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A SMART HELMET TO DETECT ANOMALIES OF ITS USERS AND ENVIRONMENT

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Abstract
The Smart Helmet is an intelligent device that can tell if a person is wearing a helmet and if they are driving with non-alcoholic breath. In this case, we have a transmitter on the helmet and a receiver on the bike. A switch ensures that the helmet is always on the user's head. The ON state of the switch guarantees that the helmet is correctly placed. Alcohol sensors are installed near the rider's mouth; if any of these conditions are not met, then the engine can't start. If the rider is involved in an accident and the helmet is thrown to the ground, then the alcohol sensor detects this and activates the GSM Module, which automatically contacts a family member. It is our main goal to make it easier for motorcycle riders to see on the road. Ultrasonic sensors and a vibrator motor in the new system can measure the necessary distances between passing motorcycles and the vehicle in the rear. The system will alert the rider through the vibrator motor, LEDs, and buzzer that are installed on their helmet as a warning to them about the range of insecurity that the ultrasonic sensor detects. Arduino UNO was used as the system's primary processing unit to manage all the system's networking elements. Arduino UNO put in front of the rider and displays the distance detected by the ultrasonic sensor using OLED displays. Data transmitted by the ultrasonic sensor will be wirelessly transferred to the helmet node, which serves as a reception unit, using the wireless transceiver module.

INTRODUCTION

It is estimated that almost 1.3 million people lose their lives as a direct result of being involved in a car accident every single year. There are an estimated 20 to 50 million additional people who suffer from non-fatal injuries, and many of these people are left with disabilities because of their injuries. Individuals, their families, and sometimes entire countries suffer substantial economic losses due to road traffic accidents [1-14].

- More than half of all fatalities resulting from traffic collisions occur among the most vulnerable road users, including pedestrians, cyclists, and motorcyclists.

- Even though these countries are home to around 60 percent of the world's automobile population, low- and middle-income countries account for 93 percent of all fatalities that occur on the world's roadways.
- Road traffic collisions are responsible for a loss of three percent of the gross domestic product in most countries.

A safe transportation system for all road users is the goal of the safe system approach to road safety. People's sensitivity to serious injuries in car accidents is taken into consideration while designing a forgiving system. All these aspects must be addressed if we are to reduce the number of fatalities and serious injuries caused by vehicle collisions and other traffic-related fatalities and injuries. The following are a few impacts of speeding:

- The likelihood of an accident occurring, as well as the severity of the results of the crash, are closely correlated with an increase in average speed
- The danger of fatality for pedestrians struck by moving cars increases quickly (by 4.5 times from 50 to 65 km/h).
- At 65 km/h, there is an 85% chance of death for vehicle occupants in accidents.

Accidents on Pakistani roads are caused by drivers' recklessness and disregard for traffic regulations, claiming the lives of thousands of innocent passengers and causing property damage in millions of dollars. The statistics are quite startling, and they require the urgent and serious attention of all parties involved to take corrective action. The Pakistan Bureau of Statistics (PBS) released a report on road accidents at the beginning of this year, covering the years 2009 through 2020. The data on the number of road accidents in Pakistan, which were acquired through the various provincial police offices, reveals an alarmingly high number. The number of road accidents that occurred in Azad Jammu & Kashmir (AJK) and Gilgit-Baltistan, where the accident ratio is significantly worse, is not included in these statistics. The instances that have been reported to police departments are reflected in the statistics that have been published in the report by PBS. However, it is reasonable to assume that there are considerable numbers of daily traffic accidents that are not being recorded and so are not being counted. In addition to the disturbing number of road accidents, the number of rail accidents that have occurred in Pakistan, particularly during the past three years, is equally concerning [15-25].

There is a total of 104,105 accidents reported in Pakistan, according to the data that is available for the years 2009 to 2020. Of these, there are 44,959 fatal accidents and 59,146 incidents that do not result in death. As a direct result of these accidents, there have been 55,141 deaths and 126,144 injuries reported. These accidents resulted in a significant amount of material being lost, and they involved a total of 120,501 cars. Due to the limited culture of follow-up reporting, it is possible to believe, at least in theory, that the number of accidents, deaths, and injuries reported so far is merely the tip of the iceberg, and that the actual figures are likely to be far more upsetting [26-47].

Road accidents are a matter of primary concern, and they demand the urgent attention of all parties involved to make every effort possible to rheostat the terrible number of occurrences. When driving on public roads, citizens have the same responsibility as drivers in other contexts to demonstrate more appropriate behaviour. According to the statistics that were made accessible to The News, more than forty percent of all accidents that occur in Pakistan end in fatalities. According to the statistics, there were a total of 68,322 car accidents during the previous six years; out of them, 27,629 resulted in fatalities [48].

One component of the Smart helmet is a receiver, while the other is a transmitter. The Smart helmet operates using two separate modules. The transmitting component is built within the helmet, while the receiving component may be put on virtually any bicycle. As a result, there is wireless communication that occurs between the two units. Pressure is detected via a pressure transducer in the transmitter module, which is positioned inside the helmet. Logic level 1 is sent from a comparator to a transmitter's input when an analogue signal is converted into a digital signal. The component that generates an output signal is known as a transducer [49-73]. When the user removes the helmet, both the transducer's output and the logic level at the transmitter's input are reset to zero. Another tool used to check for alcohol in the rider's system is the MQ-3 gas detector [74], also known as an alcohol sensor. If possible, place it directly below the face shield so that it can feel the presence of the sensor more easily. Intoxicated riders have a lower resistance value, which results in a lower voltage value. Upon receiving this value, the microcontroller stops the ignition from being turned on in this case. The receiver module's output pin provides a high-level digital output when the rider is wearing a helmet. When the digital relay signal is received, the bike's ignition unit circuit will be completed. By removing their helmet, the cyclist breaks all circuit connections, and the relay opens. The vibration sensor will identify an accident, and the location of that precise spot will be relayed to the person's family and a nearby police station via the GSM and GPS module. Both places will receive this information [75-78].

1. RELATED WORK

The current endeavour consists primarily of a wireless communication system that is linked to a smartphone. This prototype has sensors that can identify if there has been a collision or accident, and the communication hardware may then be utilized to automatically dial an emergency contact that has been predefined. The second system that is now in place regulates the rate at which the rider is travelling. A biker's headgear is equipped with all the required components and sensors, allowing the helmet to read the bike's speed and then tell the rider to slow down or speed up based on the dangers that the bike is in front of them. The following are some drawbacks associated with this:

- The rider does not wear a helmet in areas where no police officers are checking for helmet use.
- It is hard to test the blood alcohol content of each rider in large nations due to the high population density.
- The difficulty that traffic police have in enforcing traffic laws and regulations

The following are a few limitations and challenges in the existing systems:

- In a place where there are no police officers checking traffic, motorcyclists do not wear helmets.
- Drivers have a propensity to put on helmets only in areas where they believe they will be checked, but they do not do so in areas where there is no evidence of such inspections having taken place.
- If the ignition switch is bypassed, the vehicle can be taken or turned on, but not at the same time.
- It is nearly impossible to determine the amount of alcohol that is present in the blood of each rider.
- Accidents occurred because of phone calls, since older helmets did not feature Bluetooth speakers.

2. MATERIALS AND METHODS

The rider's blood-alcohol level is evaluated by the helmet to determine whether they should be allowed to ride. The motorbike's engine will not start if the rider is under the influence of alcohol, and the rider will be prohibited from operating the motorcycle. An Arduino microcontroller and an alcohol sensor are used in this setup. Microcontrollers use signals from the alcohol sensor to determine whether a person is intoxicated. The microcontroller uses an RF transmitter to communicate with the motor when it receives an alcohol signal from the sensor. To illustrate engine locking, we connect an RF receiver to the motor driver and stop the DC motor from moving. The method necessitates a button press to get the engine going. If the system detects any traces of alcohol, it will shut off the vehicle's engine. The system also sends a message that states, "Accident occurred," along with the latitude and longitude of where the incident occurred, using GSM [79] and GPS [80]. Vibration sensors are used to detect accidents. As a last precaution, the helmet has a temperature sensor that informs wearers when the temperature reaches a predetermined level.

This project is not only helpful in day-to-day living but also contributes to an increased sense of safety while driving. It is like having a virtual person there at the scene of the accident who communicates the relevant details to the ambulance. Utilization of this project protects your life at critical junctures, when the accident takes place in a no man's land (i.e., an area with no inhabitants) and no one is there to report the incident. It is useful in situations in which you are unable to move your body at all and are in a precarious posture. It automatically transmits the information to the recipient. Also included in this concept is an intelligent helmet that ensures the rider cannot start the bike without wearing it and stops the rider from doing so. This helmet can switch on a bike wirelessly, thanks to a simple cable repair. Unless you have your key and your helmet, your bike won't start. The intelligent helmet is designed to offer the necessary ventilation within the helmet, which results in an increased degree of rider comfort.

Through existing network infrastructure, the Internet of Things (IoT) provides a means for physical objects to be seen and interacted with from afar. IoT devices can be used to accomplish this goal (IoT). By eliminating the need for human intervention, this results in increased production, accuracy, and economic prosperity. These developments are because they bring up new possibilities for direct computer-to-physical conversion. Everyday objects that use integrated technology to connect and interact with the surrounding environment are included in the notion of the Internet of Things (IoT). Because of this, the internet has been used successfully. It is best shown by the Internet of Things (IoT) prototype, which envisions a global network of machines equipped with sensors and other gadgets that can communicate with one another. On the Internet of Things, aggregate sensory devices are used to depict direct and indirect views of items in real-world surroundings. Devices like this gather information from various sources. This approach is used in conjunction with the detection of computer-generated selected information. The term "Internet of Things" refers to a network that connects a wide range of items that we use in our daily lives.

3.1 Requirement Specification

Bringing cutting-edge technology to a safety staple that has been stationary for years is our goal with the Smart Helmet. First and foremost, we want to improve rider safety. We accomplish this by enhancing visibility and facilitating communication. Our device has a 360-degree range of vision, sound management, and Bluetooth capabilities built in.

3.2 Requirements for Hardware

A set of hardware was used in the system as Listed below are the minimal system requirements: Arduino UNO, MQ-3 Alcohol Sensor, Vibration Sensor module, Push button switch, HC-SR04 Ultrasonic Sensor, Jumper Wires, Mobile (As a display), Active Piezo Buzzer, GSM module, GPS module, Relay module, Bread board, Camera module for Arduino, , Temperature sensor, Water gauge sensor, Raindrop Sensor Module, OLED, and a helmet.

3.3 Block Diagram of Smart Helmet

IoT data collection uses sensors to monitor the performance of gadgets linked to the Internet of Things. The sensors acquire and transmit real-time data that is recorded and accessed at any moment to monitor the state of the IoT network. In this case, all the analogue data is translated into digital form. Data acquired from the sensor readings and this data will be recorded in the form of an array in CSV, TXT, or Excel file format. As all this data is collected from sensors termed a sensor array. After that, the array will split into training and testing phases. The Machine learning methods will be utilized to train the data. The Artificial Neural Networks (ANN) method is employed in this project. The block diagram of the smart helmet is shown in Figure 1.

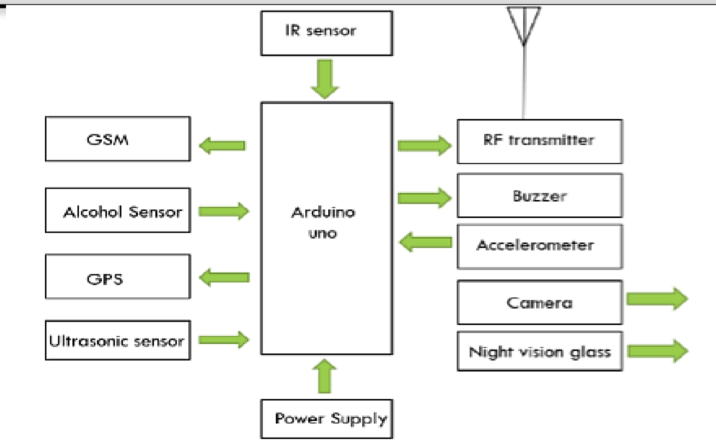

Figure 1. Block Diagram of Helmet

3.4 Smart Helmet Prototype

The MQ3 alcohol sensor [81] is used to determine whether the driver is drinking. The sensor's output will be determined by the level of alcohol in the sample. The biker's helmet status is determined by a switch. It is plugged into an external battery to supply the necessary power. For the bike to start, the helmet sensing switch must be turned ON. The helmet is detected by an IR sensor [82] as shown in Figure 2. The controller will get a signal from the IR sensor once the rider is wearing a helmet. The accident is discovered using an accelerometer. When the vehicle is getting close to another vehicle, the ultrasonic sensor is activated by connecting to the buzzer, and the buzzer turns on and notifies the rider. This way, the rider knows to pay attention. The rider's location is determined via the GPS module. The GPS module sends an alert message to the registered mobile number whenever an accident happens. A camera has been attached to the helmet to record the rider's movements while they are behind the wheel. In this case, night vision lenses are used externally to assist the driver in seeing well even in the dark, hence reducing the risk of an accident and allowing the rider to see the following vehicle or any other obstruction. In this case, a Controller acts as a command centre for all the system's various blocks.

Figure 2. Prototype of Smart Helmet

3.5 Software Specification

A. Arduino IDE

IDE stands for Arduino Integrated Development Environment, which includes a code editor, a message box, a console, a toolbar, and a set of menus for common functions. To upload programmes and communicate with the Arduino hardware, it establishes a connection with it. To develop code and upload it to Arduino boards, you will need to use the open-source software known as the Arduino IDE. Operating platforms such as Windows, Linux, and Mac OS X are supported by the IDE software. It can support both C and C++ as programming languages.

B. Machine learning

A subset of "artificial intelligence" (AI) known as "machine learning" (ML) allows software applications to increase their accuracy in predicting outcomes even if they have not been particularly built to do so. The predictions of new output values are made by machine learning algorithms using historical data as input. As a result of machine learning, organizations can gain a better understanding of client behaviour and corporate operating patterns, as well as the ability to create new products. Many of the world's most successful companies, such as Facebook, Google, and Uber, use machine learning as an essential part of their operations. Machine learning has become an increasingly important competitive advantage for many businesses. Using machine learning models was made possible by first separating the datasets into training and testing sets.

C. Decision Tree

It is common practice to use a tree-like structure to describe decision-making processes. As a visual flowchart, it is frequently used to plan and map commercial and operational decisions. The method perceives a tree-like structure or representation because of the branching of decisions that lead to outcomes. In machine learning, decision trees are used to structure the algorithm. Splitting the dataset features into groups based on a cost function will be done using a decision tree algorithm. Pruning is the process of removing unnecessary branches from a decision tree before it is optimized. The depth of the decision tree, for example, can be modified to reduce the risk of overfitting or an extremely complex decision tree. Machine learning's most common usage of decision trees will be to classify objects according to previously learnt attributes. Using this strategy can also be utilized to solve regression problems or to predict continuous outcomes from data that has not yet been observed. Decision trees are popular in machine learning because they make it easier to see and understand how decisions are made. In machine learning, decision trees can become extremely complex by creating granular branches; hence, trimming the tree structure is typically required. There are several advantages to using decision trees in machine learning:

- Even non-technical stakeholders can simply grasp the information.
- No normalization is required because the method may deal with numerical as well as categorical variables.
- Pruning and refining a dataset's features based on their hierarchical order can be accomplished using this technique.

The testing will be segmented into software testing and hardware testing. Before beginning to disassemble the prototype into its component subsystems and subcomponents, we will first discuss the conditions in which the hardware and software will be tested. Before being included in a subsystem, each subcomponent will be put through its own battery of tests. When all the subsystems have been validated, they will be combined into the creation of the whole Smart Helmet prototype, which will then be subjected to further validation.

3. IMPLEMENTATION DETAILS

The hardware components will be tested in two different scenarios to see how well they work. The first habitat will be a sealed chamber, while the second will be outside in the open. Due to the nature of the hardware that we are evaluating, we were required to conduct tests in both indoor and outdoor environments. Testing needed to be done in an environment that was as close to real life as possible because the hardware will be used in the field.

The initial setting will be a confined, indoor place that is devoid of any dynamic weather conditions. The temperature that will prevail within this location is that of a typical room, which is approximately 22°C (72°F). This first environment will be to ensure that the delivered hardware does not have any defects or other diverse issues that could potentially distort the findings of subsequent testing. Before moving on to field testing, we perform initial testing to make sure that our circuits have been constructed correctly and to our satisfaction.

When we do the second outdoor testing setting, we'll be able to test the final design. The safety of the system will be evaluated on a bright day when there will be no potentially harmful weather. This helmet can be worn in all weather, but its design will only be tested on a day with clear skies and plenty of sunlight because it is what is required by the essential specifications. If these requirements are satisfied, we will be able to carry out an exhaustive test of our prototypes without any problems. A Honda Super Sport CB400F 1976 is the vehicle on which the Smart Helmet is being evaluated for its effectiveness as a safety device. Using an old motorcycle for the Smart Helmet project does not conflict with the project's goal of being able to connect with nearly any motorcycle brand and model.

Table 4.1: Honda Specifications List

Manufacturer	Honda
Production	1976
Model	CB400F
Engine	408 cc inline 4-cylinder
Top Speed	104 mph
Transmission	6-speed manual
Power	28 kW @ 8500 rpm
Weight	392 lb.

Despite its age, this motorcycle can still reach top speeds and perform all the functions of a new model. Featuring a 4-stroke, inline-four-cylinder engine mated to a six-speed manual transmission, the motorcycle is capable of a top speed of 104 MPH.

4.1 Tests That Are Specific to The Hardware

The testing procedures for the hardware involved in the prototype design are outlined in the following sections. For the final product to be created with complete system integration, success criteria for each component must be met.

A. MCU

The Arduino microcontrollers will be put through their paces once it has been established that the loaded programme on the boards will provide accurate control over the various components of the system. To guarantee that the system functions in the way that we want it to, we will need to test the Bike-Mounted Controller as well as the Helmet Controller. Both microcontrollers, as well as the other parts of the bicycle from which we are showing or receiving data, need to be able to communicate with one another and with each other. At first, the module that is mounted on the bike will be put through its paces to check that it sends the necessary signals to the proximity sensors, causing them to begin recording and reporting distance data. After the MCU has been provided with this data, the onboard programme is tasked with transforming the information into a format that can be utilized. The testing will be deemed successful if the MCU properly triggers the proximity sensors to begin recording and if the

MCU correctly receives the sensor data. Next, we need to make sure that the MCU can detect when the turn signals on the motorcycle have been triggered.

To guarantee the module's full functionality, the microcontroller of the helmet must also be evaluated. The first step is to determine if the MCU can successfully receive wireless data from the Bike-Mounted module, which is attached to the bike. Bluetooth will be used to transmit this information wirelessly. This testing will be considered a success if the helmet MCU can receive accurate data. The next step is to do tests on the helmet module to see whether it can present the rider with visual information. To accomplish this, we'll use simulated data and make sure it displays in the format we want it to. If the data from the MCU is displayed accurately on the visual display, then the testing will be regarded a success.

B. Wireless Data Transmission

Invalid or garbled data could place the driver of the motorcycle in a puzzling situation if the data is transmitted. Testing wireless transmitters requires determining whether the transmitter has been properly configured, whether the device can survive being under- or overpowered, and how far apart the two devices can be from one another and still perform well.

Turning on both devices is the first step in conducting the test to see whether the communication is functioning as it should. Both transmitters should be emitting a steady red LED light to indicate that they have successfully connected. When information is shown appropriately on the Helmet Head-Up Display (HUD), one can deduce that the wireless connection is functioning as intended. Additional tests might be carried out to specifically and exhaustively test the wireless transmitter.

C. Power Source

Sections devoted to testing the Helmet HUD Module's power management methods are provided below. Testing was done to confirm that the hardware component functions properly and that there would be no complications during the integration process. A thorough examination is required due to the importance of the hardware components covered in the following sections to the HUD module's operation.

D. Motorcycle Power

To verify that the motorbike battery is producing 12V, it is necessary to take readings from the battery as part of the hardware testing for the motorcycle's power. To accomplish this, a multimeter is utilized to take readings of the voltage output in a variety of settings. After this step is complete, the system must have the circuit that regulates the voltage added to it. The values of the resistor R2 must coincide with the simulated testing resistances, and the output voltage needs to be measured by a multimeter. If the results that were measured do not correspond to the outcomes that were expected based on the simulation, the circuit needs to be rectified or modified.

E. Solar Power

The solar power components were first investigated to see if they could generate charge, and then reviewed to see if they could generate an appropriate amount of charge. The first test would include inserting a battery that had no charge and allowing the solar panels to try to charge the battery. It is possible to employ LEDs to indicate the remaining life of the battery. If the solar panels can charge the battery, the remainder of the Helmet HUD Module will be able to function properly. If the solar panels can generate adequate power without the need for any additional charging from the outside, then they will be determined they be suitable for use in this project. For recharging batteries, it was found that solar panels with a maximum output of 100 milliamperes were suitable.

F. Visual Display

It is necessary to do tests on the visual display to guarantee its full performance. The phrase "Smart Helmet" was displayed as part of an initial test, which was successful. Because we were able to display this string without error, we were able to have confidence that the display would meet our requirements. The visual display testing is shown in Figure 3.

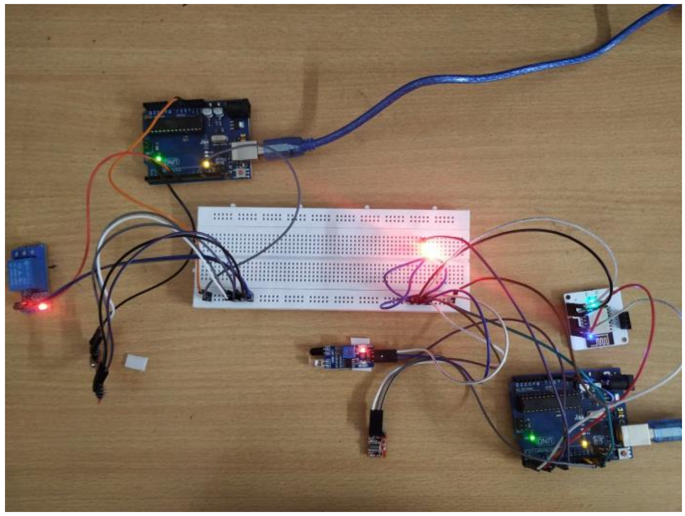

Figure 3. Testing Visual Display

4.2 The Testing Environment for Software

Either the Arduino Integrated Development Environment (IDE) or Microsoft Visual Studio will be used to develop most of the software for this project. On the Arduino Uno, software can be written, edited, tested, and installed using one of two integrated development environments (IDEs). Visual Studio has more in-depth features that allow for better testing of test criteria, however, the is easier to use and more intuitive.

4.3 Tests Directly Related to The Software

The Smart Helmet is broken down into its subcomponents, and each of those subcomponents has its testing procedure that is documented. Only the components that connect with the Arduino will require software and software testing after the software has been installed on both Arduinos.

A. The Circuit

Arduinos will be responsible for executing every line of code in this system, so they must be tested individually and as part of a complete system. The Bluetooth transceivers, the proximity sensor, and the visual display are all integrated with Arduinos. Two Arduinos are using Bluetooth to communicate with each other wirelessly in this instance. The first Arduino, seen on the left, is now recording proximity readings from the proximity sensors, converting the measurement to inches, and then passing the data to the second Arduino via Bluetooth. To display the data, a second Arduino is used. This second Arduino can be seen to the right of the first. The complete circuit has been shown in Figure 4.

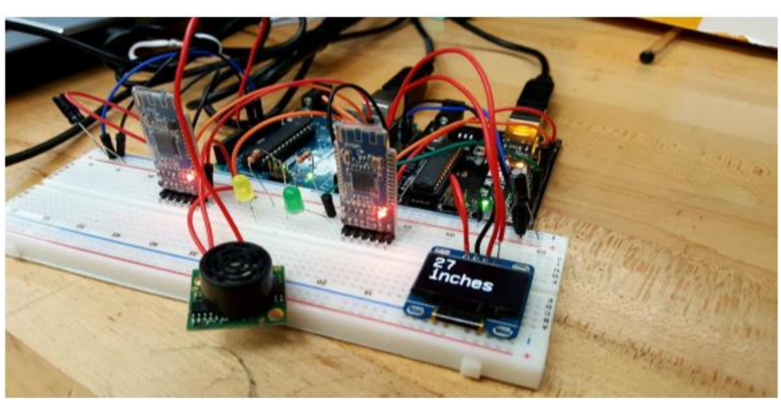

Figure 4. The Circuit

In this test scenario, we are simulating how the two subsystems will function once they have been incorporated into the helmet and motorcycle, respectively. All measurements and unit conversions will be handled by the first Arduino, which will be the master. The second Arduino will be the slave, receiving data from the motorbike module via wireless transmission. This information will then be displayed to the rider on the visual display that is attached to the helmet.

A. Visual Display

Each of these test requirements must be met individually on the visual display component before it can be merged into the testing prototype. Visual display data readability and visibility are now the testing requirements for the visual display. It is necessary to examine not only the visibility but also the readability of the outputs on the software side of the visual display. The readability testing that will be done will assist in catering to the design goals and guidelines that will be outlined in the section on software design goals. For any outputted string or text, the U8g library provides a few typefaces and font size settings to choose from. While the visual display is being mounted, a variety of font configurations will need to be examined to identify which one best fulfils the requirements of the present output.

The visual display must be checked as it changes from one reading to the next, in addition to testing for an optimal display interface. There should be little to no overlap in the output from one reading to the next, as it would make it difficult to read the data. Adding a "clean screen" function that clears the screen before displaying the fresh data is one possibility. Although it is feasible and beneficial to the user in theory, it must be thoroughly tested to ensure that the transition from one scene to the next does not cause a flashing effect. The only time blinking should be employed is in an extreme emergency. To be confident that no two sets of data are identical, it is necessary to investigate several methods of checking. Multiple sets of proximity data will be given to the visual display module to see if it can detect when the old data is removed from the display and the new data is displayed.

B. Proximity Sensor

Because the situations in which the proximity sensors will be used are not clear, there is a chance that they will make a mistake. As a result, the accompanying software must be correctly calibrated and capable of adjusting and offsetting data if/when measurement values are affected by randomness.

C. Accuracy and Delay

They can be inaccurate if the proximity sensors are being used. This is because the proximity sensor may not be able to locate the object and offer the maximum distance, or it may pick up a faulty object and give the wrong distance while measuring distance. Proper daisy-chaining and angling of proximity sensors can help reduce some of this error, but software is responsible for the majority of it. The pulse width or analogue reading setting will be used by this system. The front-facing module will take several measurements, sort them from smallest to largest, and determine the middle value. Then, the HUD module will display the middle number. The HUD module in the helmet will get the middle number, which will be shown on the HUD screen. When you use the median, most of the unusual values that the sensors may pick up will be thrown out. The median, not the mean, will be used because outliers still influence mean values. Delays and memory storage become an issue when this procedure is put into practice. By sending data sets to the proximity sensor module and keeping track of how long each function takes to run, we can see how well our input techniques are working. Software IDEs were alerted when algorithms were taking too long to run.

D. Bluetooth Communication

Bluetooth communication works a lot like a normal network connection, but it can't guarantee that data packets will get to their destination. Certain precautions must be made to ensure that lost messages don't have an impact on the device's performance when using a wireless network.

4. EXPERIMENTS AND RESULTS

This section discusses details of the experiments

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performed to test the designed systems. The results of the experiments are also discussed in this section. Figure 5 shows the result of the circuit at the bike side without wearing a helmet, and Figure 6 shows the result of the circuit at the bike side with wearing a helmet.

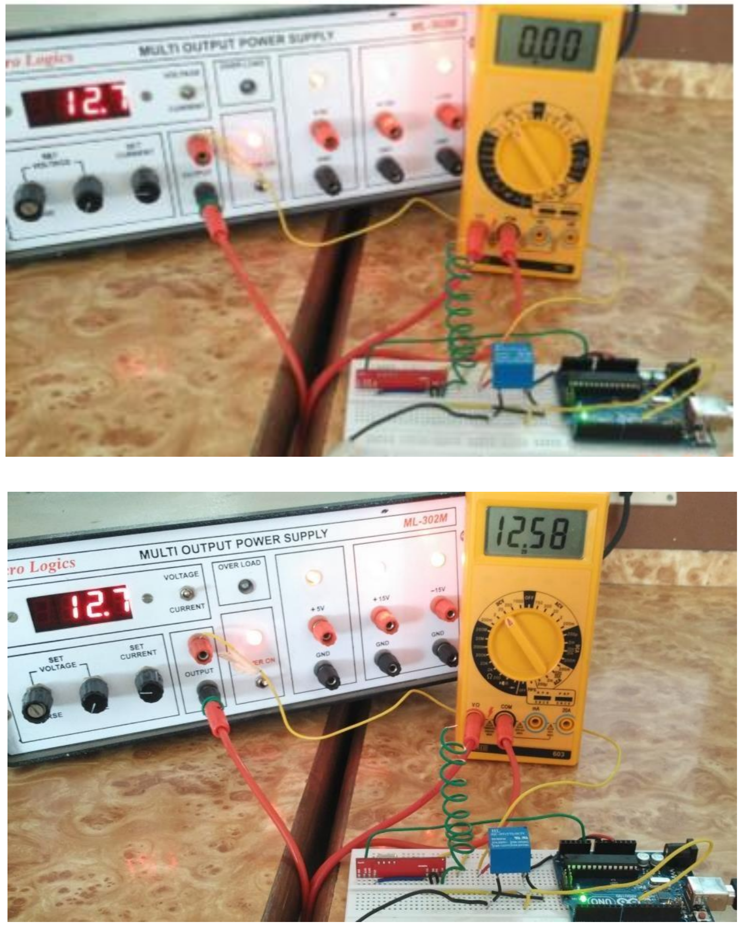

Figure 5. The result of the circuit on the bike side (without wearing a helmet)

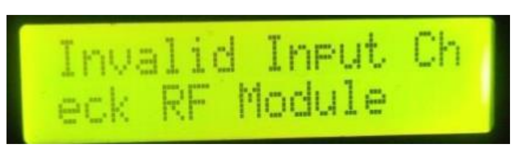

Figure 6. The result of the circuit on the bike side (wearing a helmet)

If the RF module is out of range or the helmet RF module is not turned on. Figure 7 prompts, when no RF muddle is attached.

Figure 7: RF Module out of range

The message "No Helmet Please Wear it" will appear on the screen if the rider is not currently wearing a helmet. Figure 8 prompts when there is no helmet wear.

Figure 8: Helmet wear message

Notifications are presented on the LCD screen when there is a detectable level of alcohol in human breath. This app also sends a text message to the recipient's registered phone number, which includes the recipient's location. Figure 9 shows the result of the model when the rider used forbidden liquids.

Figure 9: Alcohol detection

Figure 10. Alert message on cell phone for a drunk Driver

If there was an accident, then the bike is in a fallen position. The message was displayed on an LCD screen. In addition, it sends an SMS to the registered number, including the location of the user's now. Figure 10 shows an alert message on a cell phone in a case when the rider is drunk. It also shows the location in terms of latitude and longitude where the bike has fallen. Similarly, Figure 11 shows the message on the system screen about the fall of the bike in either case. And Figure 12 shows an alert message on a cell phone in case of an accident. Figures 13 and 14 represent the flow chart of the helmet section and bike section, respectively.

Figure 11. Bike Fallen

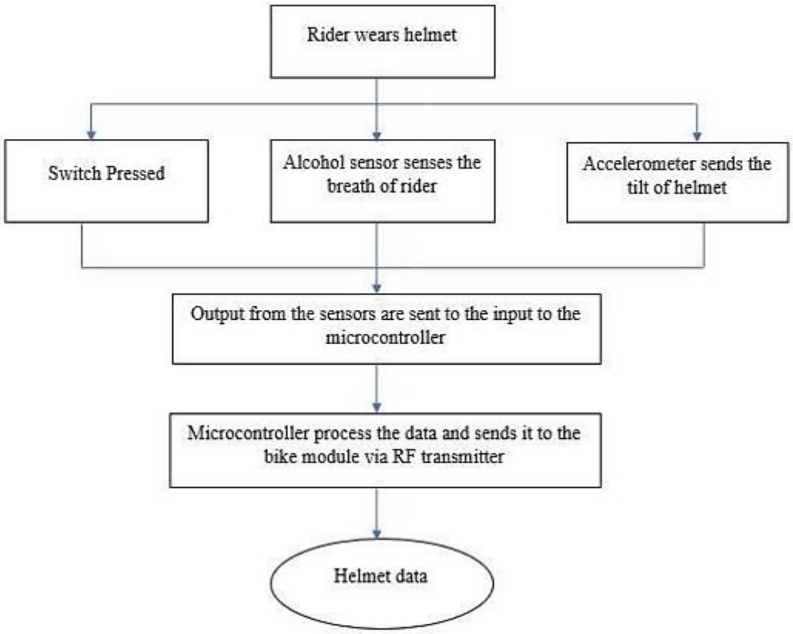

Figure 12. Alert message on cell phone for an Accident

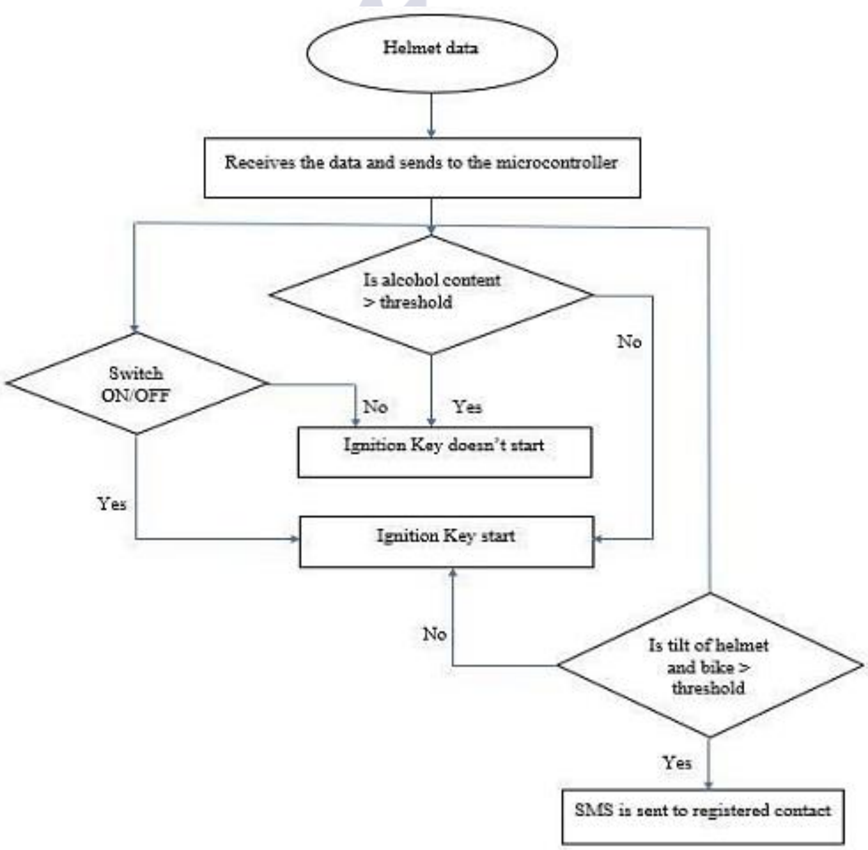

Figure 13. Helmet Section Flowchart

5. CONCLUSION AND FUTURE WORK

6.1 Conclusion

Many incidents that occur today involve bicycles. The severity of those incidents is magnified both by the lack of a helmet and by the consumption of alcoholic beverages. Research has led us to build a helmet system that can detect drunk driving and verify that drivers are wearing their helmets, which we call the "intelligent smart helmet." It is possible to have a safe voyage on a two-wheeler if this system is put into place. This would result in fewer head injuries sustained in collisions and a lower overall accident rate.

The Smart Helmet will be beneficial in reducing the number of fatalities that occur because of motor vehicle accidents. The cooling system, which aids in maintaining a temperature that is pleasant for the user, is being incorporated into the helmet as part of the effort to make it more user-friendly. The decrease in temperature experienced inside the helmet also contributes to an increase in the wearer's chances of survival. As it is currently configured, the proposed system can send alerts and messages on the occurrence of an accident by sensing the axis of the helmet using tilt sensors and messaging the concerned person about the occurrence of the accident and giving the location of the vehicle. This is accomplished by sensing the axis of the helmet using tilt sensors. As a result, in the case of an accident, a smart helmet will use GSM and GPS to pinpoint the exact position of the mishap and transmit that data to emergency personnel.

As the final step in our project, we would want to say that "If appropriate action is not taken at the appropriate moment, danger will be waiting for us with a more threatening face." When someone is hurt, we cannot delay in acting. We must treat the person in the manner that is intended. If this does not occur, a precious life can be lost. We need to understand how valuable human lives are and how crucial it is to administer first aid promptly to preserve these valuable lives.

6.2 Future Scope

The project aims to detect accidents and deliver messages with the victim's location information promptly to help those who have been injured in them. The existing technology has the potential to be improved for a wide variety of other applications. If the rider is suspected of being under the influence of alcohol, the motorcycle's engine may be disabled by an alcohol sensor. In addition to the notification that is provided after the occurrence of an accident, there may also be a notification provided for the failure of the system for accidents to prevent avoided. The Bluetooth capability can be implemented on the same module, and it can be wirelessly interfaced with mobile phones to read out the caller's name and allow the user to pick up incoming calls.

In the not-too-distant future, there will be a significant need for helmets of this sort. The complete course may be carried out in a helmet with little effort. The circuit can also be powered by solar energy, meaning that it will make use of renewable energy and will not be harmful to the surrounding environment. The bendable solar panels can be attached anywhere around the surface of the helmet. The mechanism described above is also capable of being customized to provide warnings in the event of low fuel or excessive speed. This proposed topology has the potential to be further expanded so that it protects pillion riders.

- We can install a variety of bioelectric sensors on the helmet so that we can monitor a wide range of activities.
- A tiny camera can be used to record the actions of the driver.
- By making use of a wireless transmitter, it can be used in the process of communicating information from one vehicle to another. We have installed solar panels to power the helmet, and by utilizing the same power supply, we can charge our mobile devices.

Authors Contribution: First Author Areesh Choudhary is the main contributor of this research, and this work is based on her Master's thesis. She has done the literature review, data collection, designed the approach of this research and written the manuscript. Ghulam Gilanie supervised this research work, and he has contributed to the research methodology used and proofread the manuscript and evaluated the

approach. Shumaila Yasin cross-validated the outcomes, Saira Naveed helped in the arrangements of all the hardware required, while Hina Shafique and Iqra Mubeen both configured hardware to prepare the experimental setups and aligned the libraries for their proper functioning.

Data availability: The data that support the findings of this study are available from the corresponding author upon reasonable request.

Conflicts of interest: ***The*** Authors have no conflict of interest**.**

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