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Design and Implementation of Protective Headgear to reduce Human Casualties

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Abstract

A smart helmet is a type of protective headgear used by the rider which makes bike driving safer than before. The main objective of this methodology is to build a safety system which reduces the number of two-wheeler accidents and drunken drive cases. Belt Tie Sensor checks if the person is wearing the helmet or not. If the rider is not wearing the helmet, the bike remains off. The bike will start only when the rider is wearing the helmet. When the rider crashes, helmet hits the ground, Force sensors detect the motion and tilts of helmet and reports the occurrence of an accident. It sends the information of the corresponding location using GPS, and sends a message to the registered number using GSM. Main Advantage is that proposed helmet can be used for any bikes. It is not restricted to one user. Multiple users can use it. Panic button is provided to indicate the intensity of accident.

Key words: Accident, Tracking, Belt tie sensor

1. Introduction

A traffic accident is defined as any vehicle accident which occurs on public highway roads. The thought of developing this project comes to do some good things towards the society. Many deaths are happening as the two-wheeler accidents are increasing day by day. Head protectors (Helmets) have been made mandatory in Maharashtra State. Traffic collisions in India have expanded to a greater extent. According to Section 129 of Motor Vehicles Act, 1988 makes it needed for each and every riding a bike to wear defencing headgear adhering to guidelines of the BIS (Bureau of Indian Standards). The WHO association has momentarily referenced the reason and the avoidance of traffic accidents that occurred all throughout the planet. They likewise referenced the most elevated demise rate that occurred in India and the study additionally detailed according to the rate 1.5 lakh of street passing has been represented by every year around. Smart helmet is a type of protective headgear used by the rider which makes bike driving safer than before. Nowadays most of the countries are enforcing their citizen to wear helmet while riding a motorcycle and not to ride a bike when the person is under the influence of alcohol, but still the rules are being violated. In order to overcome this problem, “Ingenious helmet with bike system” is developed.

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When person met with an accident, The helmet will fall down. Many times, person might not get immediate medical help. Because of this, person might die. In our idea, we are using Arduino for controlling entire operations. Belt tie sensor is used. If rider does not wear helmet properly, then our system will not turn ON. Pressure and Tilt sensor is used to detect the accident. Safety button is introduced to indicate the person is safe after the accident. If this switch is pressed, then through GSM module safety message will be sent to selected contacts. During the accident, if safety button is damaged in accident, then it means that, rider needs immediate medical help.

2. Literature Review

In [1], G. A. Chougule et al., designed a helmet in which there are mainly four features that are useful to prevent the accident and brain damage to the rider. It also detects the vicinity of the twist of fate. There are critical devices in the clever helmet. Helmet unit and motorcycle unit, in helmet unit there is transmitter block and in bike unit a receiver block is there. The transmitter transmit signal from transmitter to receiver thru RF transmitter. There is a restriction transfer to come across whether or not the rider is sporting the helmet or no longer. MQ2 sensor is used to locate whether or not the rider has taken alcohol or now not while using. GSM and GPS machine is used to send the message to the relative whose sim wide variety is inserted in GSM. GPS gadget is to discover the region of coincidence. These all capabilities make easy helmet into smart helmet. This paper presents the smart helmet that ensures that the rider cannot start the motorbike without carrying it. This helmet makes use of simple cable substitute for wirelessly switching on a bike, in order that the motorbike could not start without both the key and the helmet. Also, on every occasion the driver starts ignition, the alcohol sensor measures the content material of the alcohol in his breath and mechanically switches off the motorcycle if he is drunken.

In the research paper [2], Dr. B.Paulchamy et al., implemented helmet using GSM and GPS technology. Vibration sensors are located in extraordinary places of helmet in which the chance of hitting is greater that are connected to microcontroller board. So when the rider crashes and the helmet hit the floor, those sensors sense and offers to the microcontroller board, then controller extract GPS statistics. When the records exceed minimum strain limit then GSM module routinely sends message to ambulance or own family members. This paper presents the smart helmet that ensures that the rider cannot start the motorbike without carrying it. This helmet makes use of simple cable substitute for wirelessly switching on a bike, in order that the motorbike could not start without both the key and the helmet. Also, on every occasion the driver starts ignition, the alcohol sensor measures the content material of the alcohol in his breath and mechanically switches off the motorcycle if he is drunken. then controller extract GPS statistics.

In [3], K. Vidhya, M. Kasisel vanathan et al., designed the helmet which consists of an intelligent system embedded into the helmet and the vehicle. Helmet unit ensures that the rider is carrying helmet and not beneath the effect of alcohol at some stage in the experience. It communicates with automobile unit to exchange off ignition gadget of bike if above situation isn't met. Vehicle unit checks and intimates twist of fate thru geometric coordinates through Short Message Service. By the usage of geometric coordinates, area of the in juried rider may be traced using simple monitoring software. Also, this system gives robbery safety as helmet is also crucial alongside key to start motorcycle. Helmet unit ensures that the rider is carrying

helmet and not beneath the effect of alcohol at some stage in the experience. It communicates with automobile unit to exchange off ignition gadget of bike if above situation isn't met. Vehicle unit checks and intimates twist of fate thru geometric coordinates through Short Message Service. situation isn't met. Vehicle unit checks and intimates twist of fate thru geometric coordinates through Short Message Service. By the usage of geometric coordinates, area of the in juried rider may be traced using simple monitoring software. Also, this system gives robbery safety as helmet is also crucial alongside key to start motorcycle.

In [4], Prajitha Prasad A et al., designed a helmet in which the flex sensor checks if the person wearing the helmet or not. Alcohol sensors locate the alcoholic content in riders' breath. If rider isn't wearing helmet or if there may be any alcohol content material found in rider's breathe the motorbike remains off. The bike will start until the rider wears the helmet and if there may be no alcoholic content material present. When the rider crashes, helmet hits the floor, sensors come across the movement and tilts of helmet and reports the occurrence of an accident. It sends records of the corresponding region to family contributors of the rider and emergency contact variety Index Terms: Biker's protection, Accident detection, Smart helmet, Alcohol detection. So, while the coincidence takes place, it'll send message by using GSM to the registered numbers with their contemporary area by GPS module. It can be used to obtain name at the same time as driving. The distinct application of challenge is falling detection, if the bike rider falls from the motorbike, it will ship the message automatically.

In [5], Mr. Salunke et al., designed a smart helmet with advance features like alcohol detection, accident identification, location tracking, use as a hands-free device, solar powered, fall detection. Its compulsory to wear helmet, without helmet ignition transfer can't ON. A RF Module as wi-fi link which able to communicate between transmitter and receiver. If rider getting drunk it receives mechanically ignition transfer is locked, and send message routinely to their check in variety with their present-day place. So, while the coincidence takes place, it'll send message by using GSM to the registered numbers with their contemporary area by GPS module. It can be used to obtain name at the same time as driving. The distinct application of challenge is falling detection, if the bike rider falls from the motorbike, it will ship the message automatically. The exploration additionally assists with knowledge the smart head masking framework advanced over the length and as of now by way of using growing innovation like Internet of Things (IoT). This likewise addresses the canny engine - wheeler head overlaying framework that's utilized to educate the rider about again huge vans/Buses for dodging crashes.

In [6], Amgoth Kishore et al., proposed the shrewd head covering framework that is utilized to forestall the mishaps in engine two-wheeler and to recognize the two-wheeler mishaps on schedule for health of individual. Additionally, the notable head covering framework dissected on this paper is used in digging industry for protecting the excavators from risky activities in the mine and to warning the diggers from hazardous fuel emanations inner it. The exploration additionally assists with knowledge the smart head masking framework advanced over the length and as of now by way of using growing innovation like Internet of Things (IoT). This likewise addresses the canny engine - wheeler head overlaying framework that's utilized to educate the rider about again huge vans/Buses for dodging crashes. This likewise addresses the canny engine - wheeler head overlaying framework that's utilized to educate the rider about again huge vans/Buses for dodging crashes. The notable head covering framework dissected on this paper is used in digging industry for protecting the excavators from risky activities in the mine and to warning the diggers from hazardous fuel emanations inner it.

In [7], the author Sreenithy Chandran et al., discussed about the sensors, Wi-Fi enabled processor, and cloud computing infrastructures that are utilised for building the system. The twist of fate detection device communicates the accelerometer values to the processor which constantly monitors for erratic versions. When the coincidence occurs, the related info is despatched to the emergency contacts by way of utilising a cloud-based totally provider. The vehicle vicinity is received via utilising the global positioning system. The machine guarantees a reliable and short delivery of information referring to the accident in real time and is appropriately named Konnect. Then detecting if the rider has consumed alcohol or not, whether if these two conditions are yet satisfied then only the motor will ignite or else it will not ignite. In case an accident occurred, our system is capable of detecting the accident and its location approximately. Led strip indication in the helmet unit is to reduce the percentage of an accident during night times. The vehicle vicinity is received via utilising the global positioning system.

In [8], P. Dharani et al., designed a system that is capable of detecting the rider is whether wearing the helmet or not. Then detecting if the rider has consumed alcohol or not, whether if these two conditions are yet satisfied then only the motor will ignite or else it will not ignite. In case an accident occurred, our system is capable of detecting the accident and its location approximately. Led strip indication in the helmet unit is to reduce the percentage of an accident during night times. The twist of fate detection device communicates the accelerometer values to the processor which constantly monitors for erratic versions. When a coincidence occurs, the related info is despatched to the emergency contacts by way of utilising a cloud-based totally provider. The vehicle vicinity is received via utilising the global positioning system. The machine guarantees a reliable and short delivery of information referring to the accident in real time and is appropriately named Konnect. Then detecting if the rider has consumed alcohol or not, whether if these two conditions are yet satisfied then only the motor will ignite or else it will not ignite. Led strip indication in the helmet unit is to reduce the percentage of an accident during night times.

In [9], Sayan Tapadar et al., proposed mechanisms that can detect if one is wearing the helmet, detect accidents, and detect whether the person has over-consumed alcohol. For this purpose, we use onboard sensors – flex sensor, effect sensor, accelerometer (ADXL355) and breath-analyser (MQ3). The accelerometer measures the exchange in tilt, in X Y and Z axes respectively, and sends the information to a server through an internet software programming interface (API). The breath analyser senses the amount of alcohol gift in the breath of a person carrying the helmet and reports if it is past the felony restriction. The server additionally makes use of the information gathered from the accelerometer and the stress sensors, to teach a help vector system (SVM). This can help to optimize coincidence detection within the future when enough statistics is gathered to offer dependable accuracy. The helmet can hook up with any cell phone through Bluetooth, to communicate with the web API, the use of the net connection of the phone. This will make sure the holistic protection of the rider always.

In [10], Priya Parameshwari designed a system which checks the two conditions before turned ON the engine of the bike. This machine consists of an alcohol sensor and a helmet sensing transfer. A transfer is used to detect whether the biker is sporting helmet. Alcohol sensor is used to hit upon the biker is drunk, the output is fed to the MCU. Both the switch and the alcohol sensor are outfitted in the helmet. If any of the two situations are violated the engine will not grew to become ON. Alcohol sensor MQ3 is used right here for detecting the alcohol awareness gift inside the motive force's breath. Sensor presents an analog resistive output based totally at the alcohol attention. MCU takes or read information from the sensors and controls all the functions of the entire system by using manipulating these data. Alcohol sensor is hooked up to the MCU thru an interfacing circuit and the helmet sensing transfer is at once linked to the MCU. MCU gets information from these sensors and it offers a virtual information corresponding to the output of sensors to the

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encoder simplest if the two conditions are glad. Alcohol sensor is used to hit upon the biker is drunk, the output is fed to the MCU. Both the switch and the alcohol sensor are outfitted in the helmet. If any of the two situations are violated the engine will not grew to become ON.

3. Proposed Methodology

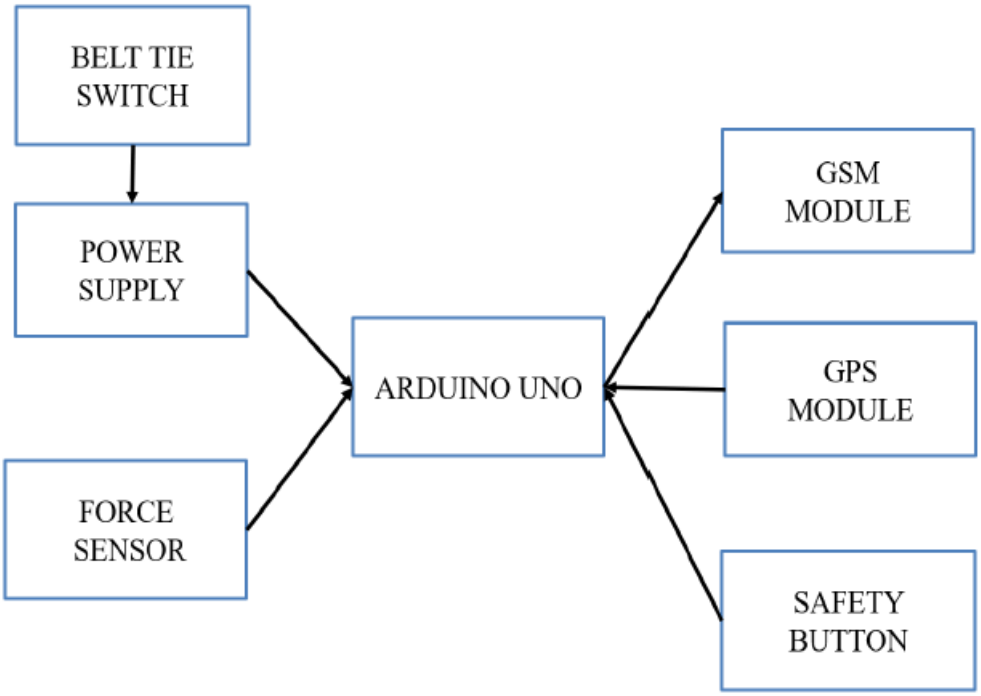

Fig 1: Block Diagram

In this above figure we start from belt tie switch, If the belt tie switch is connected only the power supply will turn ON to the (UNO). In this we are using pressure sensor to find out the accident occurred or not. If the accident occurred then GPS will find out the longitude and latitude point and that data is sent to the selected contact numbers. The safety button is used to send another message if the rider is safe.

- Belt Tie Switch: The belt tie switch serves as the power supply initialization mechanism for the system. When the rider wears the helmet and fastens the strap, the switch is closed, completing the circuit and providing power to the system. This ensures that the system is activated only when the helmet is worn.

- Arduino: The Arduino microcontroller acts as the brain of the smart helmet system. It receives inputs from various sensors and controls the system's behaviour based on the programmed logic. It processes the data from the sensors, performs calculations, and triggers appropriate actions or events accordingly.

- GPS (Global Positioning System): The GPS module is used to determine the precise location of the helmet wearer. It receives signals from multiple satellites and uses the timing of these signals to calculate the wearer's latitude, longitude, and altitude. The Arduino collects this location data from the GPS module.

- GSM (Global System for Mobile Communications): The GSM module enables communication over mobile networks. In the smart helmet system, it is used to transmit the

wearer's location information to the selected contacts. The Arduino communicates with the GSM module to send SMS messages or make phone calls to the predetermined contacts, providing them with the wearer's location details.

- Force Sensor: The force sensor is used to detect accidents or significant impacts. It measures the force or pressure applied to the helmet. When the force exceeds a predefined threshold, the force sensor triggers an event or sends a signal to the Arduino, indicating a potential accident. This event can then initiate further actions, such as activating emergency response measures or notifying the selected contacts.

- Safety Button: The safety button is a manual switch that allows the rider to interact with the system after an accident has occurred. If the rider presses the safety button within 2 minutes of the accident, it indicates their safety and triggers the "Safe Message Transmission" process. The Arduino monitors the state of the safety button and takes appropriate actions based on its status.

When the force sensor detects an accident or significant impact, it triggers the "Accident Detected" event. This event notifies the Arduino that an emergency situation has occurred, prompting the system to initiate the necessary response actions. If the rider presses the safety button within 2 minutes of the accident, indicating their safety, the Arduino triggers the "Safe Message Transmission" process. This involves using the GSM module to send a message or notification to the selected contacts, informing them that the rider is safe. The content of the message can be customized based on the system requirements, such as a predefined text or an automated notification indicating the rider's well-being. In summary, the smart helmet system uses a combination of sensors, microcontroller, GPS, GSM module, force sensor, and a safety button to enhance rider safety. It detects accidents, Smart Helmet provides accurate location information to selected contacts, and allows the rider to indicate their safety by pressing the safety button within a specific time frame.

FLOWCHART

The belt tie switch serves as the power supply initialization mechanism for the system. When the rider wears the helmet and fastens the strap, the switch is closed, completing the circuit and providing power to the system. This ensures that the system is activated only when the helmet is worn. The Arduino microcontroller acts as the brain of the smart helmet system. It receives inputs from various sensors and controls the system's behaviour based on the programmed logic. It processes the data from the sensors, performs calculations, and triggers appropriate actions or events accordingly. The GPS module is used to determine the precise location of the helmet wearer. It receives signals from multiple satellites and uses the timing of these signals to calculate the wearer's latitude, longitude, and altitude. The Arduino collects this location data from the GPS module. The GSM module enables communication over mobile networks. In the smart helmet system, it is used to transmit the wearer's location information to the selected contacts. The Arduino communicates with the GSM module to send SMS messages or make phone calls to the predetermined contacts, providing them with the wearer's location details. The force sensor is used to detect accidents or significant impacts. It measures the force or pressure applied to the helmet. When the force exceeds a predefined threshold, the force sensor triggers an event or sends a signal to the Arduino, indicating a potential accident. This event can then initiate further actions, such as activating emergency response measures or notifying the selected contacts. The safety button is a manual switch that allows the rider to

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interact with the system after an accident has occurred. If the rider presses the safety button within 2 minutes of the accident, it indicates their safety and triggers the "Safe Message Transmission" process. The Arduino monitors the state of the safety button and takes appropriate actions based on its status.

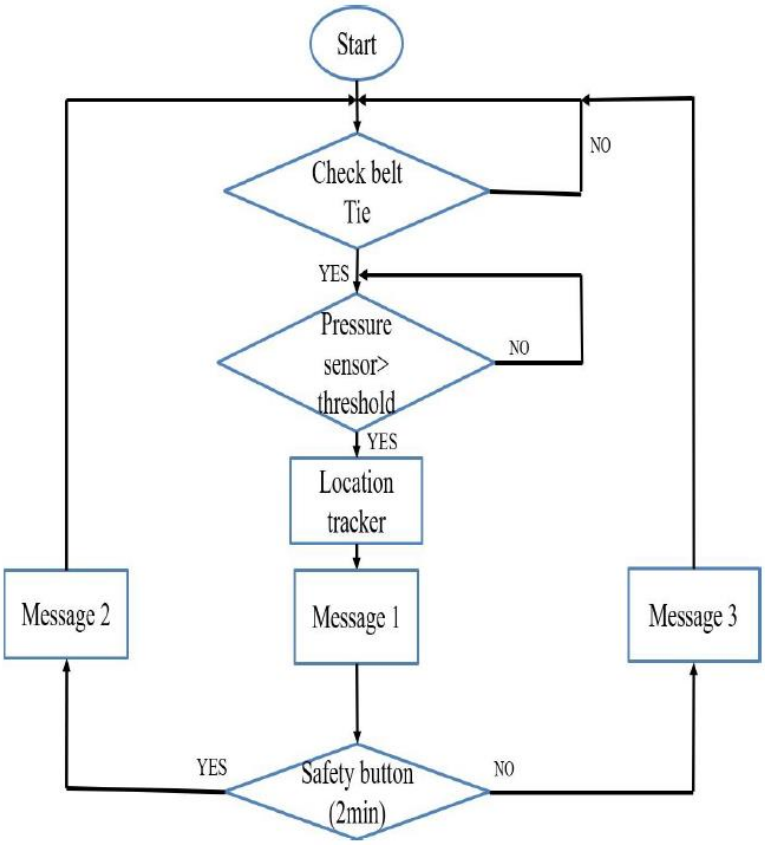

Fig 2: Flow Chart

In this above figure it will check that belt tie sensor is connected or not if it is connected power supply will ON. If it is not connected the power supply will not turn on after power supply turn on the tilt and pressure sensor will find out the accident occurred (or) not. If the rider met with accident, The GPS will find out the latitude and longitude point of accident. The data will send through GSM module to the selected numbers. In sometimes the accident happen but the rider is safe for that cases we are using a safety button. The safety button will work for two minutes after the accident happened only. If rider press the safety button, then another message will be sent through the GSM module, I am safe. If the rider didn't press the safety button, then a message will be sent to a selected numbers which is saved in GSM. After this process it starts again.

4. Implementation and Testing

The GSM module enables communication over mobile networks. In the smart helmet system, it is used to transmit the wearer's location information to the selected contacts. The Arduino communicates with the GSM module to send SMS messages or make phone calls to the predetermined contacts, providing them with the wearer's location details.

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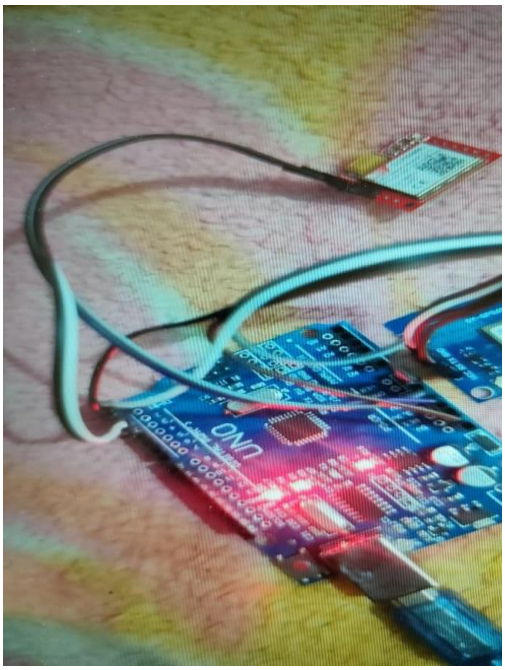

Fig 3 (a): Implementation of GSM

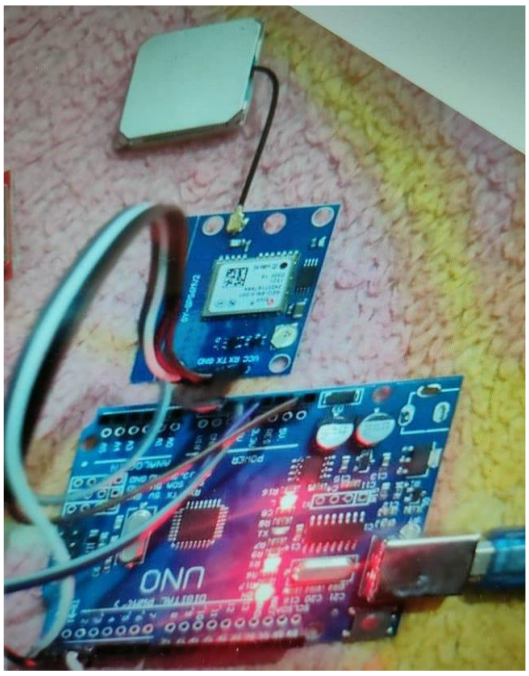

Fig 3 (b): Implementation of GPS

The GPS module is used to determine the precise location of the helmet wearer. It receives signals from multiple satellites and uses the timing of these signals to calculate the wearer's latitude, longitude, and altitude. The Arduino collects this location data from the GPS module.

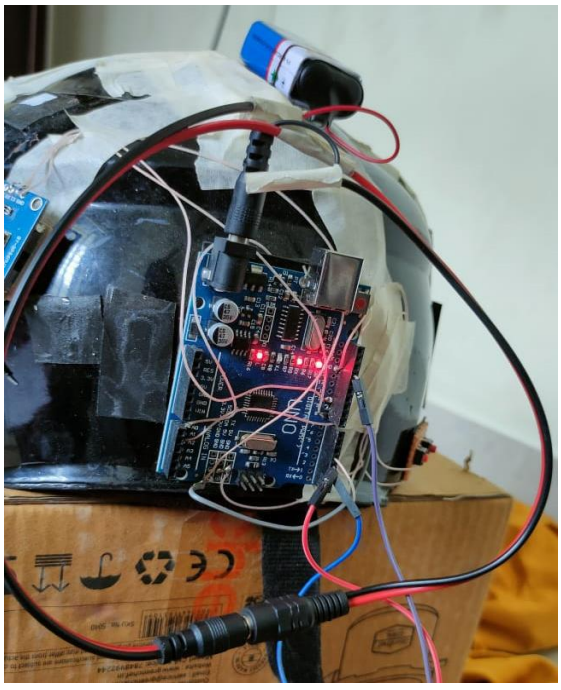

Fig 4(a): When Belt tie switch is connected

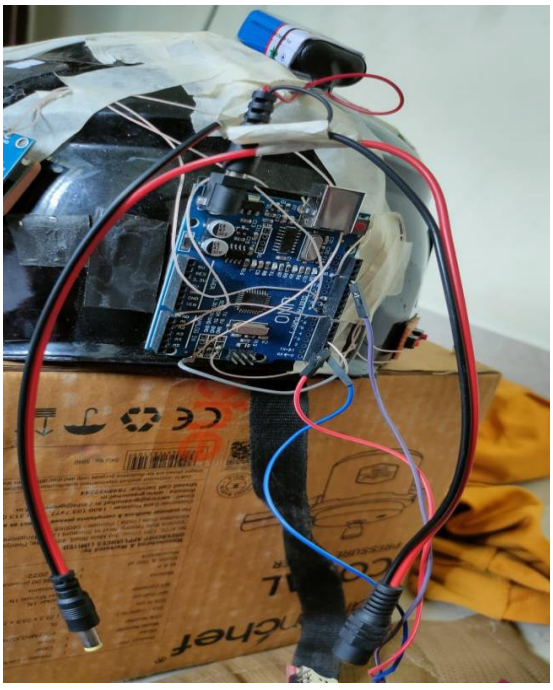

Fig 4(b): When Belt tie switch is not connected

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The belt tie switch serves as the power supply initialization mechanism for the system. When the rider wears the helmet and fastens the strap, the switch is closed, completing the circuit and providing power to the system. This ensures that the system is activated only when the helmet is worn.

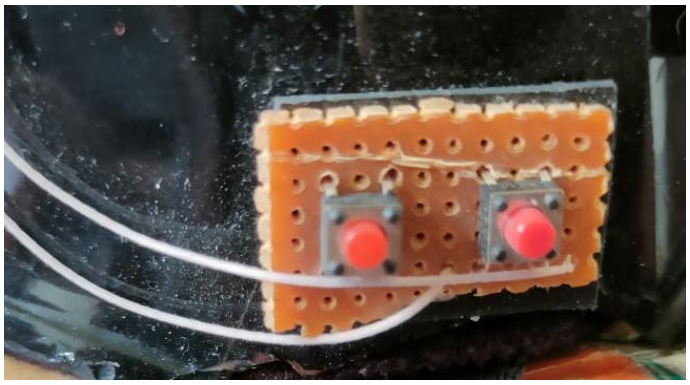

Fig 5: Safety Button

The safety button is a manual switch that allows the rider to interact with the system after an accident has occurred. If the rider presses the safety button within 2 minutes of the accident, it indicates their safety and triggers the "Safe Message Transmission" process. The Arduino monitors the state of the safety button and takes appropriate actions based on its status.

5. Results and Discussion

When an accident occurs, the impact force sensor registers the force exerted upon it and provides a corresponding reading. The magnitude of the reading can indicate the severity or intensity of the impact. By analysing the force reading, it becomes possible to assess the level of damage, evaluate safety implications, trigger appropriate responses or alarms, and potentially provide valuable data for accident investigation or analysis.

It's important to note that the specific threshold or range of force readings considered as indicative of an accident will depend on the intended application and the calibration of the force sensor. Manufacturers often provide specifications and guidelines to determine what force levels are considered significant for accident detection or analysis based on the capabilities and intended use of the sensor.

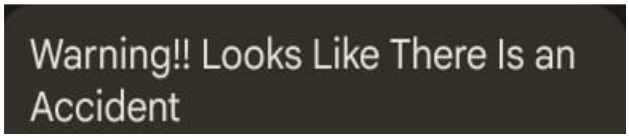

Fig 6: Accident Notification

When an accident occurs, the smart helmet system can send a message or notification to predetermined contacts or emergency services to inform them about the incident. This message serves as an alert, providing important information about the accident. The message begins with an indication that an accident has occurred. It may include phrases such as "Warning" or "Emergency Notification" to grab the attention of the recipient and convey the urgency of the situation.

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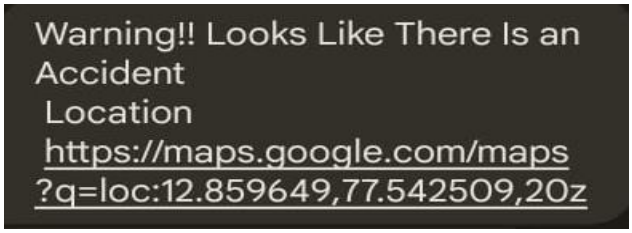

Fig 7: Accident Notification with Location

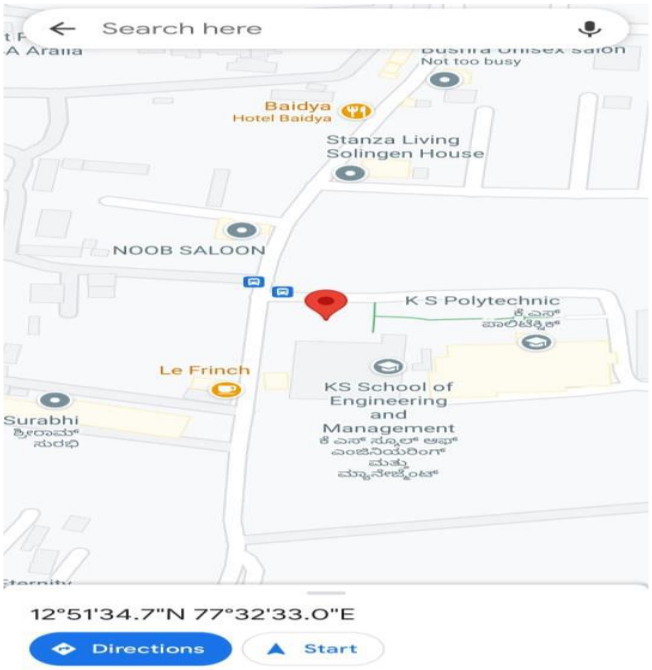

Fig 8: Sample Accident Location

When an accident occurs, the smart helmet system can send a message or notification to predetermined contacts or emergency services to inform them about the incident. This message serves as an alert, providing important information about the accident and the rider's location. The message includes the GPS-derived location data of the accident. This includes the latitude, longitude, and potentially the altitude coordinates of the rider's position at the time of the accident. These coordinates enable responders to quickly locate the accident site and provide aid or support.

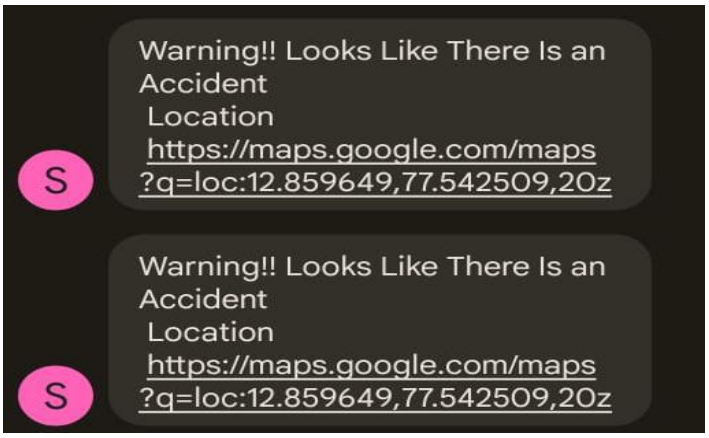

Fig 9: Alert Notification

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In the event that the rider does not press the safety button within 2 minutes of the accident, the smart helmet system can send an additional message to the predetermined contact numbers. This message serves as a notification that the rider has not confirmed their safety within the specified timeframe, indicating a potential need for assistance or further attention. The message begins with an alert indicating that an accident has occurred and the rider's safety status has not been confirmed within the allocated time. The message includes the GPS-derived location data of the accident, similar to the initial accident message. The message may include a request for assistance or further action from the recipients. This can prompt them to take appropriate measures to ensure the rider's well-being. The method of message transmission remains the same as in the initial accident message, typically utilizing the GSM module to send SMS messages to the predetermined contact numbers.

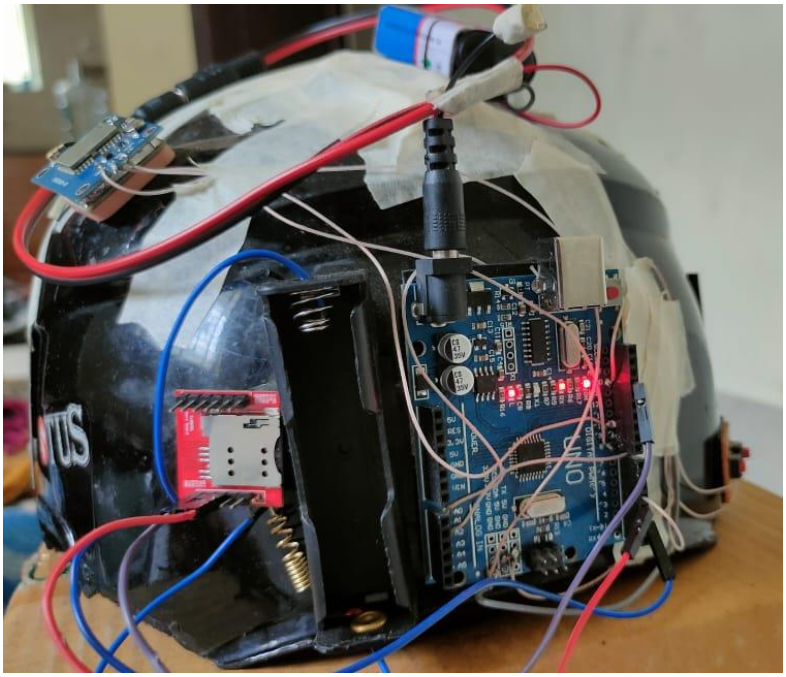

Fig 10: Final Model of Proposed System

6. Conclusion

Person must act on time when another individual is wounded otherwise, a valuable life might be lost. We need to know how precious lives of people are and what importance first-aid carries in saving these valuable lives. The system efficiently ensures that, the rider is wearing the helmet throughout the ride and Accident detection. By implementing this, a safe two-wheeler ride is possible which will prevent the head injuries during the accident. The proposed approach makes it mandatory to use this protective guard in order to drive a two-wheeler vehicle and therefore reduces the risks of brain injuries and deaths in case of accidents. This technology can further be implemented by using small cameras for recording the driver’s activity. It can be used for passing message from one vehicle to another vehicle by using wireless transmitter. It can also be implemented in cars by replacing the helmet with seatbelt.

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