An Intelligent helmet system using IoT and Raspberry Pi

N. L. Aravinda¹, Mohammad Jabirullah², DubasiKirtana³
¹,²Department of ECE, CMR Engineering College, Hyderabad, India
³Department of ECE, St. Martin’s Engineering College, Secunderabad, India
¹aravindanl@gmail.com, ²jabir.ullah@gmail.com, ³dubasikirtana@gmail.com

Abstract. If a motorcyclist is involved in a high-speed collision without wearing a helmet, the force is extremely severe and can lead to death. Wearing a seat belt can reduce the accident impact and can save a life. There are several countries that impose a law requiring the operator of the motorcycle to wear a helmet while riding on their bike, an example is Malaysia. This paper is all about providing a solution to the bikers by connecting helmet and ignition switch electronically. The helmet is equipped with a sensor which can sense whether the person is with helmet or not. The helmet and bike relate to a wireless system, whenever the rider removes the helmet a signal is send to the receives at the bike ignition and is switched OFF and it is vice versa.

1. Introduction

Wearing a helmet is must for everybody during the bike or tow-wheeler riding. Generally, accidents are the most cases where the people led to premature death due to head injuries since the difficulty, sensitiveness and complicated structure of human brain. As we can see that government has mandate everyone to wear a helmet in recent days, but most of the rural areas still not considering this as a serious issue since there are no such strict rules and regulations assumed in urban cities. Hence, this paper introduced an intelligent helmet system with incorporation of ignition circuit with the helmet where the bike will start in presence of both helmet and a key, which in results mitigates the cause of head injury in case of any accident occurs. Current scenario disclosed that most of the people died in accidents were happened with two-wheeler vehicles like bike and scooter etc. Therefore, it is required to provide some safety for a rider to reduce the major head injurie in accidental cases.

2. RELATED WORK

Author in [4] addressed a smart helmet system using Bluetooth. Additionally, detection of accidents and consumption of alcohol also implemented with usage of several sensors like impact, accelerometer, flex and breath analyser. In [5], authors described an innovative approach named smart helmet for another application like traffic control scenario. Author in [6] addressed the usage and significance of helmet and assist people to lead them safe. They utilized RF-based helmet detection approach, which comprises of both transmitter and receiver modules. Das et al. presents a novel and intelligent helmet that assures the bike will get start if the rider wears a helmet [7]. When the rider wears the helmet then it triggers the switch of ignition circuit. The bike starts only if there is both key and helmet with the rider. In [8], Gudavalli et al. proposed couple of safety systems for bike riders where the first one includes security engine system which consists of RFID reader and tags. The latter is safety engine system, which enables the bike on or off state when the rider wears helmet. The system
uses the Android Application for control of appliances and therefore the system is more adaptable and cost-effective and also providing ubiquitous access for appliance control[9].

3. PROPOSED SYSTEM

A low cost and reliable RF transponder that consists of a transmission and reception is used in this suggested framework. The sender is put in the helmet and the detector is positioned in the car so that a signal is received as the rescue vehicle reaches the transmitter’s range. A microcontroller is coded in the suggested model for both transmitting and being part and collection. The part of the transmitter is placed in the helmet and the transmitting part is placed in the car, so interaction occurs only as the part of the transmitter lands inside the range. It has already been reported that the design is split into two units, such as the helmet and the motorcycle.

![Proposed block diagram of intelligent helmet system (a) vehicle unit. (b) helmet unit.](image.jpg)

The force sensing resistor in the helmet unit, also known as the transmitter unit shown in Figure 1 (a), is mounted underneath the upper portion of the helmet where the head meets the top of the detector. And the alcohol sensor is positioned in front of the mouth of the rider so that it can quickly detect it. In direct sunshine, solar sensors are manufactured on the upper side of the helmet. And inside the helmet, the battery and standard circuits were fixed. Within the helmet, the secondary controller and RF transmitter circuit were also located. There is an antenna on the outside of the helmet. The first step of
the project is to initialise the entire port and the next step is to use the accelerometer to track incidents. If no mistake happens, so the third move will be taken. The third stage is to constantly listen to the RF module for details and interpret information using conditions. Phase 4 is to verify whether or not wear environment helmet. If you do not wear a helmet, the word 'Please wear a helmet' will be shown. The next step is to check the drunk state, show the message "You are drunk" if the rider is drunk, and then send the message to the encryption technology with the location and ask for a password. If the password is correct, then the bike begins. If the accident is found in the sixth phase, everything will be halted and a position message will be received. The helmet is equipped with a single RF Tx module that can be activated by a small switch. Whenever the signal is sent. In the signals, the RF Rx module receives the Tx signal and turns the car on.

4. HARDWARE DESCRIPTION

4.1. Liquid Crystal Display

LCD technology operates by suppressing light on the fluid crystal display. It is composed, in fact, of two polarised glass pieces containing within them a fluid crystal substance. The light that goes over the first substrate is created by a backlight. It's for the sake of show.

![LCD display](image)

**Figure 2.** LCD display

4.2. Raspberry Pi

It is an ultra-cheap minicomputer with 5.5 cm width and 9 cm length. It consists of a component named System on Chip (SoC) which comprises of single core CPU with a supportive processor for computing floating points, GPU and RAM with 512 MB size (SD-RAM). Moreover, it consumes less power, which is just around 5-7 watts. The architecture of raspberry pi is given in figure 6. It has couple of cache memory levels, where first level is of 32KB size and the latter is of 128KB size. These are utilized to store recent programs and ALU is utilized to execute instructions.
Figure 3. System architecture of raspberry pi

| Chip       | Broadcom BCM2835 SoC |
|------------|----------------------|
| Core architecture | ARM 11              |
| CPU        | 700 MHz Low power ARM1176JZFS |
| RAM        | 512 MB (SD-RAM)     |
| OS         | Linux               |
| Dimensions| 85.6 × 53.98 × 17 mm |
| Power      | Micro USB socket, 5 V, 1.2 A |

Table 1. Specifications of Raspberry pi

It is a very small device and can incorporate other devices also. It consists of both the hardware and software. It requires an SD card and a power supply to related mouse and keyboard. Additionally, a display also exists for functioning OS such as Windows and Linux.

Figure 4. Raspberry pi
4.3. RF Module

The RF module functions on Radio Frequency, as the name means. The frequency range for this ranges from 30 kHz to 300 GHz. The digital data are seen as differences in the amplitude of the carrier wave in this RF system. The Amplitude Shift Keying (ASK) is called this form of modulation.

4.4. Motor Driver

The L298N driver module is used to drive the motors. The L298N has a 15-pin multiwatt and PowerSO20 powered monolithic circuit. The TTL Logic Level Sand Drive basic, high-powered, full-scale dual driver is unlocked to accept inductive loads of standard TTL sands such as relays. The system may be triggered or disabled by two enabled inputs separately from the input signals. An additional input is required to allow the logic to run at dropout wattage.

4.5. DC motor

The DC engine is a rotary machine class that turns direct control into mechanical energy. The most popular types of magnetic fields are dependent on the forces generated. Most forms of DC motors have an internal function for regularly altering the direction of current of portion of the motor, either electromechanical or electrical. DC motors were used in a broad way as the first motor method to be operated by existing lighting delivery systems. A variable supply voltage or adjusting the strength of the current in its field windings will regulate the DC motor speed over a diverse variety. In tools, toys and appliances, small DC engines are used. The Universal Motor is a lightweight brush motor for handheld tools and equipment that can be used on direct current. In the drive of electric cars, lifts and aircraft, and in drives of steel rolling mills, massive DC motors are currently used. In many systems, the invention of power electronics has made it easier to substitute DC motors with Ac engines.

5. EXPERIMENTAL RESULTS

Hardware circuit of proposed intelligent helmet system is disclosed in figure 5, where initially rider didn’t wear the helmet which is displayed in LCD screen that no helmet exists hence ignition is in OFF condition. Figure 6 shown that ON condition of ignition when the helmet exists as we can see in the LCD screen. In this way, our proposed system provides a safety to the rider with ignition OFF when he doesn’t wear a helmet.

Figure 5. Hardware circuitry of proposed intelligent helmet system.
6. Conclusion

This article proposed an intelligent helmet system to enable a safety journey by interfacing the helmet with ignition circuit which ensure that the bike will get start in case of having helmet only. This is very useful and can reduce the head injury during any accident. Further, this is very simple and easy in cheaper cost.

7. References

[1] "Internet of things (IoT) - arm", arm.com, 2017. Available: https://www.arm.com/markets/internet-of-things
[2] Vijay savania, Hardikagravata, and dhrumilpatela, “alcohol detection and accident bar of the vehicle”.
[3] Alcohol Laws Of Asian Country - Wikipedia Available: Https://En.Wikipedia.Org/Wiki/Alcohol_Laws_Of_India, 2017.
[4] S. Tapadar et al., “Accident and Alcohol Detection in Bluetooth enabled Smart Helmets for Motorbikes”, 8th Annual Computing and Communication Workshop and Conference, IEEE, Los Vegas, NV, USA, 2018.
[5] S.Chandran, S.ChandrasekarandN. E. Elizabeth, “Konnect: An Internet of Things (IoT) based Smart Helmet for Accident Detection and Notification”, IEEE Annual India Conference, Bangalore, India, 2016.
[6] G. Sasikala et al., “Safeguarding of Motorcyclists Through Helmet Recognition”, International Conference on Smart Technologies and Management for Computing, Communication, Controls, Energy and Materials, Chennai, India, pp. 609-612, 2015.
[7] A. Das, S.Goswami and P. Das,”Design and implementation of intelligent helmet to prevent bike accidents in India”, Annual IEEE India Conference, New Delhi, India, 2015.
[8] D. K. P.Gudavati, B.S. Rani and C.V.Sagar,”Helmet Operated Smart E-Bike”, International Conference on Techniques in Control Optimization and Signal Processing, IEEE, Srivilliputhur, India, 2017.
[9] Amudha, S., Snehalatha, N. and ShinyAngel, T.S., 2016. SMS Controlled Smart Home System in IOT. International Journal of MC Square Scientific Research, 8(1), pp.1-8.
Sujath, R., Chatterjee, J. M., &Hassanien, A. E. (2020). A machine learning forecasting model for COVID-19 pandemic in India. Stochastic Environmental Research and Risk Assessment, 1.
[10] Sujatha, R., & Ezhilmaran, D. (2016). A new efficient SIF-based FCIL (SIF–FCIL) mining algorithm in predicting the crime locations. Journal of Experimental & Theoretical Artificial Intelligence, 28(3), 561-579.