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IoT based Smart Helmet for Safe Driving

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***Abstract*— Two-wheelers play a significant part in the day-to-day life of Indians. When compared to a four-wheeler it's easy to learn and maintain two-wheelers. It has copious advantages like saving time in traffic, stress-free parking, easy access to interior places and a lesser amount of insurance fee equated to four wheelers. But when it comes to safety, four-wheelers are far better than two-wheelers. There are plenty of sensors and security systems that make the customer move towards the purchase of four-wheelers. The threat of losing lives while being involved in an accident is high in two-wheelers compared to four-wheelers. So it has become a foremost concern to avert such accidents and there should be an easy rescuing system for two-wheeler users when they are involved in an accident. Hence, this research study has devised a setup, where the system is skilled in guaranteeing the availability of the helmet, spotting the drunken state of the rider and reporting the nearby infirmary and police headquarters regarding the existence of an accident. In addition to this, the system also update the insurance agent regarding the existence of two wheeler collision and its location data for quickening the insurance claiming procedure.**

Keywords—Internet of Things, Helmet, Accident detection, Wi-Fi, Insurance, Two wheeler

I. INTRODUCTION

Two-wheeler sales in 2022 reached more than 12, 45,000 up to June [1]. This count seems to be 20.6% higher compared to that of the previous year. In the current scenario, the practice of using a two-wheeler has become obligatory among middle and upper-middle-class people. Since the usage of two-wheelers has increased to an excessive extent, the accident of two-wheelers is also getting accumulated.

As per the report from Hindu magazine [2], nearly 70,000 people in India have lost their lives in road accidents which contributes to around 44.5% of the deaths in 2021. As per the report from India Today article [3], 4 riders in India die every hour due to two-wheeler accidents because of not using helmets while driving. Hence it is required to devise a mechanism that should be capable of averting the accident. In addition to that, the device should also alert the authorities to attend to the people involved in the accident.

Figure 1 exhibits the top 5 states of India which have the highest death toll because of not using helmets while riding two two-wheelers. [4]. In this regard the state Tamilnadu tops the count with 6105 deaths.

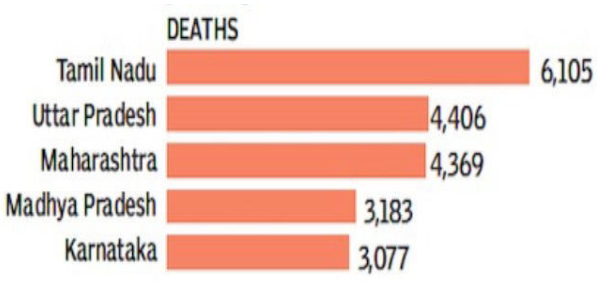

Fig. 1. Top 5 states with the highest death toll

The Internet of Things is defined as a collection of data with the help of physical objects. Further, it exchanges and processes them using the internet facility and other supportive software. IoT plays a major role in the food industry [5,6], retail industry [7], healthcare industry [8,9], transportation [10,11] etc. Hence it will be very much helpful in implementing this IoT based system with it. This system "IoT-based smart helmet for safe driving" performs the following functions

i. Ensuring the availability of helmets for the riders
ii. Ensuring the non-drunken state of the rider
iii. Alerting the rider in case of collision with the opposite object
iv. Detecting the accident spot after the collision and sending the location information to the concerned insurance agent, nearby infirmary, nearby police headquarters and a family member.

II. RELATED WORKS

Mahesh S Gour et al. suggested a system that uses an MQ3 sensor to find out the drunken state of the rider. In addition to this, the two-wheeler accident location info is

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sent to relatives as soon as it has met with an accident [12]. Sayanee Nanda et al. devised a system that contains a vibration sensor and proximity sensor to observe the occurrence of an accident [13]. It also comprises a GPS to exactly locate the collision spot and forward it to a medical centre for accidental care. The system also uses an RFID-based engine start-up mechanism which neglects the option of an unauthorised person accessing the vehicle. Dhruvesh H. Patel et al suggested a method to prevent the drunk and drive situation with the aid of an alcohol detection sensor [14]. In addition to this concept, GPS and GSM modules are introduced to exactly detect the accident location and inform the same to their relatives and doctors.

M. Lokeshwaran et al [15] proposed a smart helmet which consists of a force-sensing resistor to detect the accident and a heartbeat sensor to detect the condition of the patient involved in the accident. A similar sort of system is implemented by N Nataraja et al., [16]. S. Ram Prasath et al., [11] introduced a method which comprises of vibration sensor and GPS module. This method detects the accident via a vibration sensor and sends the location information to rescue personnel via a GPS module.

The demerits of the existing system is that it does not inform the infirmary and the insurance agent about the occurrence of accident. These problems will be rectified using our system

III. PROPOSED WORK

The proposed system includes Arduino, GPS, GSM, RFID reader, MQ 3 sensor, Wi-Fi module and a push button. Initially the Arduino checks for the input from the push button. The push button is placed inside the helmet. While wearing the helmet the top layer of the head will contact with push button which will turn on the push button. This confirms that the Rider's helmet is on.

After this, the system looks for a response from the MQ 3 sensor. If the threshold level is crossed then this provides an alert indication signal to Arduino regarding the intoxicated condition of the rider. If no input is acquired from MQ 3 Sensor then the rider is in a stable state. After ensuring these two constraints only the two-wheelers engine will be turned on. Apart from this, an ultrasonic sensor is positioned at the anterior end of the vehicle. This monitors the other vehicle's position which is travelling in front of our vehicle. Once any object or vehicle is witnessed within the striking range an alarm will be engendered and passed to the rider. This will prevent the collision to an extent. In addition to this, our system also has a vibration sensor which notices the collision of vehicles and conveys the signal to Arduino. Then Arduino collects the location of the collision spot and propels those data to the relative via the GSM module. The nearby infirmary will also receive the location details for handling the rider who was involved in the accident. The same info will also be passed to the police headquarters to preclude the hit and case. The insurance agency will also receive the location data to ensure the collision and to fasten the insurance claiming process. The architecture of this system is presented in figure 2.

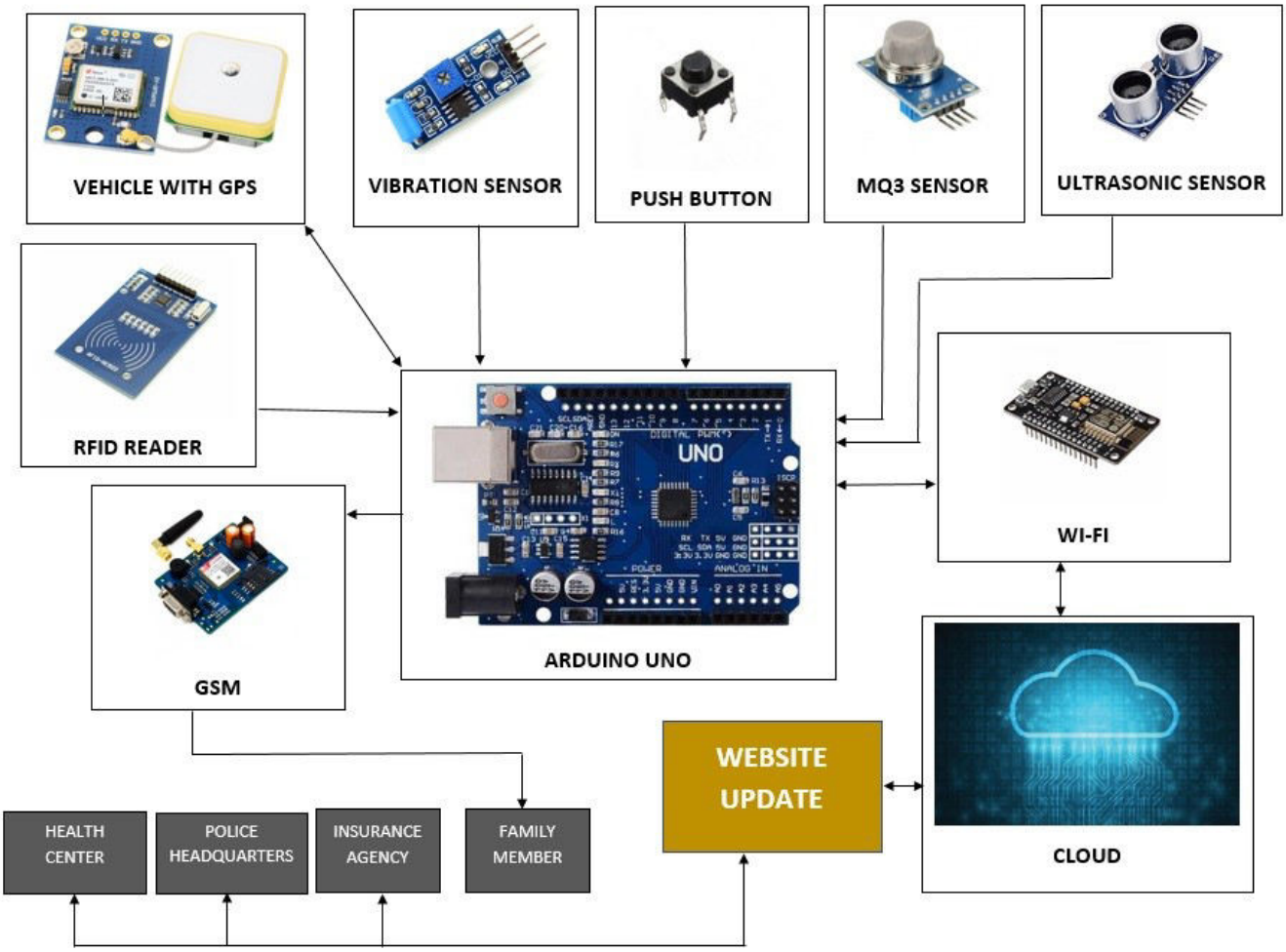

Fig. 2. Block diagram of IoT based Smart Helmet System

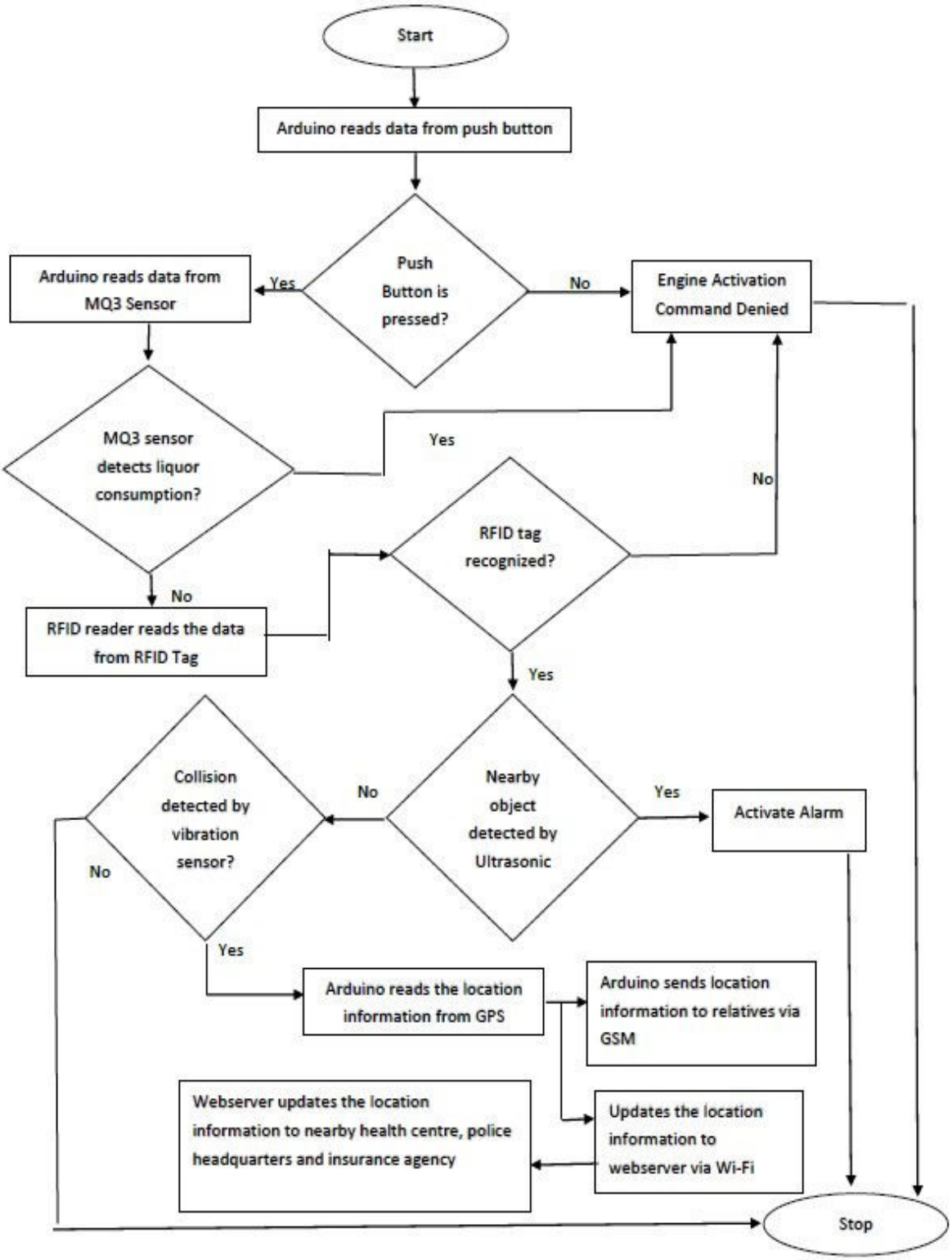

Fig. 3. Overall flow diagram

The flow diagram of the proposed system is presented in figure 3. The whole operational setup is elucidated using the following steps.

Step1: As soon as the system is turned on the Arduino Uno begins to sense the data from all possible sensors. First, the Arduino senses the pieces of information from the push

button. If the push button is turned on then the system certifies that the rider is wearing the helmet. If not then the system will not allow the rider to turn on the engine.

Step 2: If the system ensures the status of the helmet, then it looks for the stable state of the rider. If the MQ 3 sensor detects the intoxicated condition, then it alerts the Arduino. If the MQ 3 sensor doesn't detect any such liquor consumption it does not pass any info to Arduino. This ensures the stable state of the driver.

Step 3: After completing the two-stage verification then it goes for checking the authorized user. If the RFID reader detects the RFID tag, then our system enables the engine to be turned on.

Step 4: Once the engine gets turned on the Arduino looks for the input from the ultrasonic sensor. If the ultrasonic sensor spots any object or vehicle in front of the rider's vehicle and it is found to be within the threshold range, it sends an alert to Arduino. This in turn propels an alarm to the rider. If the ultrasonic sensor doesn't detect any obstacles within the threshold range, then the system ensues to the next stage

Step 5: If the rider has met with an accident and it is get observed by the vibration sensor then the system retrieves the location data attained from the GPS module and forwards those data first to the relative of the rider via the GSM module. Then by using the Wi-Fi module, the same details will be updated on the cloud server. From the cloud server, the collision location data are referred to the nearby identified infirmary and police headquarters. The same data will also be referred to the insurance agent for initiating the claiming process.

IV. RESULT & DISCUSSION

Whenever the two-wheeler encounters an accident, the system immediately retrieves the location details and shares them with their relative with the support of the GSM module. This is represented in figure 4.

Arduino takes 956ms to receive the data from vibration sensor. After receiving the information it is passed to the relatives within 55 seconds with the support of GSM.

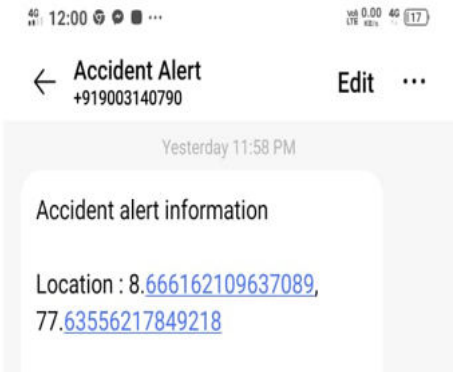

Fig. 4. SMS to rider's relative

Similarly, this system also refers the location details to the Insurance Agency (IA), nearby Infirmary (I) and nearby Police Headquarters (PH) with the support of a cloud server. It is represented using figure 5

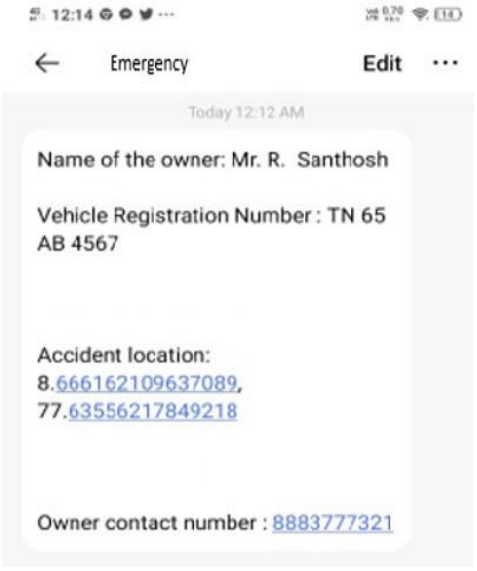

Fig. 5. Message transferred with the support of Cloud server

The two-wheeler collision details can also be witnessed on the website which is also shown in figure 6. A distinct two-wheeler database is maintained to enroll the particulars of the two-wheelers that have undergone an accident. The two-wheeler database is interpreted in Table I.

TABLE I. TWO WHEELER DATABASE

BIKE_ ID	BIKE_NAME	BIKE_NO	USER_NAME	USER_ CONTACT
1	Hero Passion Pro	TN 72 AJ 3872	Mr. Gautham	9789341098
2	Honda Activa	TN 65 AB 4567	Mr. Mani	9486075146
3	Honda Shine	TN 72 BC 7499	Mr. Ram	9566509646

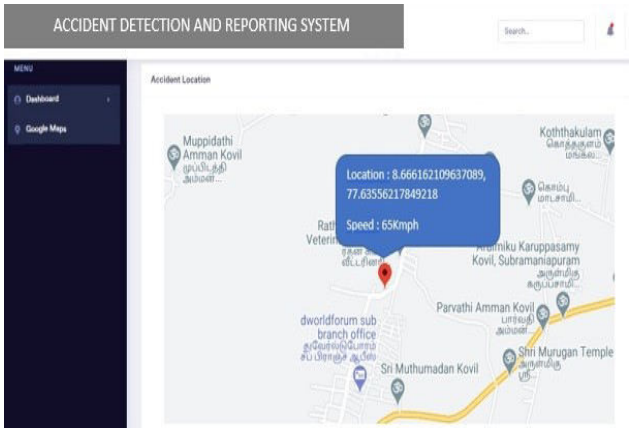

Fig. 6. Accident update process

A unique database is also maintained for Infirmary and Police Headquarters which contains the details of the

information passed by the cloud server. It is given in Table II and Table III

TABLE II. INFIRMARY DATABASE

HC_ID	INFIRMARY_PLACE	HC_CONTACT
1	Pattamadai Primary Health Centre	04634250380
2	Government General hospital, Cheranmahadevi	04364260650
3	Kallur primary health Centre	04634292272

TABLE III. POLICE HEADQUARTERS DATABASE

PD_ID	PH_PLACE	PH_CONTACT
1	Pattamadai Police Headquarters	04634260165
2	Cheranmahadevi police Headquaters	04634260 125
3	Sudhamalli Police Headquarters	04622342625.

Thus compared to the existing methods the system seems to be more effective in preventing the hit and run cases and it also sends the alert to insurance agent for quickening the insurance claiming process

V. CONCLUSION

This systemaffords a superior solution to avert the theft of automobiles. In addition to this, the system also guarantees the safety and stability of the drivers before preparing for the drive. Our system also delivers a solution for avoiding collision with other vehicles. Moreover, our system also guides the health care representatives and policemen to be present at the accident spot on time whenever the two-wheeler has witnessed an accident. The collision spots are also communicated to the relatives within a short time of the occurrence of the accident. This system also fastens and simplifies the insurance claiming progress.

REFERENCES

[1] https://www.financialexpress.com/express-mobility/vehicles/2-wheelers/two-wheeler-sales-report-june-2022-hero-leads-followed-by-honda-and-tvs/2584620/

[2] https://www.thehindu.com/news/national/two-wheelers-claimed-highest-number-of-lives-in-accidents-in-2021-ncrb-report/article65829329.ece

[3] https://www.indiatoday.in/diu/story/two-wheeler-death-road-accidents-helmets-states-india-1602794-2019-09-24

[4] http://indpaedia.com/ind/index.php/Road_accidents:_India

[5] N. Kumar, A. K. Dahiya, K. Kumar and S. Tanwar, "Application of IoT in Agriculture," 2021 9th International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions) (ICRITO), 2021, pp. 1-4, doi: 10.1109/ICRITO51393.2021.9596120.

[6] R. Niranjana, R. S. Krishnan, K. L. Narayanan, X. A. Presskila, E. G. Julie and S. Sundararajan, "Intelligent Itinerant Robot [IIR] for Agricultural Farm Monitoring using IoT," 2022 Second International Conference on Artificial Intelligence and Smart Energy (ICAIS), 2022, pp. 1346-1351, doi: 10.1109/ICAIS53314.2022.9742895.

[7] S. O. Kediya and S. Kumar, "An Analysis of Factors Affecting IoT Adoption by Indian Retail Industry," 2021 International Conference on Computational Intelligence and Computing Applications (ICCICA), 2021, pp. 1-3, doi: 10.1109/ICCICA52458.2021.9697253.

[8] R. Thirupathieswaran, C. R. T. Suria Prakash, R. S. Krishnan, K. L. Narayanan, M. A. Kumar and Y. H. Robinson, "Zero Queue Maintenance System using Smart Medi Care Application for Covid-19 Pandemic Situation," 2021 Third International Conference on Intelligent Communication Technologies and Virtual Mobile Networks (ICICV), 2021, pp. 1068-1075, doi: 10.1109/ICICV50876.2021.9388454.

[9] U. Umar, M. A. Khan, R. Irfan and J. Ahmad, "IoT-based Cardiac Healthcare System for Ubiquitous Healthcare Service," 2021 International Congress of Advanced Technology and Engineering (ICOTEN), 2021, pp. 1-6, doi: 10.1109/ICOTEN52080.2021.9493478.

[10] M. Al-Jabi, "Toward an IoT-enabled adaptive interactive bus transportation system," 2017 2nd International Conference on the Applications of Information Technology in Developing Renewable Energy Processes & Systems (IT-DREPS), 2017, pp. 1-4, doi: 10.1109/IT-DREPS.2017.8277802

[11] S. R. Prasath, R. S. Krishnan, S. M. Priya, M. A. Kumar, M. C. Ranjitham and Y. H. Robinson, "IoT based Smart Accident Detection [ISAD] System for Hit and Run Cases," 2022 International Conference on Electronics and Renewable Systems (ICEARS), 2022, pp. 555-560, doi: 10.1109/ICEARS53579.2022.9751931.

[12] M. S. Gour, D. K. S, P. Kumara, M. S, S. K. K and C. H, "Arduino based smart and intelligent helmet system for two-wheelers," 2020 IEEE International Conference on Distributed Computing, VLSI, Electrical Circuits and Robotics (DISCOVER), 2020, pp. 236-240, doi: 10.1109/DISCOVER50404.2020.9278032.

[13] S. Nanda, H. Joshi and S. Khairnar, "An IOT Based Smart System for Accident Prevention and Detection," 2018 Fourth International Conference on Computing Communication Control and Automation (ICCUBEA), 2018, pp. 1-6, doi: 10.1109/ICCUBEA.2018.8697663.

[14] D. H. Patel, P. Sadatiya, D. K. Patel and P. Barot, "IoT based Obligatory usage of Safety Equipment for Alcohol and Accident Detection," 2019 3rd International conference on Electronics, Communication and Aerospace Technology (ICECA), 2019, pp. 71-74, doi: 10.1109/ICECA.2019.8822104.

[15] M. Lokeshwaran, S. P. Nikhit Mathew and A. Joshuva, "Raphael—The Smart Helmet," 2020 International Conference on Wireless Communications Signal Processing and Networking (WiSPNET), 2020, pp. 48-51, doi: 10.1109/WiSPNET48689.2020.9198463.

[16] N. Nataraja, K. S. Mamatha, Keshavamurthy and Shivashankar, "SMART HELMET," 2018 3rd IEEE International Conference on Recent Trends in Electronics, Information & Communication Technology (RTEICT), 2018, pp. 2338-2341, doi: 10.1109/RTEICT42901.2018.9012338.