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SMART AND SECURE CYCLIST'S HELMET

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ABSTRACT

Road accidents especially two-wheeler accidents are a global issue that results in millions of deaths and injuries every year. Smart Helmets contribute to a green environment by promoting cycling, a mode of transportation that produces zero emissions. The smart and secure cyclist's helmet, centered around ESP32, which is equipped with indicators for turns and stops, health tracking, and crash detection which enhances safety and provides an intelligent safety solution for rider's health and security. This approach prioritizes simplicity while effectively incorporating advanced technology making cycling not only more secure, but also technologically advanced and enjoyable.
Keywords: Accidents, Smart Helmet, ESP32, Indicators, Health tracking, Crash detection, Security.

I. INTRODUCTION

Smart helmets for cyclists contribute to a green environment by encouraging cycling, a zero-emission mode of transportation. These modern innovations enhance safety through features like built-in LED lights. Positioned strategically on the helmet, these lights enhance visibility. These helmets incorporate sensors that monitor vital metrics such as heart rate, temperature and amount of oxygen in blood. In addition to offering insightful information about the health and performance of the rider, this data may be utilized to optimize riding routes for a commute that is both environmentally and health-conscious. By promoting a safer and more enjoyable cycling experience, smart helmets play a role in encouraging sustainable transportation choices. A standout feature in this technology is crash detection. Utilizing advanced technology and sensors, the helmet can analyze sudden impacts or unusual movements indicative of a crash. In the event of an accident, the helmet can automatically trigger alerts to emergency contacts, providing crucial information about the cyclist's location. This proactive safety measure significantly reduces response times and enhances the overall well-being of the cyclist. These helmets also has LED's for indicating right turn, left turn and stop as per the riders control. These cutting-edge innovation - smart helmets redefine cycling by prioritizing safety and elevating the riding experience through advanced technologies. They symbolize a promising future where innovation enhances our timeless love for cycling, ensuring a secure and enjoyable journey on two wheels. Therefore reducing accidents and keeping the rider safe is the main aim of these Smart helmet.

II. LITERATURE SURVEY

Shafiulla Basha et al [1]reported the design of smart helmet which is used to avoid motor bike accident that are majorly due to without wearing a helmet or driving while intoxicated. Thus, the creation of a smart helmet system is the main goal of this system. This system monitors the helmet wearing and drunken driving. For the bike to start, the rider must wear a helmet, and he must not be intoxicated.Sensors utilized in the bike and helmet modules as well as the alcohol detection sensors keep an eye on this. In the event of an accident, the GPS and GSM have been added to track the rider's location and notify the closest emergency service. Neelam Yadav and Sunil Singh [2] have designed a smart helmet to ensure everyone's protection and safety while riding. It has a touch sensor to verify that the helmet is being worn, an alcohol detection sensor, GPS and GSM, and lights to indicate turns and stops. One disadvantage is that if the helmet is taken off or kept out of the head, the bike will abruptly stop functioning. Vedanvita et al[3]in their paper claim that the smart helmet design by them can transmit accident information by tilting the helmet or moving it in certain ways. The rider's caregiver and an emergency contact receive accident information via the smart helmet. In their work they have used an STM controller instead of Arduino. If the rider is involved in an accident this system will assist the victim in receiving appropriate and timely medical assistance. Anandhi et al [4] have designed a system to prevent the theft of motorbikes. With the use of a fingerprint module only authorized persons can use the bike and this prevents vehicle theft. In addition to requiring the rider to wear a helmet and having

sensors to detect alcohol consumption, GPS, and GSM, the ignition is only activated if the rider's unique code matches Ramesh Kagalkar, [5] designed a helmet in which the he has integrated an alcohol sensor, magnetic sensor, IR sensor, limit switch,alarm, RF transmitter and receiver, GSM, GPS technology, and an Atmega8 micro-controller. With this wireless technology, an RF transmitter and receiver are used to facilitate wireless communication between the helmet and bike components. The helmet has an RF transmitter attached, and the bike has a receiver.

Without wearing the helmet the bike will not start, it detects alcohol consumption, accident detection, petrol level detection and also obstacle detection to avoid collision. The best way to make the riders wear helmets is this system. Kalpana Manjul [6] in her review paper discusses the accidents that occur due to speeding, intoxicated driving, and reckless driving are the leading causes of mortality among two-wheeler drivers. This technique is budget-conscious, i.e. operating a two-wheeler while keeping safety as well as cost in mind. By mandating that motorcyclists wear helmets and making sure they haven't consumed more alcohol than is permissible, the smart helmet safeguards their safety. The technology here would prohibit the rider from starting the bike if any of these primary safety guidelines are broken.This technology also uses GPS and GSM for sending messages to emergency number in case of accidents. This is a review of the smart helmets that are being in use. The main objective of the work by Keerthika et al[7] is to protect the rider's head during two-wheeler accidents which cause more head injuries. In force-sensing resistors, percolation and quantum tunneling are the two main concepts. The heart rate of the rider is monitored and with the help of these signals, the data of the riders health along with the location is shared via GSM module to the emergency contact. Arduino mega is used as the controller. A report by Arghyadeep Roy et al [8] primarily focuses on the intelligent bike system and smart helmet for two-wheeler safety. These systems are dependable and help in accident prevention, detection, and reporting, which lowers the likelihood of drunk driving incidents. In order to protect the helmet's safety, the system also makes sure that it is put back in the trunk after the ride. By putting this system in place, safe two-wheeler travel is made feasible, which lowers the risk of head injuries in collisions caused by drivers who are intoxicated as well as the number of accidents caused by helmet-less drivers. Harendra Kumar et al[9] discuss the Safety Enhancement Smart helmets designed by them.It incorporates features like impact discovery, fall discovery, and collision avoidance systems,this in turn may help reduce the inflexibility of injuries and enhance safety. Real- time Feedback and Alerts Smart helmets give real- time feedback Connectivity and Communication Smart helmets offer wireless connectivity, enabling flawless communication with other bias and networks, easing data exchange, and access to information.

I. OBJECTIVES

1. To develop a cost effective, safe and secure cyclist's helmet.
2. To track the location of cyclist in case of accidents.
3. To alert the cyclists about the variations in his/her heart rate.
4. To alert the public in case of any problem in the rider's health by producing beep sound.
5. To indicate right turn, left turn and stop.

III.METHODOLOGY

To create a smart and efficient helmet system, this methodology focuses on integration of various components and health monitoring parameters.

The block diagram in Fig.1 comprises of key components, with the central unit being ESP32. Various inputs, including power supply, SPO2 and HR sensor, temperature sensor, brake and indicator switch, fall detection sensor and GPS and GSM. ESP32 is a 32-bit, 30 pin micro-controller with two ground and voltage pins along with 25 general input output pins. The operating voltage of this controller is around 5V to 14V. The heart rate and SPO2 sensor used is 30100, which senses both the heart rate and oxygen concentration in blood. There are indicator switches connected to the LED's for the indication of the turns of the rider during cycling. There is also a brake switch for the indication of stop. The controller ESP32 undertakes the processing of these inputs. Subsequently, the processed signals are given to the outputs like LED's, buzzer and the GPS and GSM sends message to the care taker in case of health variations of the rider or if the rider is met with an accident.

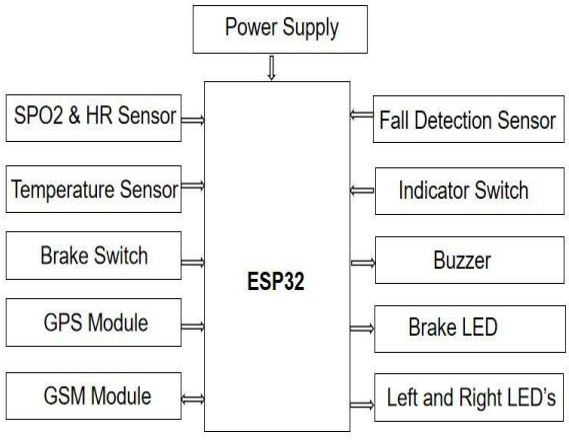

Fig.1 Block Diagram of Smart and Secure Cyclist's Helmet

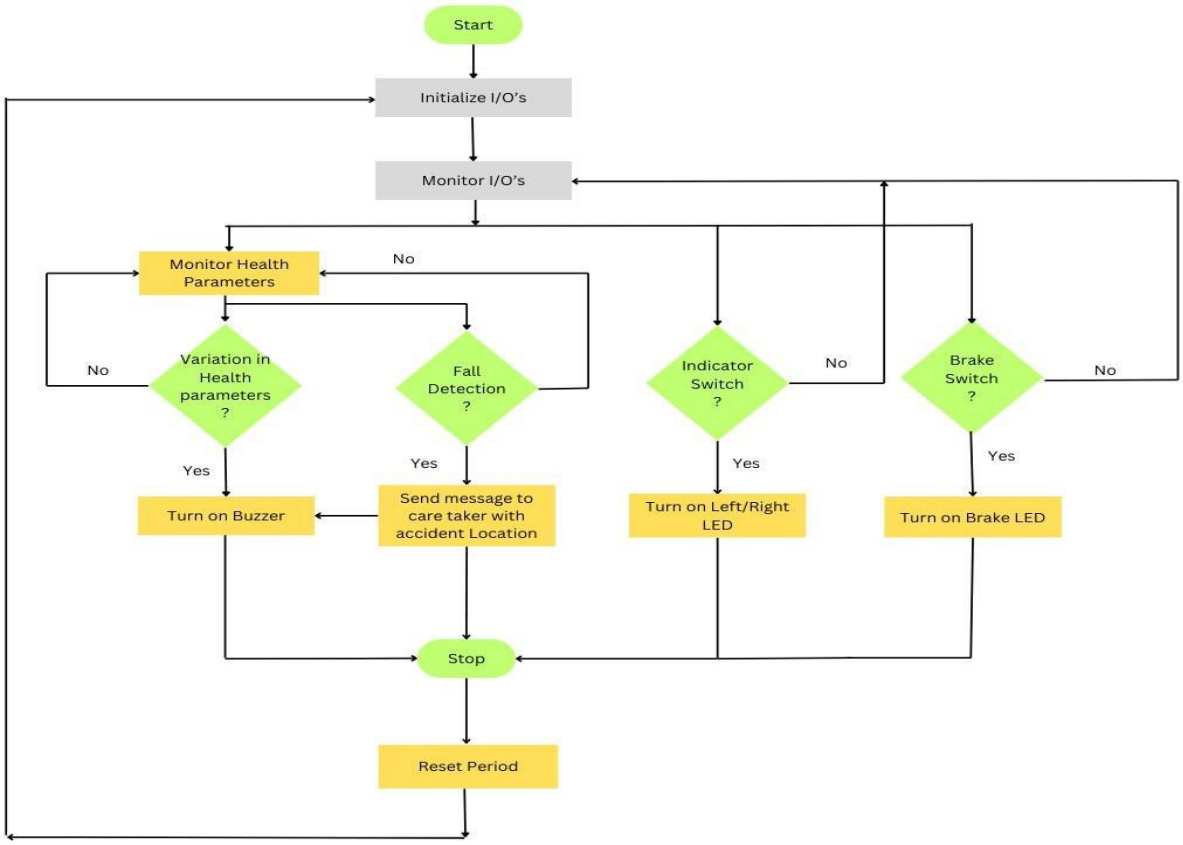

Fig.2 Flow Chart of Smart and Secure Cyclist's Helmet

The Fig.2 represents the step-by-step process that involves initializing I/O's and monitoring inputs of the smart helmet. Numerous health measures are continuously monitored, including heart rate, oxygen saturation, body temperature, and fall detection. The buzzer will beep to alert the rider to any changes in health metrics, such as elevated body temperature, decreased oxygen concentration, or elevated heart rate. Alternatively, the rider will be continuously monitored. The GPS and GSM module notifies the caregiver of the cyclist's location in the event of an accident or fall, and it also activates the buzzer to notify bystanders of the incident. These variables are constantly observed. The indicator lights on the helmet are activated by using the indicator switch.When the right indication switch is engaged, the rider's right turn is shown by the glowing right LEDs, and when the left indicator switch is engaged, the left side's LEDs glow to show the rider's left turn on the bike. The brake light at the back should shine to indicate that the cycle has stopped when the brake switch is pressed and held.

A reset period is set for the monitoring of the inputs continuously. The controller ESP32 controls all these operations by processing the inputs collected by the sensors and also the inputs given by the user for the turns and stop indication along with monitoring the health parameters. The controller ESP32 monitors the overall health along with the safety of the cyclist on the road during his ride. Thus, using a smart helmet offers greater benefits than donning a traditional helmet.

IV.RESULTS

A cost-effective cyclist's helmet is integrated with safety features like real-time GPS tracking for accident response, heart rate monitoring with alerts, and an audible health warning system. The helmet also incorporates LED indicators for turns and stops, promoting cyclist visibility and communication. The GPS and GSM sends the message to the care taker in case of accident. The cyclist's health metrics are tracked and notifications are sent out based on the circumstances.

Fig.3 Left turn indication

Fig.4 Right turn indication

Fig.5 Stop indication

V.CONCLUSION

Smart helmet is an effective solution to many problems. The system helps in efficient handling of the accidents by sending a SMS with the location of the rider to the family members. This ensures that the victim get proper medical attention if they have met with an accident. This system also monitors the rider's health like heart rate, body temperature and also the oxygen concentration in the riders body and gives him the warning in case of any changes.

The main advantages of this smart helmet are it offers an advanced level of safety with features like GPS tracking and health monitoring. Also smart helmets offer improved visibility and communication of the rider like having the indicators on the helmet. The health of the cyclist is monitored continuously for his well-being.

The limitations of this system are the system depends on the battery efficiency or its duration. Also the sensor calibration may not precise all the time and the user adaption may take time because of the new technologies.

FUTURE SCOPE

The system's reach can be extended by incorporating a LoRa module for accident detection in areas with weak cellular connectivity. Additionally, a camera can be integrated to record driver activity, enhancing safety and security. Furthermore, vehicle-to-vehicle communication can be enabled through a communication device, potentially improving road safety by allowing cars to share information about hazards or accidents.

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