroller is used and sensors here give the input in form of analog signals. Analog to Digital conversion takes place then the digital output from the ADC

is given as an input to the ATmega328 microcontroller. ATmega16 Microcontroller is an 8bit high performance microcontroller from the Atmel's Mega AVR family.ATmega16 Microcontroller is a 40 pin based on enhanced RISC architecture with 131 powerful instructions.It has 16KB programmable flash memory, static RAM of 1KB and EEPROM of 512 Bytes.The microcontroller is connected to the LCD display where output is shown in text format. To control the power supply in the input part relay and relay drivers are used. For wireless communication between bike and helmet part RF transmitter and receiver is used. Sensor used is MQ3, Magnetic, and IR sensor.Fig. 2 shows sytem setup of our proposed system.

Fig. 2. System setup of proposed system

2.2 Flow Chart

The Fig. 3 represents what all are the functions and how the decision is made. Input to our project is helmet and processing starts from this part. When the helmet is worn then helmet is detected if yes bike starts else bike won't starts. Same way if alcohol is detected if yes then bike stops else bike will be in running state.
In accident detection system continuous monitoring of accident is there at the time accident detected if yes message is quickly sent to pre – defined number else bike is in running state. Petrol level is monitored if low petrol bike stops. And if any obstacle is detected message is displayed on LCD. This process of execution is represented in the form of flow chart.

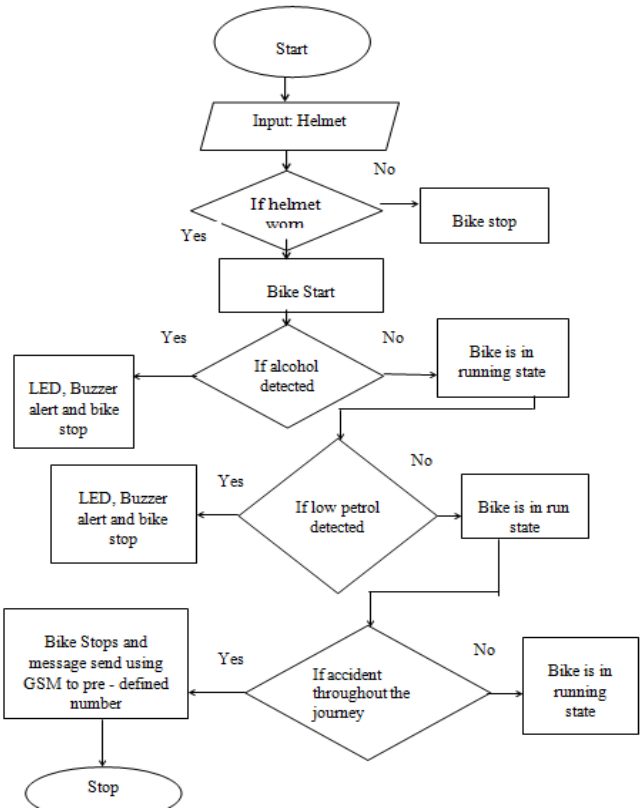


Fig. 3. Flow chart

3. Implementation

There are totally five modules in our project and microcontroller used in our system is ATmega328 which has 28 pins and each pin description is as shown in Fig. 4. All sensors we used in implementation is connected to input pin of microcontroller.

By taking input from different types of sensors the microcontroller will produce output. To set some condition and requirement data we developed code in Embedded C language which will be dumped on to the ATmega328 microcontroller. Arduino software is used in order to execute our Embedded C code.

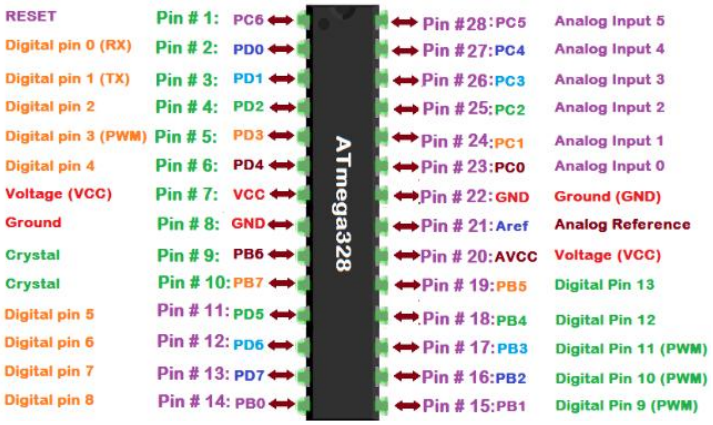


Fig. 4. Pin diagram of ATmega328 microcontroller.

3.1. Helmet detection module

As shown in Fig. 5. push limit switch is used in order to detect the helmet is worn or not. The push switch is attached in such a way that when person wear the helmet the push switch is pressed at that time RF transmitter send signal that analog signal is converted to digital by ADC after that binary 1 is generated that is transmit to bike part where in RF receiver receives after that bike is going to start. And if RF receiver of bike part receives binary 0 then bike will not start.

Fig. 5. Push switch

3.2. Alcohol Detection Module

Alcohol detection is done by the MQ3 gas sensor which senses the alcohol fumes from the breath of the person. So, if alcohol is detected then immediately bike stops there is no chance of riding bike by consuming alcohol. MQ3 gas sensor is as shown in Fig. 6. MQ3 is sensor which senses the gases produced by alcohol. And the ADC conversion takes place.

Fig. 6. MQ3 Sensor

3.3. Accident Detection System

Magnetic sensor will helps to detect the accident and GSM modem will immediately send the SMS to the predefined numbers. By this we can provide proper facility to the person who got in to an accident. GSM modem is as shown in Fig. 7. when a person got into an accident at that time helmet send the signal to bike part

and then GSM receives signal to send the message to pre – defined number to give a in time treatment to injured person.

Fig. 7. GSM Modem

3.4. Petrol Level Detection Module

In this module it helps the rider to know about petrol level of bike by indication. And the levels are low level, middle level, full level and over full level. If petrol tank has less petrol level then indication is made by buzzer and display message on LCD.

3.5. Obstacle Detection Module

Collision of vehicle also leads to accidents to avoid that IR sensor is used at backside of bike in order to detect obstacles at back side. So, here sensor will detect obstacle and alert is given by the buzzer sound and message on LCD display. IR sensor is as shown in Fig. 8.

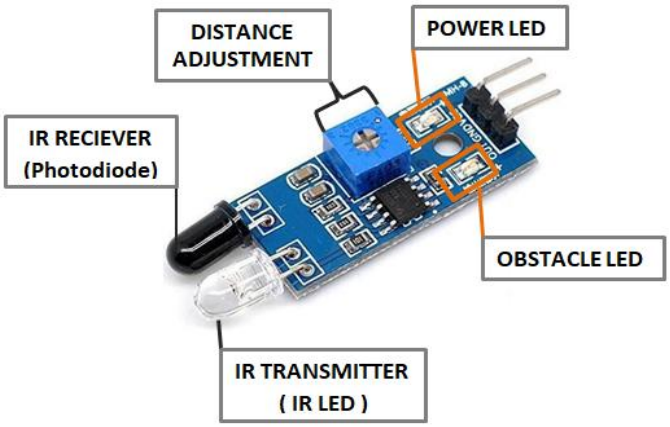


Fig. 8. IR sensor

IV. System Execution and results

Execution is done to check whether the system is working or not. And we performed following testing.

4.1 Unit Testing

In this testing each unit is tested to check the performance and efficiency of the unit. Unit testing description is in Table 1.

Table1. Unit testing in detail.

Module Name	**Sample Input**	**Expected Output**	**Actual Output**	**Remark**
Helmet detection	Helmet	When push switch is On bike should start else bike should stop	It runs as expected	Pass
Alcohol detection	Alcohol	When alcohol fumes detected bike should stop	It runs as expected	Pass
Accident detection	Vibration	GSM modem sends a message to pre – defined number	It runs as expected	Pass
Obstacle detection	Obstacle	When obstacle is found alert is given by buzzer.	It runs as expected	Pass
Petrol level detection	Petrol	When there is low petrol in tank it should give a alert.	It runs as expected	Pass

4.2 System Testing

Testing has been done to check each unit is working in integrated environment or not. All units are integrated and system testing is done as shown in below Table 2.

Table 2. System testing

Test Case	**System Test**
Name of the test	Run whole system
Sample input	Helmet switch, magnetic sensor, alcohol sensor
Expected output	All the test cases should run successfully
Actual output	System runs as expected
Remark	Pass

4.2 System Testing

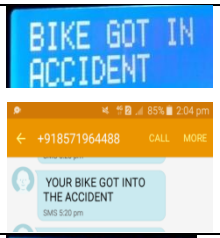
Testing has been done to check each unit is working in integrated environment or not. All units are integrated and system testing is done as shown in below Table 2.

Table 2. System testing

Test Case	**System Test**
Name of the test	Run whole system
Sample input	Helmet switch, magnetic sensor, alcohol sensor
Expected output	All the test cases should run successfully
Actual output	System runs as expected
Remark	Pass

V. Results and discussion

The Table 3 shows the objectives, expected output and output of our project in which detail description of output part is described. And after testing we got result as expected. It includes all five module output and by the result we reached project objective successfully and we plotted graph to represent the response time of each module execution.

Objective	**Expected output**	**Output of our Project**
Without wearing helmet bike will not start.	If a person tries to start bike without wearing helmet then bike won't start. LCD should display: PLEASE PUT A HELMET**:** When a person start bike without wearing helmet.. NO HELMET:When person remove helmet from head.	
Alcohol fumes to be detected from breath of the person.	When a person is riding bike at that time if alcohol fumes are detected from breath of the person then LCD should display "ALCOHOL DETECTED" and bike automatically have to stop.	
Accident detection and response message.	Accident is found quickly and message to be sent to pre - defined number and on LCD "BIKE GOT INTO ACCIDENT" to be displayed.	
Petrol level detection	Continuously system should monitor petroleum level in fuel tank LCD displays FULL, MIDDLE and LOW level. At the time of low level petrol bike should stop automatically.	
Obstacle to be detected to avoid collision.	After detecting obstacle at the back side LCD should display "OBSTACLE IS DETECTED AT THE BACK".	

VI. Conclusion

The research over this idea fetches us the knowledge, that this technique is yet play the vital role in Society. We have proposed an effective Smart and Secure Helmet system which is based on wireless technology this is achieved through RF transmitter and receiver. There are five modules and those are to be considered as feature of our project. We made use of ATmega328 microcontroller.The experimental testing is done by taking average response time after multiple execution of each module and graph is plotted. System will respond within few milliseconds. These advantages demonstrate that Smart and Secure Helmet is very use full and efficient application for socity.

References

[1]. Prashant Ahuja, Prof. Ketan Bhavsar: Microcontroller based Smart Helmet using GSM & GPRS. In: 2nd IEEE International Conference on Trends in Electronics and Informatics. IEEE Press, Year: 2018.

[2]. Mingi Jeong, Hyesun Lee, Myungnam Bae, Dong-Beom Shin, Sun-Hwa Lim, Kang Bok Lee: Development and Application of the Smart Helmet for Disaster and Safety. IEEE Press, Year: 2018.

[3]. Sayan Tapadar, Shinjini Ray, Arnab Kumar Saha, Robin Karlose, Dr.HimadriNathSaha: Accident and Alcohol Detection in Bluetooth enabled Smart Helmets for Motorbikes. IEEE Press, Year:2018.

[4]. Joyendra Roy Biswas, Shubham Kachroo, Parth Chopra, Shubham Sharma: Development of an App Enabled Smart Helmet for Real Time Detection and Reporting of Accidents. IEEE Press, Year:2018.

[5]. Rohith Revindran, Hansini Vijayaraghavan, Mei-Yuan Huang: Smart Helmets for Safety in Mining Industry. IEEE Press, Year:2018.

[6]. Agung Rahmat Budiman, Dodi Wisaksono Sudiharto, Tri Brotoharsono: The Prototype of Smart Helmet with Safety Riding Notification for Motorcycle Rider. In: 3rd IEEE International Conference on Information Technology, Information Systems and

Electrical Engineering. IEEE Press, Indonesia(2018).
[7]. Xitian Long, Wenpeng Cui, Zhe Zheng: Safety Helmet Wearing Detection Based On Deep Learning. In: 3rdIEEE InformationTechnology,Networking,Electronic and Automation Control Conference. IEEE Press, Year:2019.
[8]. Pradheep T Rajan.B, Mounika.M, Nivetha.S, Olive Sherine.J: SMART HELMET BASED ON IOT FOR ACCIDENT DETECTION AND NOTIFICATION. International Journal of Emerging Technology and Innovative Engineering, Volume: 5, Issue:9, Year: 2019.
[9]. Keesari Shravya, Yamini Mandapati, Donuru Keerthi, Ranjan K. Senapati: Smart helmet for safe driving. E 3S Web of Conferences, Year: 2019.
[10]. Prof. Shikha Gupta, Kashish Sharma, Nihar Salvekar, Akshay Gajra: Implementation of Alcohol and Collision Sensors in a Smart Helmet. In: IEEE International Conference on Nascent Technologies in Engineering. IEEE Press, Year: 2019.