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Implementation of Smart Helmet Based on IOT

Pooja Aher[1], Lokesh Nagpure[2], Samiksha Darode[3], Shreya Bagde[4], Shruti Kalbagwar[5]
Computer science and engineering, Rashtrasant Tukadoji Maharaj Nagpur University

***Abstract:** Nowadays accidents are increasing, hence many rules and regulations are proposed by the government to reduce the accident rate. Accidents are unplanned events that result in injury as well as sometimes accident leads to death also. Reasons for these accidents are the rider is not wearing a helmet as well as riding and being drunk. In this paper, an effective technology of Smart Helmet using the Internet of Things (IoT) is being introduced which helps to reduce these problems. One MQ-3 gas Sensor is used which can detect whether the bike rider is alcoholic or not. If the bike rider is alcoholic, then the MQ-3 sensor detects it and the system goes off. The bike rider's engine will start only when the rider is wearing a helmet. A helmet is a form of protective gear worn to keep safe the head from injuries. A smart helmet can detect the accident's locations and send text messages to family members by using GPS and a GSM module. This survey is related to smart helmets to avoid accidents. Smart helmet system helps to provide safety and security to two-wheeler riders.*

***Keywords:** Sensors, Smart helmet, Internet of Things (IoT), Prevention, GPS and GSM technology, Accident Detection, Bike Rider's Safety.*

I. INTRODUCTION

Due to this huge amount of population, road accidents have become a huge concern in everyday life. With the increasing population, technology is also becoming advanced which leads to an increase in the number of motorcycles on roads and streets. The helmet is termed as one of the most essential aspects so a bike rider must wear a helmet to avoid road accidents. IoT-based Smart Helmet ensures safety for the driver's head from the deadly impact caused by accident and provides a guarantee to driver for their safety. Smart helmet provides reliability. It consists of two sub-systems that aim to build and ensure a safe and cost-effective system to prevent alcoholic people from riding vehicles. This project consists of sensors, modules, and microcontrollers. The helmet is completely portable, battery-based, and lightweight. This smart helmet system is connected to one more system via an RF link (wireless) which is used to control the ignition of the vehicle. The primary function of this Smart helmet system is that it helps in detecting unplanned events such as accidents as well as collisions. If it detects an accident it will send alert notification/SMS to a person (family member, friend, etc.). After detecting an accident it turns off the ignition system of the vehicle. It also notifies about the event's location (accident/collision location). For sending alert notifications i.e. SMS, this helmet system requires a sim card. This sim card can be inserted into a sim slot/socket in the helmet system. The notification SMS consists of a URL to the location of the accident. Hence one can open it in google maps and track that location. For location tracking/identification this helmet consists of a GPS module which enables this smart helmet to track the live location of the driver at a frequency of up to 2Hz. It consists of an accelerometer sensor to detect accidents or sudden collision events that give continuous 3D coordinates data of acceleration to detect sudden collisions, falls, side-falls, etc. The helmet is connected to the ignition system wirelessly. Being Wireless, it will automatically control the ignition of the vehicle. The subordinate function of this smart helmet is that it helps to detect alcohol levels to control the ignition of the vehicle. It helps to reduce the risk of accidents as it is directly controlling the ignition of the vehicle. In case alcohol consumption is detected, the vehicle turns off the ignition system of the vehicle. MQ-3 Sensor is used in Smart Helmet to detect alcohol consumption. Once enough amount of alcohol gas is getting detected the smart helmet system sends data to the wirelessly connected vehicle ignition control system. Then it turn-off the ignition of the vehicle. The complete smart helmet and ignition control system is based on an 8-bit low-power, low-cost 8051/52/MCS51/52-based microcontroller (AT89C51/52 from Atmel). This microcontroller is programmed in Embedded-C with lightweight firmware, performance-efficient drivers, and algorithms.

II. LITERATURE REVIEW

In this survey, various smart helmets with various approaches and methodologies are given:

Kimaya Bholaram Street. al proposed a system that consists of a helmet module and a bike module. It consists of IR sensors, an MQS alcohol sensor, a vibration sensor, a GSM module, a GPS module, Arduino, Intercom system.

The workflow of the system is as follows when the bike starts if the rider has consumed the alcohol and if it is greater than the threshold then the bike won't start else the bike will start and if the vibration sensor limit is greater than the threshold message is sent to the registered number about the accident. This system is cost-effective and provides better security to the biker.

Jesudoos A et. al proposed a mechanism, where sensors such as IR sensors, vibration sensors, and gas sensors, mems are used. The gas sensor is used to detect the amount of liquor he had consumed by checking the breath of a person wearing the helmet. The bar control of the vehicle is handled by MEMS. The accident is detected by a vibration sensor. The load of the vehicle is recognized by the load checker. The Sensors are interfaced with the PIC microcontroller. The gas sensor will detect if a user consumed alcohol and display it on the LED display. If an accident occurs the vibration sensor, senses the accident and sends information through GPS to the hospital. If there is any rash driving done by the rider the MEME sensor detects the amount of the person from his bank account. To check whether the rider is wearing the helmet or not IR sensor is used. In this system exactness and accuracy are high and the ambulance is booked automatically based on ten locations.

S.R.Kurkute, N.R.Ahirrao, R.G.Ankad, V.B Khatal "IOT based smart system for the Helmet detection" SUSCOM-2019. KabilanM,Monish S, DrS.Siamala Devi "Accident detection system based on IOT-Smart Helmet" IJARIIT 2019 S.R.Kurkuteet.al proposed a system consisting Raspberry Pi module, a Pi camera, pressured sensor, inbuilt wifi, and a GPS. Image processing algorithms are used to capture the face of the biker. It can be applied in real-time and it is cost-efficient and effective and also used in any type of vehicle.

Kabilan M et. al proposed a system using vibration sensors. When the rider wears the helmet consisting of a vibrator sensor with a frequency if the frequency crosses the threshold, the message is sent to the emergency responses using the GPS module. This system helps to detect and report accidents and can save the life.

Dr. D. Vivekananda Reddy et.al proposed a system consisting of two sections i.e a helmet section and a bike section. In the helmet section, there is an alcohol gas sensor to check if a person is drunk and it also contains an IR sensor, Alcohol sensor, and LCD to display the information. In the Bike section, there is a vibration sensor that senses the accident and sends the information using the GSM network and GPS module.

III. METHODOLOGY

The IoT-based Smart Helmet is a microcontroller-based electronic system that is embedded inside a normal helmet which makes it smart and intelligent. This IoT-enabled Smart Helmet consists of two separate systems which are used to perform specific/dedicated work intelligently without any human intervention. These systems are based on a base-line 8-bit low-cost, low-power, MCS51/52 core based 8051/52 microcontroller (AT89C51/52). Apart from microcontrollers these systems also consist of various I/O devices, sensors, and electronic passive/active components. There are two circuits designed one is for IoT-enabled Smart Helmet and another one is for Vehicle Ignition Control System. It consists of various I/O devices and passive/active electronic/electrical components such as Integrated Circuits (ICs), BJT Transistors, Quartz Crystal, Resistors, Capacitors [Ceramic and Electrolytic], Diodes, LEDs, Buzzer, Connectors, etc. The microcontroller used in this system is AT89C51/52 which is an 8051/52 core-based microcontroller. This microcontroller is the backbone of the complete system. Almost all I/O devices are connected to this microcontroller to perform dedicated tasks/work based on input/incoming signals/data from various input devices/sensors. This complete circuit is divided into seven parts as marked in the circuit diagram. The power supply unit/circuit is used to regulate two DC sources of 5v and 3.3v to complete the system. This power supply circuit consists of two voltage regulator ICs as IC 7805 which regulates 5v and LD1117S33 which regulates 3.3v. The system is operated on a 9v-12v DC source (battery) which is connected to this power-supply circuit at Vin of IC 7805. The input power source from the battery is connected in parallel with one 100uF electrolytic capacitor which is used to reduce/minimize fluctuations/jitters in the power supply. Similarly, a few more capacitors [C2, C6, C7, C8] are used after each power stage to minimize fluctuations in power lines (3.3v and 5v both). For 3.3v regulation LD1117S33 IC is used which is getting an input source of 5v from a 5v power rail to convert it into 3.3v with minimum voltage drop (efficiently). For system indication purposes two LEDs are used as shown in the Indication LEDs section in the circuit diagram. These LEDs are system signal LED (Green/Blue Colour) and system alert LED (Red/Orange Colour). The system signal LED is a heartbeat of the system which indicates either the system is running or it is hanged. This signal LED blinks for a few milliseconds every few seconds like a strobe/signaling light. For alert indication, an alert LED is used which continuously flashes in case of alerts like accident events or alcohol detection. In the system's ideal state, this alert indication LED remains off. Both LEDs are connected and controlled by two GPIO pins of the microcontroller. Apart from LED indication, there is one more alerting/indication device i.e., a buzzer. In case of alert events (accident or alcohol detection), this buzzer beeps several times. The buzzer is driven through a buzzer driver circuit as shown in the circuit diagram. This buzzer driver circuit consists of one NPN-type BJT transistor (BC547) which is configured in CE mode for switching purposes. As the output of the microcontroller is not enough to drive the buzzer directly this driver circuit aims to boost the current required to drive/turn on the buzzer with the help of a weak signal (from uC) applied to the base terminal of the transistor. The buzzer is 5v operated so the power supply through the driver circuit is tied to 5v.

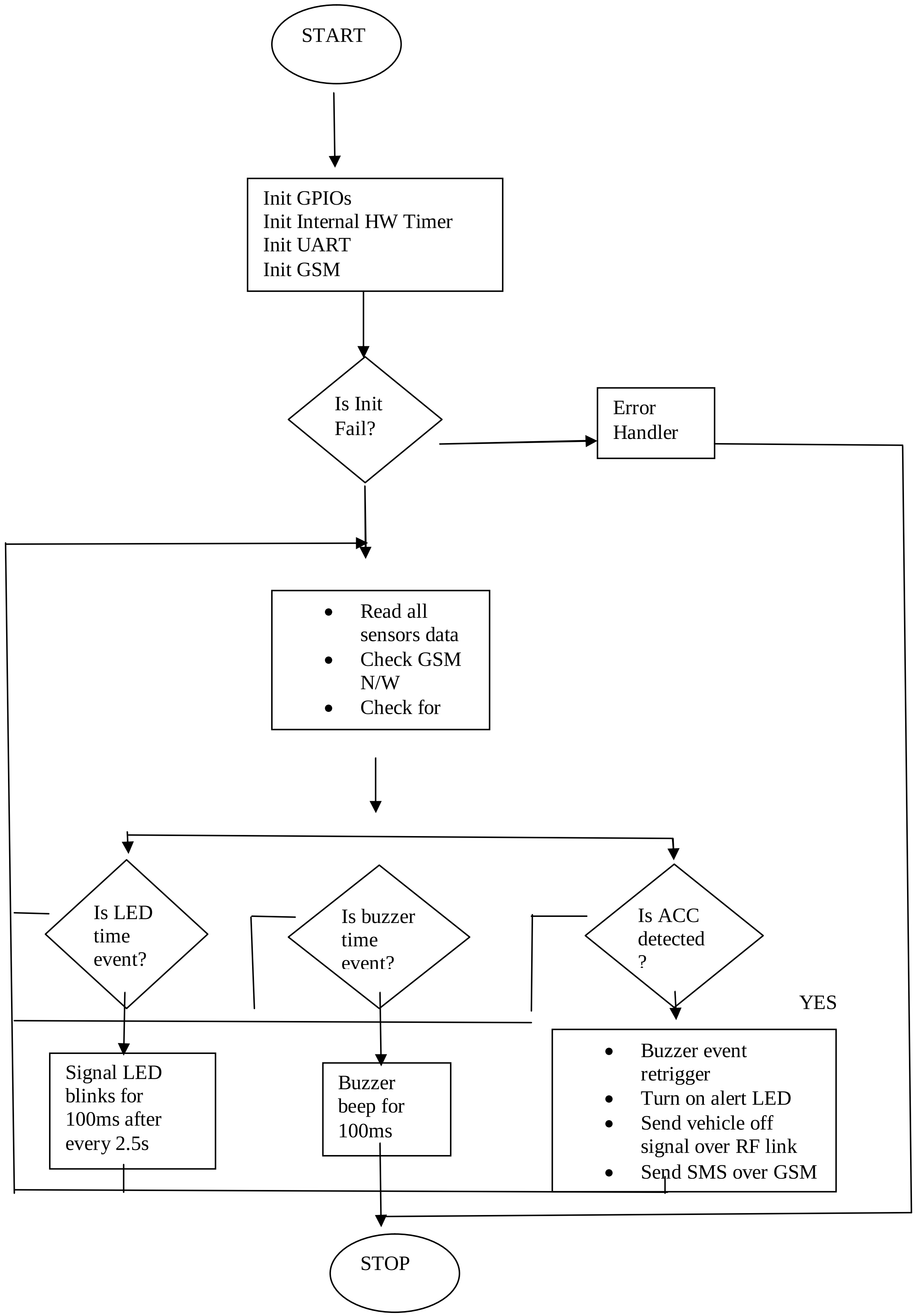

Fig1: Flow Diagram

The system also consists of some wireless modules such as an RF trans-receiver, GSM module, and GPS module which can only be interfaced and communicate with the microcontroller via the UART interface. But as in AT89C51/52 microcontroller, there is only a single UART port which is not sufficient to interface multiple devices at the same time (to prevent data corruption/collision). To overcome such a problem a Mux/De-Mux IC (74HC4051/CD4051) is used. This Mux/De-Mux splits the single UART of the microcontroller into multiple UARTs so that we can connect various UART devices/modules. As shown in the circuit diagram the UART MUX/DEMUX unit/circuit block consists of Mux/De-Mux IC and 3x 4-pin headers to interface GSM, GPS, and RF modules. Out of these three modules, only the RF module is 5v compatible rest of the two modules (i.e., GSM and GPS) are 3.3v compatible. But as our uC and CD4051 MUX/De-MUX are operated at 5v the signals through them are also of 5v peak. So, to prevent 3.3v compatible modules/device (GSM, GPS) from getting damaged via a 5v signal few resistor-based voltage divider circuit [R5, R6, R7, R8] is used which reduces the 5v peak signal to around 3.3v peak. The communication speed/baud rate of uC and modules are the same i.e., 9600 b/s (9600 bits per second).

The uC used in the system is a baseline microcontroller with limited features. It is not having any in-built on-chip ADC (Analog-to-Digital Converter). So, to interface any analog sensor or give analog input to uC one technique is used which aims to convert an analog signal into digital values with the help of simple digital GPIOs. As any basic microcontroller at least consists of a few GPIOs and an internal hardware timer so this technique can be used to implement software ADC converter using digital GPIOs. As shown in the bottom right section of the circuit diagram a diode and capacitor pairs are used along with the sensor or any input analog source. This makes an RC n/w (Resistor-Capacitor circuit) based charge-discharge circuit to which a few GPIOs of uC are connected. The ADC_S GPIO is a general-purpose output that charges the capacitor via a diode for a few milliseconds. After charging the capacitor the uC monitors the discharge time of the capacitor by reading the value at ADC_Rx general-purpose input pin/GPIO. Based on variations in the resistance of the input sensor the discharge time calculated inside the controller using a hardware timer might vary. This varying digital value representation is 16-bit (as the timer is of 16-bit resolution) and is treated as ADC quantity. Based on these converted values uC controls the output device or performs some action.

For proper microcontroller operation, an 11-16MHz quartz crystal is used which is connected to the Xtal1 and Xtal2 pins of the microcontroller. For stability purposes, two 22pF capacitors are pulled down to these pins. This crystal plays a very important role to generate the microcontroller's internal clock using an internal oscillator circuit. As all the internal blocks/units of the microcontroller are synced with each other this clock is mandatory. Apart from the crystal clock oscillator, the second important thing for a microcontroller is to reset the control circuit. As shown in the circuit diagram the reset circuit/unit consists of one capacitor, a resistor, and a switch/push-button. The rest of this microcontroller is active high which means it is active when tied to 5v/VCC. The reset circuit is used to perform two types of resets. The first one is cold/manual reset which can be done by pressing the reset switch/push button and the second one is POR reset. The Power-On Reset (POR) can be done using capacitor C5 of 10uF. To discharge the capacitor, to prevent auto-random resets due to EMF interference, and to perform a complete reset cycle again and again a pull-down 10k resistor R2 is used. The microcontroller is also having one pin as EA which is tied to 5v VCC. This External Access (EA) pin of the microcontroller configures the microcontroller to use its internal memories (128/256B RAM & 4KB/8KB ROM).

The microcontroller is programmed using an embedded-C programming language in Keil uVision IDE to get/generate binary/hex code. To flash/burn/upload this hex/binary code inside the microcontroller a High-Voltage Serial-Parallel programming hardware and software tool is used.

IV. HARDWARE AND SOFTWARE REQUIREMENTS

A. Hardware Requirement

1) AT89C51/52 Microcontroller
2) 40-Pin IC Base
3) ADLX335 Accelerometer
4) MQ-3 Alcohol Sensor
5) IC LM358N Dual Op-Amp
6) SIM800L GSM Module
7) Neo-6m GPS Module
8) IC CD4051 MUX/DEMUX
9) LEDs: (RED, GREEN, BLUE)
10) Small 5v Buzzer

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11) BC547 Transistor
12) 433MHz RF Trans-Receiver
13) IC LM7805 5v Voltage Regulator
14) IC AMS1117 3.3v Voltage Regulator
15) Capacitors
16) Resistors
17) 9v Battery
18) 9v Battery Cap
19) Small Copper Clad PCB

B. Software Requirement

1) Keil µVision IDE (v5): For AT89C5x microcontroller programming.
2) Proteus ISIS & ARES (v8): For circuit & PCB design.
3) AT89Cxx HV Prog (v1): For uploading binaries into the microcontroller.
4) Pulse View (v4): For digital signal analysis

V. ADVANTAGES

1) It will send a message of location automatically when he/she met an accident with a helmet on.
2) RF transmitter and receiver are used for starting the two-wheeler.
3) If he/she is not wearing the helmet the two-wheeler will not start.
4) The alcohol sensor is used to sense alcohol consumption and it will lock the ignition if drunk.

VI. OBJECTIVE

The main objective of the project is to design a low-cost intelligent helmet that is capable of identifying alcohol consumption and preventing road accidents. This system is capable of providing safety and security to the bikers against road accidents. The circuit so designs that the bike won't start without wearing a helmet and if the rider is drunk and in case of an accident.GSM system will globally locate the biker and an immediate message will be sent to the family members about the location of the accident.

VII. RESULT

The result shows that the system detected the presence of alcohol in the breath of the rider if the rider is over drunken then the bike will not start. This system will process completely based on rider activities.

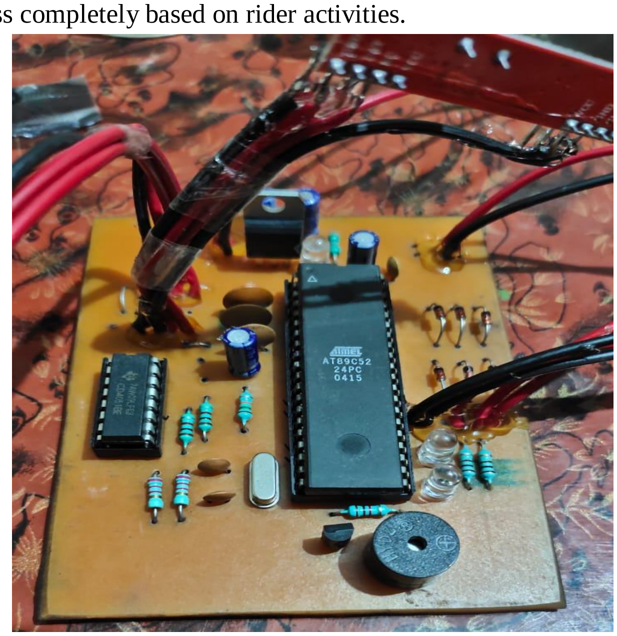

Fig2. Helmet Section

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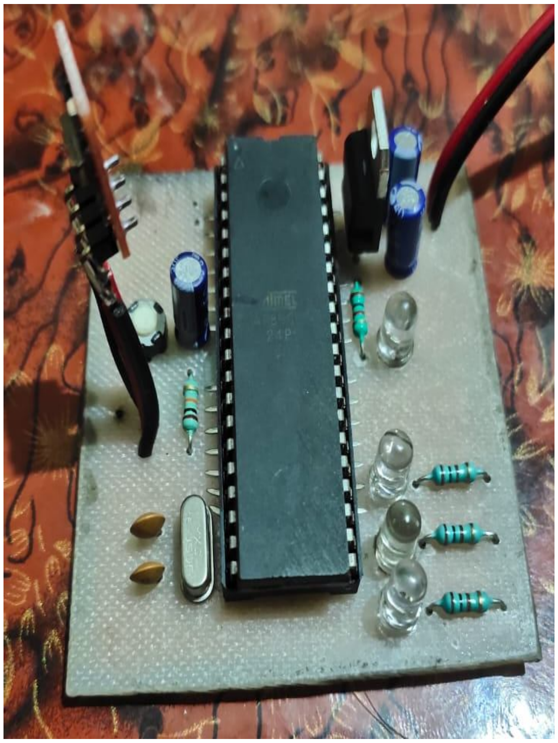


Fig3.Vehicle section

VIII. CONCLUSION

The smart helmet is an intelligent system that will support more secure bike riding. Regarding the poor condition of roads, a large number of accidents, a lot of violations of traffic rules, and poor regulation systems, there is no alternative to smart helmets for motorcycle riders' safety. It can save the rider from severe injury to the head in the case of an accident. To reduce manual efforts and human errors, we need to have some kind of automated system monitoring all the parameters and functioning of the connections between the two-wheeler personnel and the parents.

REFERENCES

[1] Kimaya Bholaram Mhatre, Raj Maruthi N and waka, Aditya Prasanna Patil Rushikesh Vijay Shinde, Prof.Pralnyakamble, "Smart Helmet with Intercom feature", Social Science Research Network (SSRN 2020).

[2] Suman, A. Parashar, A. Shukla, and K. R. Shobha, "Aagaahi - A Smart Helmet", 2020 IEEE International Conference on Electronics Computing and Communication Technologies (CONNECT), 2020.

[3] S.R.Kurkute, N.R.Ahirrao, R.G.Ankad, V.B Khatal, "IOT-based smart system for the Helmet detection", International Conference on Sustainable Computing in Science, Technology, and Management (SUSCOM-2019).

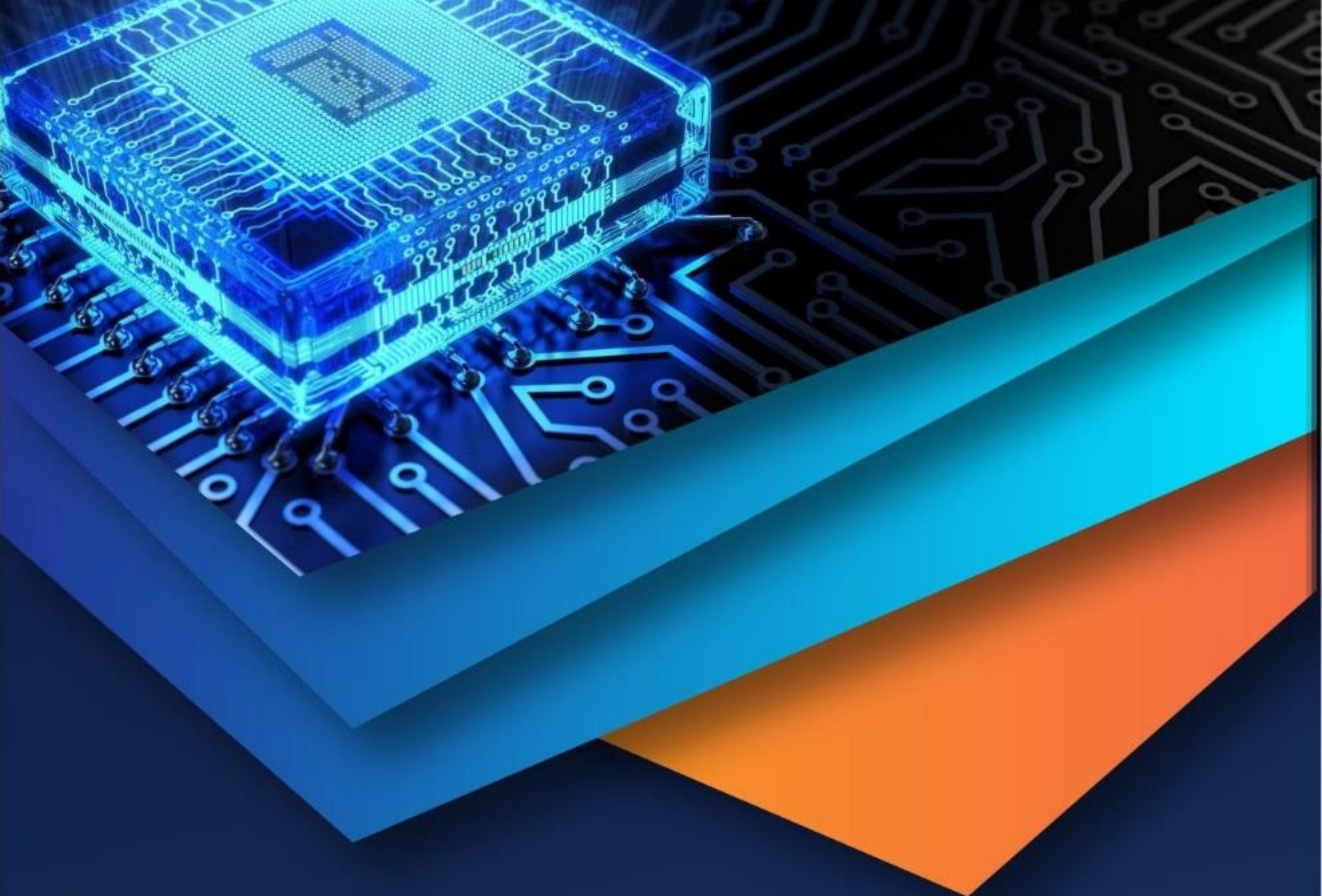
[4] KabilanM,Monish S, DrS.Siamala Devi, "Accident detection system based on IOT-Smart Helmet", International Journal of Advance Research, Ideas and Innovations in Technology (IJARIIT 2019).

[5] Dr.D Vivekananda Reddy,V.Suresh, T.Hemalatha, "Smart Helmet and Bike management system", Journal of Gujarat Research Society 2019.

[6] JesudossA, Vybhavi R, Anusha B, "Design of Smart Helmet for Accident Avoidance", International Conference on Communication and Signal Processing, April 4-6, 2019, India.

[7] S. Gupta, K. Sharma, N. Salvekar and A. Gajra, "Implementation of Alcohol and Collision Sensors in a Smart Helmet", 2019 International Conference on Nascent Technologies in Engineering (ICNTE), pp. 1-5, 2019.

[8] N. Divyasudha and P. Arulmozhivarman, "Analysis of Smart helmets and Designing an IoT based smart helmet : A cost-effective solution for Riders", in 1st International Conference on Innovations in Information and Communication Technology (ICIICT), 2019.



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