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Smart Helmet Driven by Arduino Features Adaptive Sensors and Wireless Communication Technology

Kazi Kutubuddin Sayyad Liyakat*

Abstract

Equipped with wireless communication technology, sensors, and a microprocessor, the Arduino-Futured Smart Helmet constitutes an incredibly powerful and efficient device. The microcontroller serves as the brains of the helmet, receiving and processing data from the sensors and guiding the other components as necessary. This technology allows the helmet to monitor its surroundings and respond to them immediately. The integrated sensors in the helmet measure temperature, humidity, and fluctuations in the state of the air, among other things. They can also measure the wearer's heart rate and body temperature, which provides vital information about their overall health. The wearer then receives an in-depth understanding of how they are doing via a mobile app that receives this data wirelessly. One of the most crucial aspects of the Arduino-Futured Smart Helmet is its capacity to recognize and avoid collisions. When the sensors, which are designed to detect such situations, detect any unexpected impact or fall, an emergency signal is sent to the chosen emergency contact. This feature makes the helmet an essential piece of safety gear for activities such as motorcycling, skiing, and cycling where accidents are common. The smart helmet's built-in GPS allows for the wearer's location to be traced in an emergency. This function may be especially useful to outdoor recreation aficionados who often engage in activities in distant and unknown locales. In addition to providing turn-by-turn directions, the helmet's GPS can be utilized for navigation, making it a useful tool for both safety as well as convenience.

Keywords: Arduino, GPS, GSM, SIM, helmet system

INTRODUCTION

A helmet is one of the most important pieces of safety gear that an individual may use while riding a bicycle or a motorbike, or even when engaging in activities such as skiing or snowboarding. Despite the known benefits of wearing helmets, many people choose not to do so. A helmet is an essential component of safety equipment. They fail to recognize the multitude of circumstances in which a helmet may save a person's life. First, helmets protect the head, which is one of the most vulnerable regions of the body. In the event of an accident, a helmet acts as protection between one's head and anything that might impact it. It helps to disperse and absorb the shock equally, reducing the force of the hit on the skull. By doing this, serious harm such as skull fractures, concussions, and even mortality may be prevented. According to the World Health Organization, wearing a helmet can reduce the risk of brain damage by as much as 70%. Helmets serve as a clear precaution to motorists, in addition to protecting riders from injury. Especially at night or in bad weather, riders are more visible to other cars while wearing helmets with reflective stripes and bright hues. This can significantly reduce the likelihood of accidents caused by other cars not being able to see a rider.

***Author for Correspondence**
Kazi Kutubuddin Sayyad Liyakat
E-mail: drkkazi@gmail.com

Professor and Head, Department of Electronics and Telecommunication Engineering, Brahmdevdada Mane Institute of Technology, Solapur (MS), India

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Thanks to technical breakthroughs and the Arduino platform, a smart helmet, despite sounding like something out of a science fiction movie, is already a reality [1–3].

A helmet with attached sensors, microcontrollers, and communication modules is called a smart helmet. These technologies provide users with helpful information and enable helmets to perform a multitude of activities. This cutting-edge device can improve efficiency, increase safety, and simplify daily tasks [4, 5].

One of the most important components of a smart helmet is an Arduino microcontroller. Interactive electronic projects can be created using the Arduino open-source platform [6]. It is widely used in robotics, automation, and the Internet of Things [7, 8]. Because Arduino boards are simple to adapt and program [9, 10], they are an ideal option for powering smart helmets.

Ensuring user safety is the main goal of smart helmets. With the use of sensors, they can recognize potential threats and notify the user of them [11]. For instance, sensors [12] can detect sudden changes in acceleration, direction, or speed that could indicate a fall or collision. The helmet can instantaneously inform the wearer of such situations, allowing them to take the necessary safety precautions [13]. For riders who are more inclined to get in accidents, such as motorcyclists and cyclists, this is an especially useful feature.

The added benefit of a smart helmet is its communication capability. Through Bluetooth and Wi-Fi modules, the helmet can be linked to a smartphone or other device, allowing the user to receive calls, texts, and directions for navigation while taking their grip off of the handlebars or steering wheel. This feature is highly useful and enhances safety by reducing distractions [14].

A smart helmet may help monitor a user's health and performance. It can track vital indications such as heart rate, body temperature, and the amount of hydration. Using this data, a user's smartphone can receive information about their physical condition, allowing them to adjust their schedules or take rests as needed. Since a smart helmet can measure performance data including speed, distance traveled, and calories burned, it's a useful tool for athletes and fitness fanatics [15, 16].

Smart helmets are used, in addition to their safety and performance. It can also be used in a range of industries such as construction, mining, and firefighting, where workers are subjected to hazardous situations. Owing to its sensors, a smart helmet can monitor the temperature, air quality, and other variables, providing workers with early warnings and ensuring their safety.

There are endless options for a smart helmet, and no limits to what may be achieved with the ever-expanding Arduino community. Arduino is an ideal platform for developing smart helmets because of its open-source nature that encourages creativity and continuous progress. As additional developers and fans join the Arduino ecosystem, we expect to see more innovative and sophisticated smart helmets in the future [17, 18].

Numerous functions, including call and navigational capabilities, intoxication plus accident identification, and many more, enhance the status of a smart helmet. This helmet can be helpful for driver security and safety. For instance, you are unable to pedal a bike if you are intoxicated. Consequently, it has been updated using numerous features. The primary goal of smart-helmet communication is to increase driver safety.

A**pplication**s

1. It can be used when driving a motorcycle or scooter.
2. It can also keep up with the rider.
3. It may also be utilized to automatically finish calls and receive

Benefits

1. One benefit of smart helmets being that, in the event of an accident, they help shield the rider's head.
2. Additionally, one tool that can help prevent drunk driving is a sensor that measures an individual's degree of drunkenness.

PROPOSED SYSTEM

This system is composed of a transmitter (Figure 1) and a receiving section (Figure 2). Numerous electrical components, including GPS, GSM, and additional sensors, constitute this helmet. A functional 3G or 4G SIM card was also required for the GSM module. A smart helmet project powered by Arduino for accident detection is a highly creative idea. This helmet can shield a driver from injury during an accident. Additionally, it uses a GSM module to make a call and relay the location to your relatives. Figure 2 displays the circuit architecture of the smart-helmet receiver, which includes the GPS, GSM, servo motor, alcohol sensor, NRF module, and push button.

Only alcohol can be detected by a unique MQ3 sensor, which detects atmospheric moisture. The sensor can determine the moisture content of the alcohol. If the alcohol is in contact with the metal electrode of the sensor, it may be activated. The conductivity of the same electrode is high when alcohol comes into proximity with the sensor. This sensor can be sensed at the output pin, which makes it useful in the Arduino-Futured smart helmet project. Consequently, we can link the MQ3 sensor to an Arduino sensor.

The vibration sensor is another significant sensor. The vibration sensor under question was model number SW-420. The vibration sensor operated in a straightforward manner. There were numerous metal lines throughout the sensor. Ground plus signal cables were attached to both lines. The ball contacted both lines, conducted electricity, and generated a signal at the output pin when it vibrated. The GSM module was turned on using this vibration sensor. An Arduino constantly receives inputs from a vibration sensor. Our choice of microcontroller for this particular smart-helmet project is Arduino. In the event that the signal grows, the Arduino responds by taking appropriate action. if the smart helmet vibration sensor detects an approaching collision. The GSM module receives the message, and the call is initiated by Arduino.

We utilize the GSM SIM800L Module in our smart-helmet application for area navigation. It is activated by the use of the vibrating sensor. By employing both 4G and 3G SIM cards, the low-power GSM SIM800L module makes communication easier. It can establish GPRS connections using other devices, send and receive SMS messages, and conduct voice conversations. The quadband supports the 850/900/1800/1900 MHz frequency bands. The phone number, which can be used to place calls and send SMS messages, is updated in the program.

The Arduino-futured Helmet project uses the Neo 6M module to transmit its current location. This compact module outputs the position, time, latitude, and longitude in addition to receiving GPS signals. It is interoperable with the global navigation satellite system and operates with a global positioning system (GPS). It is crucial to remember that the module cannot receive GPS signals indoors or in areas with inadequate satellite coverage; it needs an unobstructed view of the nighttime sky to do so.

An application for the NRF module, a tiny, low-cost, high-power wireless transceiver running at 2.4 GHz, is wireless communication. It is also feasible to connect many NRF modules to one another and facilitate their interactions among them all. Any of the two NRF modules are attached to the transmitter and reception modules. NRF modules use a serial peripheral interface (SPI) protocol to establish connections between devices.

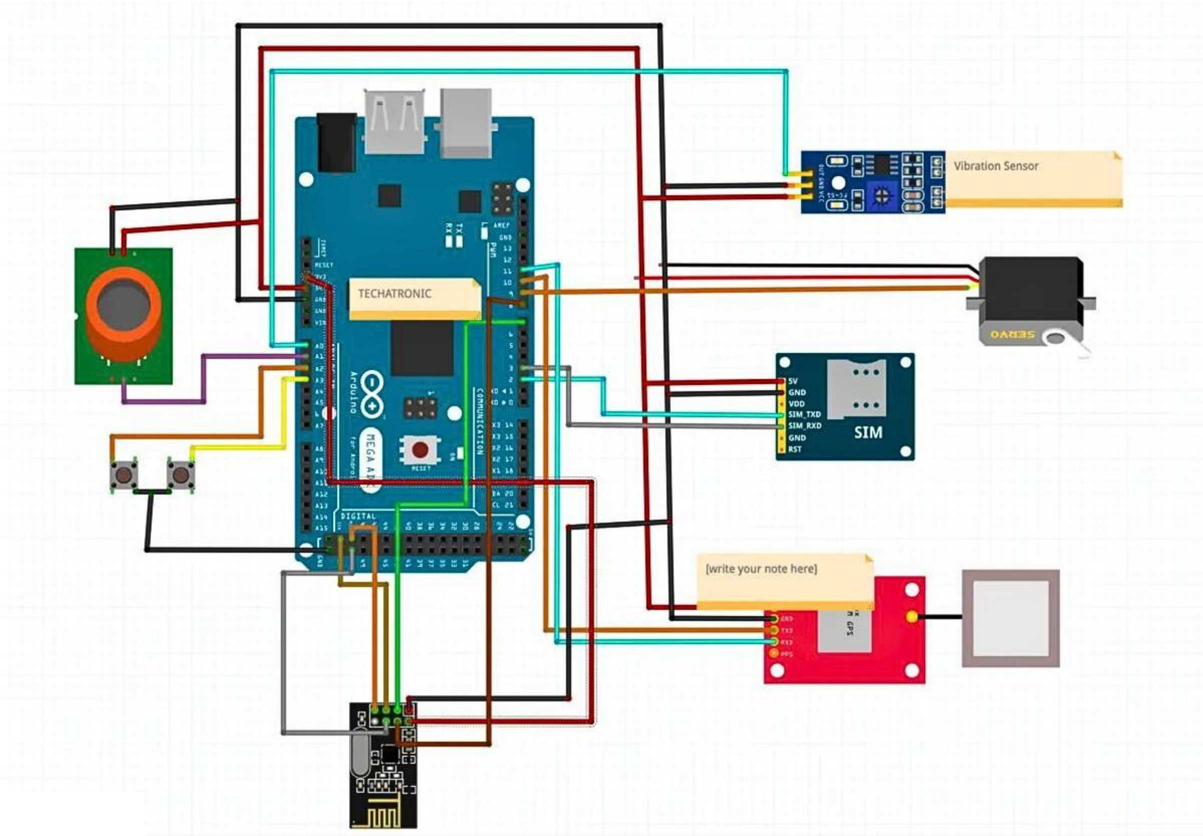

Figure 1. Suggested transmitter system.

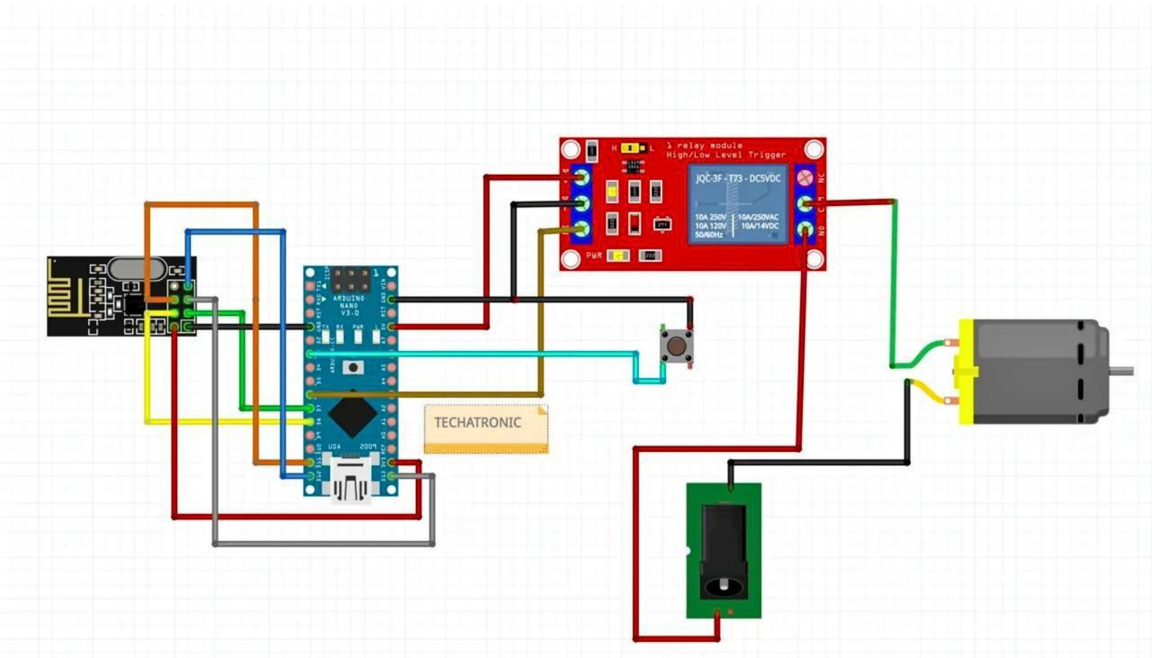

Figure 2. Suggested receiver system.

DISCUSSION

Figure 3 shows the entire proposed system comprising receiver and transmitter parts. Two sensors are installed in the helmet: one for detecting alcohol and the other for detecting accidents. An MQ3 sensor is sometimes referred to as an alcohol sensor.

The Arduino-powered smart-helmet project for accident detection is an innovative concept. In the event of an accident, the helmet can protect the driver from harm. It will also send your relative location and place a call using the GSM module.

Figures 4 and 5 depict the codes for both the transmitter and the receiver.

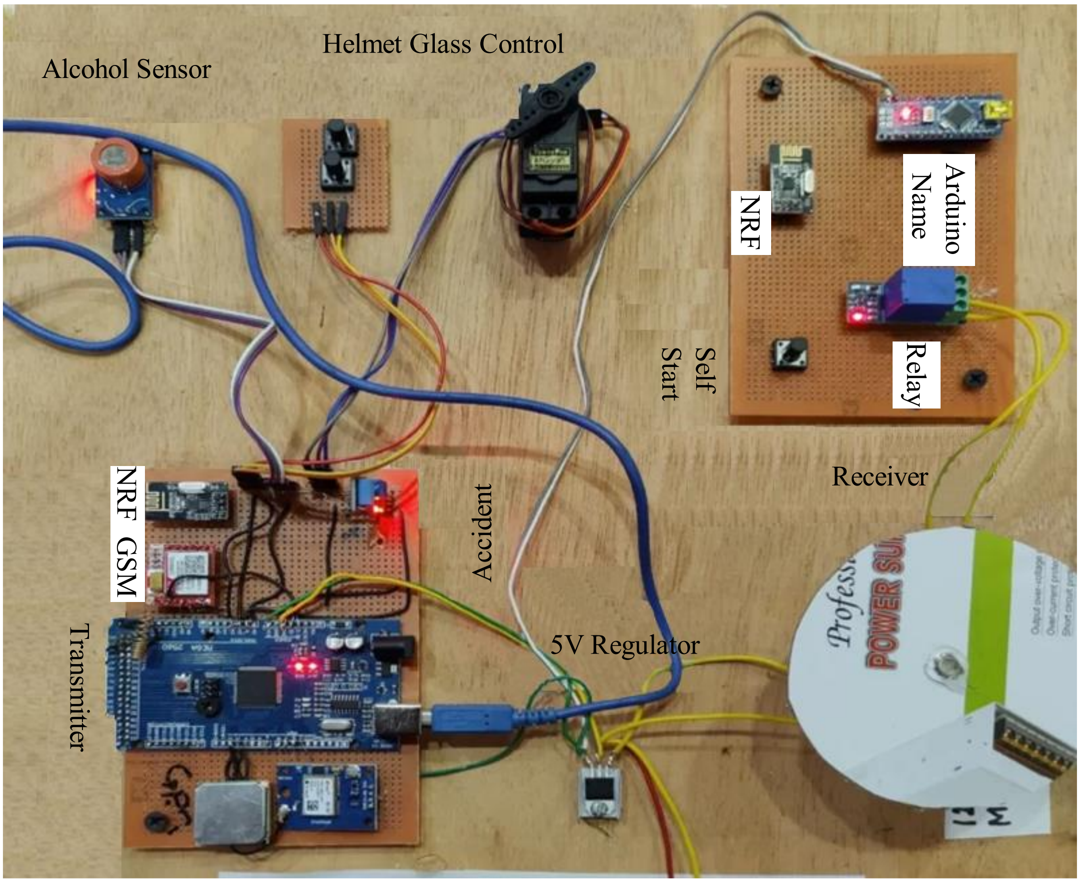

Figure 3. Suggested circuit schematic.

```
TinyGPS gps;
SoftwareSerial sgps(10, 11);
SoftwareSerial sgsm(2, 3);

void setup() {
  // put your setup code here, to run once:
pinMode(A0, INPUT_PULLUP);
pinMode(A1, INPUT_PULLUP);
pinMode(A2, INPUT_PULLUP);
pinMode(A3, INPUT_PULLUP);
 myservo.attach(9);

sgsm.begin(9600);
  sgps.begin(9600);
```

Figure 4. Part code of the transmitter.


```
void setup() {
  pinMode(6, OUTPUT);
   pinMode(3, INPUT_PULLUP);
  Serial.begin(9600);
  radio.begin();
  radio.openReadingPipe(0, address);
  radio.setPALevel(RF24_PA_MIN);
  radio.startListening();
}

void loop() {

  int c= digitalRead(3);
  if(c==0)

  {
```

Figure 5. Part Code of the Receiver.

CONCLUSION

The Arduino-Powered Smart Helmet has been one of the incredible technological innovations in the past several years. This innovative helmet has the power to drastically change how we think about safety and protection in a variety of sports. It is an essential item for any individual who values ease and safety because it combines the greatest features of both modern and classic helmets. Customization is an additional benefit of this smart helmet. Users can add or remove characteristics from the Arduino platform based on their requirements and preferences. Because of this characteristic, helmets are adaptable and appropriate for a variety of activities and occupations. In conclusion, the Arduino-powered smart helmet is groundbreaking in terms of its effectiveness, performance, and security. It can communicate, recognize threats, and monitor vital indicators. Such skills can improve a range of activities and save lives. As technology advances, we can expect to see even more incredible features and uses added to smart helmets, making them essential pieces of equipment for everyone.

REFERENCES

1. Liyakat KS, Liyakat KK. IoT based Arduino-powered weather monitoring system. J Telecommun Stud. 2023;8(3):25-31.
2. Liyakat. Arduino based weather monitoring system. J Switching Hub. 2023;8(3):24-29.
3. Gund VD, et al. PIR sensor-based Arduino home security system. J Instrumentation Innov Sci. 2023;8(3):33-37.
4. Kazi Kutubuddin, Sayyad Liyakat. System for love healthcare for loved ones based on IoT. In: Research Exploration: Transcendence of Research Methods and Methodology. Volume 2. ISBN: 979-8873806584, ASIN: B0CRF52FSX; 2023.
5. Kazi K. AI-driven IoT (AIIoT) in healthcare monitoring. In: Nguyen T, Vo N, editors. Using Traditional Design Methods to Enhance AI-Driven Decision Making. IGI Global; 2024. p. 77-101. Available from: https://doi.org/10.4018/979-8-3693-0639-0.ch003. Available at: https://www.igi-global.com/chapter/ai-driven-iot-aiiot-in-healthcare-monitoring/336693
6. Liyakat KK. Implementation of e-mail security with three layers of authentication. J Operating Syst Dev Trends. 2022;9(2):29-35.
7. Kazi Kutubuddin, Sayyad Liyakat. Blynk IoT-powered water pump-based smart farming. Recent Trends Semicond Sensor Technol. 2024;1(1):8-14.

8. Kazi Sultanabanu, Sayyad Liyakat. IoT-based alcohol detector using Blynk. J Electronics Design Technol. 2024;1(1):10-15.
9. Sultanabanu, Sayyad Liyakat. Accepting internet of nano-things: Synopsis, developments, and challenges. J Nanoscience Nanoeng Appl. 2023;13(2):17-26. DOI: https://doi.org/10.37591/jonsnea.v13i2.1464
10. Mishra SB, et al. Review of the literature and methodological structure for IoT and PLM integration in the manufacturing sector. J Adv Machines. 2024;9(1):1-5.
11. Magadum PK. Machine learning for predicting wind turbine output power in wind energy conversion systems. Grenze Int J Eng Technol. 2024;10(1):2074-80. Grenze ID: 01.GIJET.10.1.4_1
12. Mishra SB, et al. AI-driven IoT (AI IoT) in thermodynamic engineering. J Modern Thermodyn Mech Syst. 2024;6(1):1-8.
13. Sayyad Liyakat. Impact of solar penetrations in conventional power systems and generation of harmonic and power quality issues. Adv Res Power Electron Devices. 2024;1(1):10-16.
14. Kazi K. Modelling and simulation of electric vehicle for performance analysis: BEV and HEV electrical vehicle implementation using Simulink for E-mobility ecosystems. In: E-Mobility in Electrical Energy Systems for Sustainability. Hershey (PA): IGI Global; 2024. p. 295–320. DOI: 10.4018/979-8-3693-2611-4.ch014.
15. Sayyad Liyakat. Integrating IoT and mechanical systems in mechanical engineering applications. J Mechanical Robotics. 2023;8(3):1-6.
16. Kazi Sultanabanu, Sayyad Liyakat. IoT changing the electronics manufacturing industry. J Analog Digital Commun. 2023;8(3):13-17.
17. Liyakat KS, Liyakat KK. IoT in the electric power industry. J Controller Converters. 2023;8(3):1-7.
18. Liyakat KS, Liyakat KK. IoT in electrical vehicles: A study. J Control Instrum Eng. 2023;9(3):15-21.

