JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Design of Personal Protective Kit for Health Safety

1st CH BALA SWAMY
Professor, dept. of ECE
Seshadri Rao Gudlavalleru
Engineering college
India
balaswamy@gecgudlavallerumic.in

2nd GADDAM HEMAVALLIKA
dept. of ECE
Seshadri Rao Gudlavalleru
Engineering college
India
hvallika46@gmail.com

3rd DAKARAPU VEDA PRIYA
dept. of ECE
Seshadri Rao Gudlavalleru
Engineering college
India
dvedapriya522@gmail.com

4th KURCHETI SRI DEVI
dept. of ECE
Seshadri Rao Gudlavalleru
Engineering college
India
sridevikurcheti18@gmail.com

5th KUPPALA TULASI PAVAN MANIKUMAR
dept. of ECE
Seshadri Rao Gudlavalleru
Engineering college
India
kmanikumar159@gmail.com

Abstract—In order to combat the COVID-19 pandemic, it is essential to ensure that safety measures are taken in a variety of workplaces. For the purpose of enhancing safety measures across a variety of sectors, this article suggests the implementation of a Smart Helmet that makes use of STM32 microcontroller technology. The helmet has sensors that detect fire, smoke, and temperature, as well as a dispenser for automated hand sanitizer and capabilities that allow for social separation via the use of a microphone and speaker. Real-time monitoring is further improved by the addition of an alarm system that is powered by an ESP8266 WiFi module. Through the implementation of this cutting-edge technology, the goal is to make the working environment safer in a variety of situations, therefore reducing risks and protecting the well-being of workers.

Index Terms—motorcycle helmets; Bluetooth; mobile phone; microphone; GAS, Fire, Temperature sensors;

I. Introduction

Because of the epidemic caused by COVID-19, civilizations all over the world have been profoundly affected, which has led to substantial changes in the way industries function and how they prioritize safety in the workplace. As a result of the introduction of new issues linked with the virus, it has become of the utmost importance across a variety of industries to ensure the safety and well-being of workers. Employers are faced with the responsibility of establishing stringent safety measures to protect the health of their personnel and reduce the danger of COVID-19 transmission. These precautions may be implemented in a variety of settings, including manufacturing facilities and office spaces.

A significant emphasis has been placed on utilizing technology to develop new solutions that meet the particular safety issues provided by the epidemic. This is a reaction to the unusual problems that have been presented. The introduction of wearable technology in particular has emerged as a potentially fruitful route for the improvement of safety standards in the workplace. By incorporating sophisticated sensors, communication devices, and warning systems into wearable gear, such as helmets or vests, businesses are able to efficiently monitor the conditions of the surrounding environment, enable communication among employees, and offer timely notifications in the case of crises or abnormal events.

The Smart Helmet is an example of such a technical breakthrough. It is designed to improve safety measures in a variety of sectors by utilizing the capabilities of STM32 microcontroller technology. In order to make the working environment safer, the Smart Helmet is a versatile solution that integrates numerous critical characteristics into a single package. The helmet has sensors that are able to detect fire, smoke, and variations in temperature. This allows for the early identification of possible risks, which in turn permits prompt response and risk reduction.

In addition, the Smart Helmet is equipped with an automated hand sanitizer dispenser, which addresses the vital requirement of ensuring that adequate hand hygiene is maintained in the workplace. Through the implementation of this function, not only is the danger of virus transmission decreased, but also a culture of health and safety is fostered among the workforce. In addition, the helmet is equipped with social distancing capabilities, such as a microphone and speaker system, which allow workers to successfully converse with one another while yet maintaining a safe distance from one another.

In addition, the Smart Helmet is outfitted with a notification system that is driven by an ESP8266 WiFi module, which makes it possible to communicate and monitor in real time. In the

event that abnormal situations or emergencies occur, the system is able to promptly warn workers and managers, which enables timely response and ensures the safety of all individuals. The Smart Helmet, in its whole, is a proactive strategy to tackling the expanding safety concerns provided by the COVID-19 pandemic. It provides a holistic solution for improving workplace safety across a variety of sectors at the same time.

II. Related Work

Earlier studies and advances have investigated a wide range of technologies and approaches with the objective of enhancing worker safety, particularly in potentially hazardous areas such as building sites, industrial facilities, and mining operations. Despite the fact that these attempts have focused on a wide variety of topics, such as sensor-based systems, communication devices, and wearable technology, the overall objective has been to improve worker safety and reduce the risks that are connected with hazards in the workplace.

When it comes to sensor-based systems, researchers have devised novel approaches to identifying and monitoring environmental variables that might potentially endanger the safety of workers. For example, sensor networks have been implemented in mining operations in order to facilitate the detection of gas leaks, fires, and other potentially hazardous events that may occur within underground mines. In order to give real-time data on environmental factors, these systems make use of a mix of gas sensors, temperature sensors, and pressure sensors. This allows for early detection and quick action, which in turn helps to prevent accidents and injuries.

In a similar manner, sensor-based systems have been deployed in production facilities in order to monitor the functioning of equipment and identify any possible defects or breakdowns. It is possible for operators to notice concerns such as overheating, vibration, or excessive noise by installing sensors on machinery and manufacturing lines. These issues may signal that there is an imminent breakdown of equipment or that there are potential safety hazards. It is possible to avoid downtime, minimize the likelihood of accidents, and guarantee the safety of workers by using this preventative approach to equipment maintenance.

In addition to sensor-based systems, research efforts have also been concentrated on the development of communication devices and wearable technologies in order to enhance worker safety and coordination in hazardous situations. When workers are executing activities in remote or dangerous regions, they are able to maintain communication with their coworkers and supervisors through the use of wearable devices that are equipped with communication capabilities. These devices include smart glasses, vests, and helmets. Workers are able to report issues, request help, or get instructions without having to be physically close to one another thanks to these devices, which permit real-time communication.

Additionally, wearable technology has been utilized to improve worker safety by including features such as biometric monitoring, location tracking, and emergency alert systems. This has been accomplished through the utilization of wearable technology. For instance, wearable devices that are fitted with biometric sensors are able to monitor vital indicators such as the heart rate and the temperature of the body. This allows for the early detection of any health problems or hazards associated with exhaustion. In a similar vein, location monitoring technology gives managers the ability to keep track of the movements of their employees in real time, which helps to ensure their safety in workplaces that are either huge or complicated.

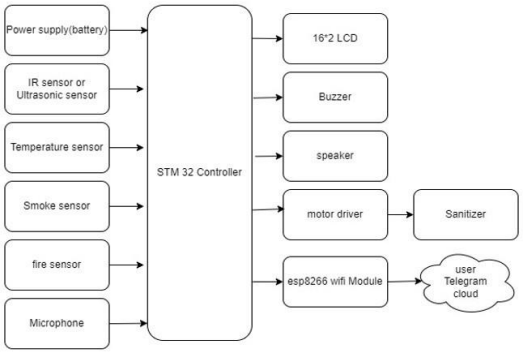

Fig. 1. Block Diagram.

The present study separates itself from the past research initiatives by offering an integrated solution that is targeted to the unique problems provided by the COVID-19 pandemic. These prior research endeavors have achieved considerable achievements in increasing workplace safety. A complete approach to improving safety measures and minimizing hazards in a variety of workplace environments is provided by the Smart Helmet. This is accomplished by merging sensor-based detection, communication capabilities, and alarm systems into a single wearable device.

III. Proposed Work

The Smart Helmet system that has been developed was designed with the intention of incorporating cutting-edge technology in order to improve safety measures and solve the specific issues that the COVID-19 pandemic presents in a variety of occupational settings. This section provides an overview of the Smart Helmet's primary components and features, elaborating on the ways in which each component contributes to the creation of a more secure working environment for employees with disabilities. The block diagram and model helmet are shown in figures 1 and 2 respectively.

- First, the Integration of Sensors: Additionally, the Smart Helmet will be outfitted with a variety of sensors that are able to identify and keep track of environmental variables that might potentially endanger the safety of workers. Sensors for fire, smoke, gas, temperature, and humidity are some examples of the types of sensors that may be included in this category. The helmet is able to give early identification of possible threats by continually monitoring these factors. This enables prompt action and risk reduction to take place.
- The automatic hand sanitizer dispenser is the second item. In order to meet the urgent requirement of ensuring that good hand hygiene is maintained in the workplace, the Smart Helmet will be equipped with an automated

hand sanitizer dispenser. Workers will be able to sanitize their hands in a rapid and effective manner thanks to the

Fig. 2. Model Helmate.

dispenser, which will be positioned on the helmet in a convenient area. This will help to reduce the risk of virus transmission and promote a culture that prioritizes health and safety.

- Features that contribute to social distance: It is planned that the Smart Helmet will contain communication elements such as a microphone and speaker system in order to make it easier for individuals to comply to social distance norms. Through the utilization of this feature, employees will be able to efficiently interact with their coworkers and superiors while simultaneously keeping a safe distance from one another. In addition, the helmet may be equipped with proximity sensors or Bluetooth technology, which would notify the wearer when they are approaching close proximity to other people. This would encourage the wearer to adhere to social distance standards.
- Fourth, the Warning System: The alarm system that is included into the Smart Helmet is an essential component. Its purpose is to provide workers and managers with information on any abnormal circumstances or crises that may occur in the workplace. It is possible for the helmet to communicate real-time notifications to selected receivers by utilizing wireless communication technologies such as the ESP8266 WiFi module. This enables fast action and ensures the safety of all people.
- Integration and User Interface: The many components of the Smart Helmet will be combined into a userfriendly interface in a seamless manner, which will make it possible to easily monitor and manage the safety features. In order to offer visual feedback on sensor readings, sanitizer levels, and communication status, the helmet could come equipped with an LCD screen or LED indicators. Additionally, the interface of the helmet may feature voice commands or touch controls for hands-free operation, which would enhance its usage in a variety of job contexts thanks to its versatility.
- Testing and validation: In order to guarantee the Smart Helmet's efficiency and dependability in real-world settings, the development of the Smart Helmet will be supported by stringent testing and validation methods. Simulations of working settings, such as being exposed to potentially dangerous circumstances, practicing communication skills, and practicing emergency response drills, will be used in the testing process. Users and other stakeholders will be asked for their feedback in order to determine whether or not there are any areas that might be improved or optimized.

When it comes to boosting workplace safety in the era of COVID-19, the Smart Helmet that has been offered is a comprehensive solution that offers an overall answer. The helmet provides a proactive approach to lowering hazards and protecting the health and well-being of employees across a variety of sectors. This is accomplished via the use of cuttingedge technology and unique features.

IV. Methodology

A methodical strategy that includes stages of design, prototyping, testing, and refining will be utilized in the process of developing the Smart Helmet. This section provides an overview of the technique that was utilized during each phase of the project, elaborating on the many procedures that were taken to transform the Smart Helmet from an idea into a functioning product.

- The first phase of design is:An exhaustive examination of the Smart Helmet's functional needs and specifications will be the first step in the design phase of the project. In order to do this, it will be necessary to define the essential characteristics and components of the helmet, such as the integration of sensors, the capabilities of communication, and the design of the user interface. The helmet will be designed by engineers and designers working together to create precise schematics and three-dimensional models of the helmet. These models will take into consideration a variety of criteria, including ergonomics, durability, and compatibility with existing safety equipment.
- The Prototyping Process: After the design criteria have been established, the prototyping phase will begin, with the primary focus being on the construction of a prototype of the Smart Helmet that is capable of functioning. Obtaining the relevant components, such as STM32 microcontrollers, sensors, communication modules, and dispenser mechanisms, will be required to accomplish this task. These components will be assembled and integrated into a prototype helmet by engineers, who will use feedback from design reviews and usability testing in order to enhance the design in an iterative manner by incorporating the feedback.
- The Development of Software It is anticipated that software development work will be undertaken concurrently with the prototyping phase in order to program the microcontroller and produce the firmware for the Smart Helmet. In order to accomplish this, you will

need to write code that will interface with the sensors, communication devices, and user interface components. Additionally, you will need to create algorithms for data processing and decision-making. The software will be developed to allow real-time monitoring of environmental conditions, to make it easier for users to communicate with one another, and to send out notifications in reaction to anomalous occurrences.

- The fourth step is testing and validation: Once the prototype and software have been produced, extensive testing and validation processes will be carried out in order to evaluate the Smart Helmet's performance as well as its dependability. In order to do this, the helmet will be put through a series of environmental conditions and situations, such as simulated risks in the workplace, communication tests, and emergency response exercises. A thorough examination of the test findings will be carried out in order to evaluate the precision of the sensor readings, the efficiency of the communication features, and the dependability of the warning systems.
- In the fifth place, refinement and optimization: After the results of the testing and validation have been analyzed, the Smart Helmet will be subjected to iterative refinement and optimization in order to solve any problems or deficiencies that have been discovered. Depending on the situation, this may require adjusting the calibration of the sensors, optimizing the communication protocols, or improving the aspects of the user interface in order to increase the usability and functionality. Throughout the entirety of this process, feedback from users and stakeholders will be collected in order to guarantee that the final product will fulfill their requirements and fulfill their expectations.

The goal of the development team is to successfully create a Smart Helmet that effectively improves workplace safety and tackles the unique issues provided by the COVID-19 epidemic. This will be accomplished by adhering to this methodology. The Smart Helmet will emerge as a dependable and technologically advanced solution for fostering a safer working environment across a variety of sectors. This will be accomplished through a methodical approach to design, prototyping, testing, and improvement.

V. Hardware Components

A. STM 32 micro controller

The STM32 microcontroller family from STMicroelectronics is known for its adaptability and performance in many applications. STM32 microcontrollers, based on ARM CortexM processors, provide strong peripherals, wide connectivity, and low power consumption. STM32 microcontrollers serve

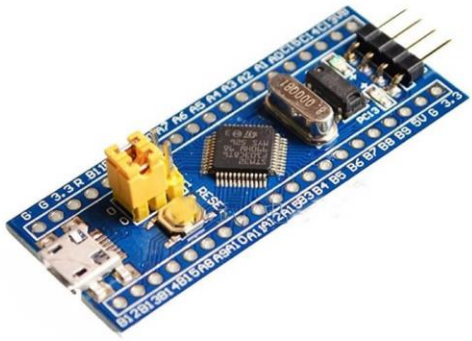

Fig. 3. STM 32 micro controller.

industrial automation, consumer electronics, automotive, and IoT applications with entry-level to high-performance devices. Their ecosystem of development tools, software libraries, and community support streamlines embedded system development and deployment. To power basic sensor nodes or large control systems, developers continue to use STM32 microcontrollers for dependability, scalability, and cost-effectiveness.

B. Temperature sensor

Electronic temperature sensors sense temperature and produce an electrical signal or digital data. Thermocouples, RTDs, thermistors, IC sensors, and IR sensors each have their unique function and uses. Thermocouples are durable and suitable for a wide temperature range, RTDs are accurate and stable, thermistors are compact and sensitive, IC sensors are simple and low-power, and IR sensors monitor temperature noncontactly Temperature sensors are essential for temperature monitoring, control, and optimization in HVAC, automotive, and food processing.

C. Fire sensor

Fire sensors, often known as smoke detectors or fire alarms, alert people to fires by detecting smoke, heat, or flames. These sensors detect fires via ionization, photoelectric, heat, and carbon monoxide sensing. They alarm residents and activate sprinkler systems or call 911 when detected. Fire sensors in homes, businesses, and factories reduce property damage and save lives by detecting and responding to fires early.

VI. Smoke sensor

Fire detection systems use smoke sensors to detect airborne smoke particles. They detect smoke using ionization, photoelectric, or dual-sensor technologies. Ionization smoke detectors ionize air molecules with a tiny radioactive source, whereas photoelectric sensors detect smoke particles with light beams. These sensors notify building inhabitants when smoke

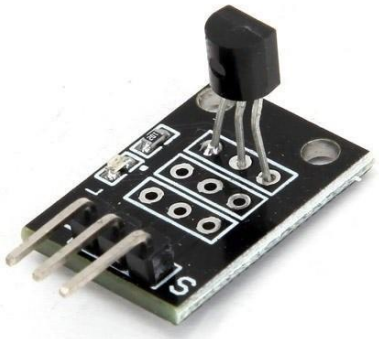

Fig. 4. Temperature sensor.

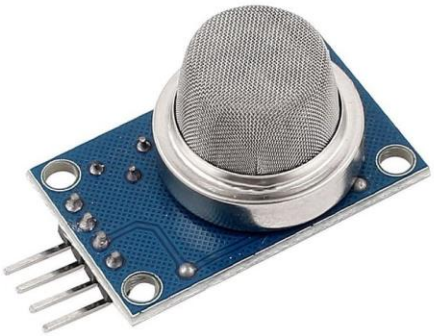

Fig. 6. Smoke sensor.

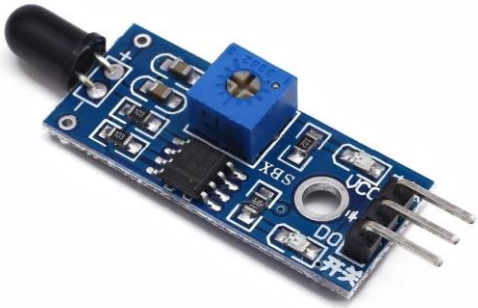

Fig. 5. Fire sensor.

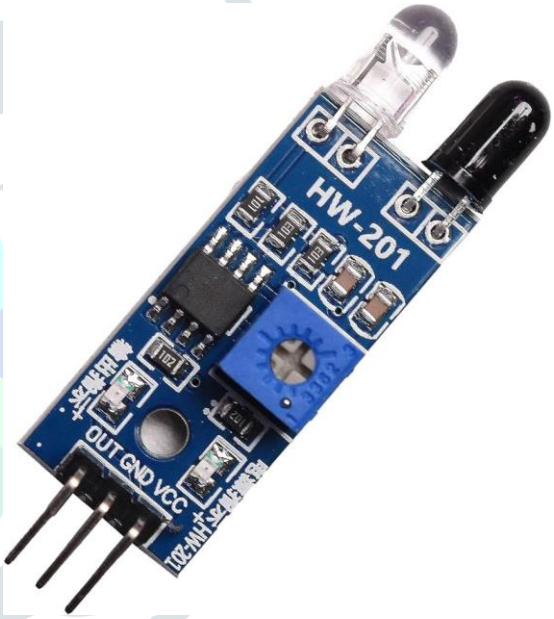

Fig. 7. IR sensor.

is detected, allowing them to take fire precautions. Early identification of fires in residential, commercial, and industrial buildings via smoke sensors saves lives and property.

A. IR sensor

IR sensors detect infrared radiation from objects. They measure the intensity of infrared radiation in their range of view and transform it into an electrical signal proportional to object temperature. Passive or active IR sensors. Passive IR sensors are used in security systems and automated lighting to detect infrared radiation from moving objects. For proximity sensing, object detection, and temperature measurement, active IR sensors emit infrared light and assess its reflection or absorption by nearby objects. IR sensors are used in automation, consumer electronics, automotive, and healthcare for noncontact sensing.

B. LCD

A 16x2 LCD (16 characters by 2 lines) is a popular alphanumeric display module for text and symbols. Its 16 characters on two lines can show sensor readings, messages, and status updates in electrical projects. Hobbyists and professionals use these displays for their simplicity, ease of usage, and interoperability with microcontrollers like Arduino.

C. Buzzer

Buzzers are electronic components that make sound when activated. It usually has a magnet, wire coil, and vibrating

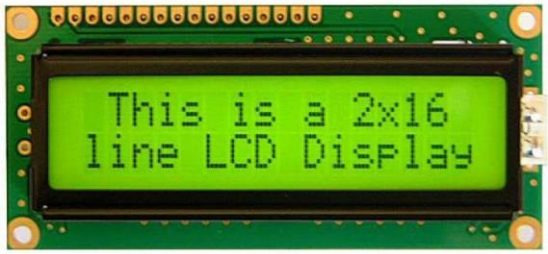

Fig. 8. 16X2 LCD.

Fig. 10. Sanitizer.

Fig. 9. Buzzer.

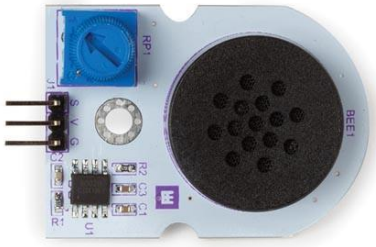

Fig. 11. Speaker.

diaphragm or piezoelectric element. An alternating current across the coil creates a magnetic field that vibrates the diaphragm or piezoelectric element, creating sound waves. Electromagnetic and piezoelectric buzzers differ in frequency, loudness, and power usage. Electronic devices and systems employ them to provide auditory warnings, notifications, and alarms, from appliance beepers to industrial, security, and automobile signaling devices.

D. Sanitizer

Sanitizer, usually a liquid or gel, kills or neutralizes germs, viruses, and bacteria on surfaces and skin. It usually contains ethyl or isopropyl alcohol, which kills dangerous bacteria on contact. Sanitizers are used in hospitals, food processing areas, public places, and homes to prevent infection and preserve hygiene. Sanitizers make hand hygiene and surface disinfection easy and effective for personal and public health safety due to the global focus on health and cleanliness.

E. Speaker

Transducers like speakers turn electrical impulses into sound waves. It usually has a cone-shaped diaphragm and a voice coil hung in a magnetic field. An electrical audio signal given to the voice coil generates a changing magnetic field that interacts with the permanent magnet, vibrating the diaphragm and producing sound waves. Speakers are available in many sizes and configurations for headphones, earphones, home stereo systems, automotive audio systems, public address systems, and more. They contribute to high-quality audio reproduction for entertainment, communication, and information in daily life.

F. Esp8266 wifi module

The ESP8266 WiFi module, created by Espressif Systems, is a small and affordable option for integrating wireless connection into IoT and embedded projects. Equipped with a robust 32-bit microcontroller unit (MCU) and compatibility with IEEE 802.11 b/g/n standards, this device may function

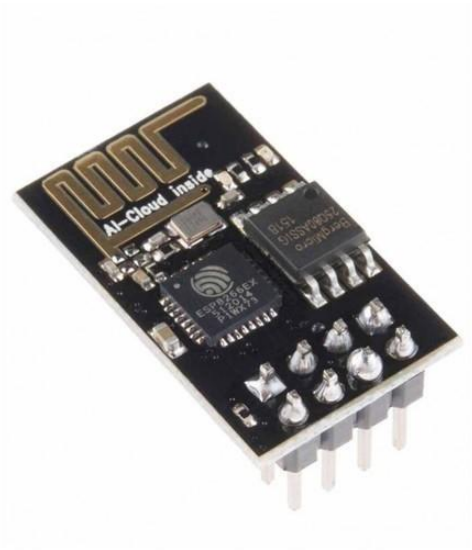

Fig. 12. Esp8266 wifi module.

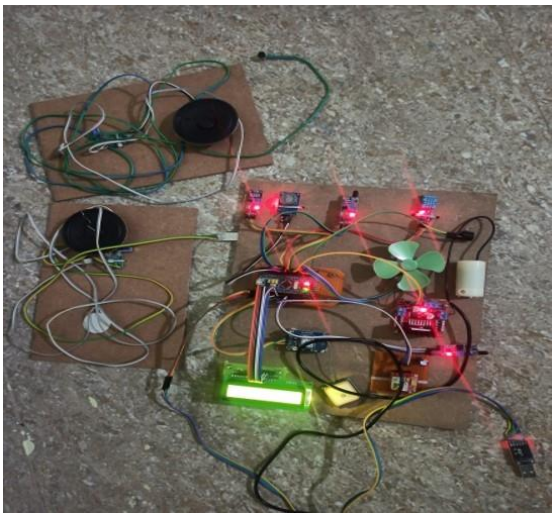

Fig. 13. Hardware Implementation.

Fig. 14. LCD display Output.

as both a client and an access point, providing versatility in network setups. The board's simplicity in programming, including compatibility with Arduino IDE, Lua scripting, and MicroPython, together with an active community, ensures that developers of any skill level may easily use it. The ESP8266 continues to be a favored option for several applications, including home automation and industrial monitoring, because of its compact size, little energy usage, and cost-effectiveness, even if more powerful alternatives like the ESP32 are now available.

VII. Results

It is anticipated that the Smart Helmet system would exhibit enhanced safety and efficiency in coal mining operations after the phases of research and testing have been completed. During the preliminary testing, the accuracy of the sensor readings, the efficiency of the hand sanitizer dispenser, and the dependability of the communication and alarm systems will all be evaluated. It is planned to collect feedback from both miners and supervisors in order to identify any areas that might benefit from improvement and optimization. In order to achieve the ultimate aim of improving the safety and wellbeing of coal mine workers during the COVID-19 epidemic and beyond, the findings of these testing will be used to guide additional changes to the design and functioning of the Smart Helmet.Which is shown in figures 13,14.

VIII. Conclusion

A significant step forward in the direction of strengthening safety measures within coal mines is represented by the application of STM32 technology in the construction of a smart helmet. This is especially crucial in light of the ongoing COVID19 epidemic. The smart helmet transforms into a complex instrument that is loaded with state-of-the-art features that are specialized to monitor and ease communication in hazardous work situations. This cutting-edge technology allows the smart helmet to become more than simply a protective gear. This forward-thinking integration provides a multi-pronged strategy for protecting the health and safety of coal mine workers, which has the potential to result in a significant reduction in the number of accidents and an overall improvement in the welfare of workers.

References

[1] IEEE Transactions on Industrial Electronics: For papers on embedded systems, microcontroller applications, and thermal regulation.

[2] Eusofe Z, Evdorides H. Assessment of road safety management at institutional level in Malaysia: A case study. IATSS Research 2017; 41(4): 172-181..

[3] Marizwan M, Manan A, Jonsson T, Varhelyi A. Development of a safety performance function for motorcycle accident fatalities on Malaysian primary roads. Safety Science 2013; 60: 13-20.

[4] Umar R, Wong SV. The Malaysian government's road accident death reduction target for year 2010. IATSS Research 2005; 29(1): 42-49.

[5] Romero DL, de Barros DM, Belizario GO, Serafim AP. Personality traits and risky behavior among motorcyclists: An exploratory study. PLoS one 2019; 14(12): e0225949.

[6] Marizwan M, Varhelyi A. Motorcycle fatalities in Malaysia. IATSS Research 2012; 36(1): 30-39.
[7] Marizwan M, Manan A, Varhelyi A, Celik AK, Hanis H. Road characteristics and environment factors associated with motorcycle fatal crashes in Malaysia. IATSS Research 2018; 42(4): 209-220.