A MULTIFUNCTIONAL SMART HELMET FOR BIKE RIDERS BASED ON AN EMBEDDED SYSTEM.

An Undergraduate CAPSTONE Project
By

1. MD. RASHEDUL HASAN BHUIYAN	ID: 19-39418-1	Dept: EEE
2. TANZIM BIN AHMED	ID: 19-39450-1	Dept: EEE
3. QUAZI FARHAN AMER.	ID: 19-39344-1	Dept: EEE
4. FARHAN-AL-ISRAQUE.	ID: 18-36212-1	Dept: EEE

Under the Supervision of

Tahseen Asma Meem
Lecturer

Summer Semester 2021-2022
September, 2022

Faculty of Engineering

American International University - Bangladesh

A MULTIFUNCTIONAL SMART HELMET FOR BIKE RIDERS BASED ON AN EMBEDDED SYSTEM.

A CAPSTONE Project submitted to the Faculty of Engineering, American International University - Bangladesh (AIUB) in partial fulfillment of the requirements for the degree of Bachelor of Science in their mentioned respective programs.

1. MD. RASHEDUL HASAN BHUIYAN ID: 19-39418-1 Dept: EEE
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4. FARHAN-AL-ISRAQUE. ID: 18-36212-1 Dept: EEE

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American International University - Bangladesh

DECLARATION

This is to certify that this project is our original work. No part of this work has been submitted elsewhere partially or fully for the award of any other degree or diploma. Any material reproduced in this project has been properly acknowledged.

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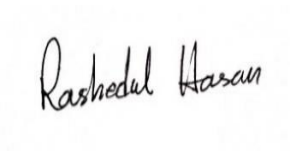
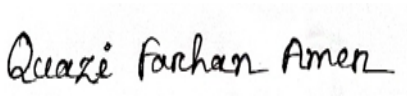
Students' names & Signatures

1. **MD. RASHEDUL HASAN BHUIYAN**

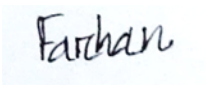


2. **TAZNIM BIN AHMED**

3. **QUAZI FARHAN AMER**



4. **FARHAN-AL-ISRAQUE**



APPROVAL

The CAPSTONE Project titled **A MULTIFUNCTIONAL SMART HELMET FOR BIKE RIDERS BASED ON AN EMBEDDED SYSTEM** has been submitted to the following respected members of the Board of Examiners of the Faculty of Engineering in partial fulfillment of the requirements for the degree of Bachelor of Science in the respective programs mentioned below on **September 2022** by the following students and has been accepted as satisfactory.

1. MD. RASHEDUL HASAN BHUIYAN	ID: 19-39418-1	Dept: EEE
2. TANZIM BIN AHMED	ID: 19-39450-1	Dept: EEE
3. QUAZI FARHAN AMER.	ID: 19-39344-1	Dept: EEE
4. FARHAN-AL-ISRAQUE.	ID: 18-36212-1	Dept: EEE

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Supervisor
Tahseen Asma Meem
Lecturer
Faculty of Engineering
American International University-Bangladesh

_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

External Supervisor
Abu Hena Md. Shatil
Assistant Professor
Faculty of Engineering
American International University-Bangladesh

_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

Prof. Dr. Md. Abdur Rahman
Associate Dean
Faculty of Engineering
American International University-Bangladesh

_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

Prof. Dr. ABM Siddique Hossain
Dean
Faculty of Engineering
American International University-Bangladesh

_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

Dr. Carmen Z. Lamagna
Vice Chancellor
American International University-Bangladesh

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1. MD. RASHEDUL HASAN BHUIYAN
2. TANZIM BIN AHMED
3. QUAZI FARHAN AMER
4. FARHAN-AL-ISRAQUE

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ABSTRACT

The increasing number of motor bikes around the country has subsequently increased the number of fatal accidents. Most often this accident occurs due to the carelessness of the driver using no helmets while riding. To eradicate this the use of a smart helmet could overcome the situation in a great extent. It can help a biker if he or she has an accident and is unable to call for help. The emergency message system will notify their family and friends that an accident may have occurred. It even prevents the biker from falling asleep while driving. The user is able to follow the Google Maps directions effortlessly using it. This smart helmet is powered by a battery, which is capable of storing charge for long period and is rechargeable within a short span of time.

Chapter 1

INTRODUCTION

1.1. Overture

In Bangladesh, the number of two-wheelers / motorbikes is seemingly increasing day by day. Such vehicles are more accident-prone. Often such accidents take away the lives of people or leave them handicapped for their entire life. In most cases, it is seen that accidents become serious due to not wearing a proper helmet or a well functional helmet. This is where we came up with the idea of developing 'A Smart Helmet' for bike riders to lessen the number of accidents and eventually save lives.

The concept of a smart helmet is to provide the rider with enough technologies which will protect his head and eventually his life from some serious accidents. Such kind of helmets will be able to detect whether the rider is ready to drive or not, it will be able to give a hand-free communication facility during riding, it will have an alarm system that will prevent riders to ride without a helmet, and will have a GPS to track location with ease and lastly it will be able to call for emergency help if needed via mobile apps.

The helmet will be lightweight & easy to use. Ensuring riders' safety is the main motive with smart technologies to make bike riding more convenient and safer for all riders.

1.2. Significance of the Project / Research Work

Because the number of bikers has recently increased, so has the number of motorcycle accidents. The system helps to reduce a significant number of accidents. It consists of a microcontroller, IR and PIR sensors for helmet authentication, and an MQ3 sensor for alcohol detection. When the bike rider tries to start the bike, the IR and PIR sensors will detect whether or not the rider is wearing the helmet. Furthermore, the MQ3 sensor detects the presence of alcohol, and if it is detected, the bike will not start. It also detects accidental falls through an accelerometer. The project focuses on bike rider safety and the reduction of fatal accidents. To avoid this situation, we designed a system that will reduce the number of accidents in half. We also use the ADXL sensor to detect vibration and the SIM 800L module to send messages - to notify relevant authorities such as hospitals, police stations, and parents via text messages.

1.3. Engineering Problem Statement

The aim of building a smart helmet for preventing accidents raises several engineering problems to implement in real life. Dealing with such sensitive issues requires enough technologies to work with. The basic idea of a smart helmet is to have a 'Transmitter' mounted on the bike to collect necessary data and a 'Receiver' mounted on the helmet. These systems are all made up of microcontrollers. This system will be easy to implement. The whole system would relate to a mobile phone via Bluetooth connection. A such kind of smart helmet requires several sensors, batteries, buzzers, and detectors to make it smart and useable. To ensure proper safety a sensor called 'PIR (Passive Infrared)', MQ-3 sensor, ADXL sensor, GPS locator, etc. sensors would be used. There will be a mounted battery that will provide enough power to the helmet to sustain for a long period without external charging. A solar panel will be continuously charging the helmet without producing excessive heat. Buzzers will be used to give an alert if the bikes are under any security threat or damage has been done. These are the complex engineering problem solving that will bring a revolutionary change for bikers all over the country.

1.4. Objective of this Work

The death rate of two-wheeler/motorbikes accidents is increasing day by day in Bangladesh. This Smart helmet aims to provide safety to the bike rider. The safety of a rider is assured and if an accident occurs, our system will give information to the ambulance about the accident, so they can take certain measures to save the life of the person who meets with an accident.

1.4.1. Primary objectives

- To design a helmet that can improve bike riders' safety.
- To prevent an accident by detecting whether the biker is alcoholic or not.
- To ensure bike security by adding a GPS and anti-theft alert.
- To reduce the loss of life due to the late arrival of the ambulance by sending an emergency message to relatives.

1.4.2. Secondary Objectives

- To keep the helmet comfortable and lightweight.
- To develop an android/iOS mobile application that will be user-friendly and easy to access.

• Set up Google Assistant on the helmet for hand-free communication through voice command.
• Set up Google map voice direction feature.

1.5. Comparison with Traditional Method

The idea of developing a smart helmet system in terms of "A Multifunctional Smart Helmet for bike riders" is considered a social responsibility. Recently the number of bike riders has increased in Bangladesh so the number of bike accidents has also increased. In this circumstance, wearing or using a helmet while riding a motorbike is essential. As it has been found various types of traditional bike helmets are arising. Though various types of modern helmets are found still some questions are appeared regarding the "Safety" & "Security" of bike riders.
In this case, for providing high safety and security "A Multifunctional Smart Helmet for bike riders" device is very much reliable.

The reasons why the device is much better than the traditional system or method can be divided into some criteria:

- **Hands-free communication:** During bike riding, a hands-free communication system is a requirement of every bike rider because picking up calls through mobiles is too risky then also leads to occur accidents. So basically, a Bluetooth system is needed to prevent accidents that can't be found in traditional helmets but the device "A Multifunctional Smart Helmet for bike riders" provides an HC-05 Bluetooth module system to fill the requirements of a hands-free communication system for bike riders.

- **Alcohol detection:** To ensure proper safety & security, it becomes necessary to implement such a technique to avoid drunken bike riding. In ordinary helmets or traditional helmets, alcohol detection systems can't be detected whereas in the developed smart helmed system alcohol detection system has been implemented. MQ-3 gas detector (alcohol sensor) has been used in the device and is suitable for detecting alcohol content from the breath.

- **GPS and anti-theft alert:** GPS and anti-theft alert are essential for every biker to protect their bike from theft. This system also helps the rider in navigation for route detection

through a voice navigator in a helmet. This advanced development program has not been seen in any traditional system till now.

- **Ambulance Calling system:** This is the most highlighted feature of the project. In Bangladesh, the rate of loss of life due to late medical service or the late arrival of an ambulance is quite high. To lessen the inconvenience, the Ambulance Calling system is also included in this helmet. The rider can cooperate with a selected ambulance service. If the rider had an accident the selected ambulance service will get the notification or alarm also with the location so that the ambulance will rush on the spot to save the rider. This advanced technology is only can be found on this helmet so-called "A Multifunctional Smart Helmet for bike riders." None of any traditional or ordinary bike helmet can provide this service to bike riders.

1.6. Organization of Book Chapters

This chapter discusses the introduction of our project. Then discuss the historical background and it is divided into two parts, some described earlier research, and recent recharge. Also, discuss currently using technology. This chapter discusses our primary and secondary target, also shown comparison with the traditional method.

Chapter-2: Literature Review with the in-depth investigation: This chapter discusses the literature review with an in-depth investigation. In this chapter mainly worked several previous papers were collected. Then the technology was shown in some previous researches.

Chapter-3: Project Management: In this chapter, we discussed the strengths, opportunities, weaknesses, threats of our project. We also discuss our schedule management timing. The cost analysis of our project, which is the most important aim of our project to make an efficient solar vehicle is also explained in this chapter. Here we also explained about political, economic, social culture factors & technological factors on our project. Individual accountability and the life cycle of the project are also explained in this chapter.

Chapter-4: Methodology and Modeling: This chapter discusses the methods that are going to use to implement the project. Some flowchart, models are going to provide to show how the whole project is going to implement.

Chapter-5: Implementation of Project: In this chapter, the process of training the datasets, preparing the neural network model, and the other implementation details will be discussed. Wide discussion of different software applications & the way we fetch the data are described in this chapter.

Chapter-6: Results Analysis & Critical Design Review: In this chapter, the results & the data we have found are going to analyze with the earlier research experiments. The critical design of the whole project is going to elaborate in this chapter.

Chapter-7: Conclusion: At the end of this chapter, we will conclude it saying different drawbacks of the project, future scopes & the impact of the project in the society. All of these will be discussed in the last chapter.

Chapter 2

LITERATURE REVIEW WITH IN-DEPTH INVESTIGATION

2.1. Introduction

A helmet is a type of head protection that is worn on the head. A helmet, in particular, works in conjunction with the skull to protect the human brain usually made of a hard material to resist the impact of external forces to protect our head. Helmets protect the head by slowing or stopping the acceleration or deceleration of the skull and brain caused by a collision. Shock absorption is provided by the helmet. The expanded polystyrene liner is designed to crush as it is impacted, distributing the energy over a gradually growing surface, similar to a cone. A helmet becomes one of the most impactful safety tools in many sectors of our daily life. In the perspective of Bangladesh, it is gradually moving toward to be a developed country. Like other developed countries, Bangladesh is building up huge road links to communicate and transport throughout the country. As the number of roads is increasing and so on the transportation vehicle has also increased. In terms of easy communication and easy maneuvering, facility bike numbers have increased significantly. According to Bangladesh Road Transport Authority, about 375,252.000 Unit Bikes were registered in 2021. For riding a bike, the driver and passenger need to wear a helmet to protect themselves from severe accidents. Traditional helmets are being used for a long time in Bangladesh while riding bikes. Traditional helmets are way too less durable or less efficient to prevent heavy impacts. In the age of upgradation and digitalization helmets need to be smarter and user-friendly to bring a change. Smart helmet brings an upgrade to the helmet design for bike riders. Smart helmets are being used in the defense forces for different purposes with different motives. But using a smart helmet in a bike helmet is not a common phenomenon to look after. The explanation to use a smart helmet for the bikers is to protect their lives from severe accidents, to prevent alcoholic bikers from riding, to locate a biker using a GPS, and to deliver emergency medical help through automated emergency calls to nearby hospitals or medical clinics. A smart helmet brings up an idea to protect a rider through smart technologies mounted on the helmet. The use of a smart helmet in Bangladesh is not so prominent. While lots of lives are being lost due to bike accidents causing huge damage not to an individual rather to a whole family too. According to the RSF report, 38.68% of all accidents occurring in 2021 involved motorbikes. At least 2,214 people were killed and 1,309 were injured in these crashes. A total of 2,078 motorcycles were involved in these accidents [1]. To eradicate

such losses 'A Smart Helmet' can dig into a greater depth to provide a long-lasting solution for bike riders throughout the country. Though Smart Helmet is not a new technology. But in the context of Bangladesh, it is completely a new idea to bring on for the bike riders.

2.2. Related Research Works

There are quite healthy numbers of research conducted on smart helmets. In many countries of the world, these kinds of helmets are used to ride bikes for a better riding experience. The main objective of the research was- The Smart helmet's design assures the rider's safety by requiring the use of a helmet, as well as ensuring that the rider has not drunk alcohol over the legal limit. The suggested technology will prevent the biker from starting the bike if any of these primary safety guidelines are broken. The device also aids in the effective handling of accident aftermath by sending an SMS to the police station with the position of the motorcyclist.

Figure 2.2.a&b Smart helmet for bikers (with multiple functions).

2.2.1. Earlier Research

Since the first use of helmets for riding bikes in the year 1914 human civilization has come up with different types, different models, and different work purposes helmets respectively. Until the year 2004 Motorola and MOMODESIGN had announced the release of the world's first Bluetooth-enabled motorcycle helmet, which will allow riders to scoot around town while staying connected. The Bluetooth-mounted helmet gear was based on the design of the popular HS810. This helmet is considered the first Smart Helmet in the world.

These helmets were used to stay connected via Bluetooth throughout the biker's journey. Such helmets use piconets to form a network with mobile / devices to avoid using any wires. The Bluetooth in these helmets is powered by a small battery that does not fail to provide you with a stable connection.

Figure 2.2.1 Smart helmet for bikers (with Bluetooth connectivity).

2.2.2. Recent Research

With the span of time research works on building a proper smart helmet continued. As a result, in 2017 JARVISH become the first smart helmet of the world. It fulfills all the criteria of a helmet to be smart.

Figure 2.2.2.a A popular smart helmet named as JARVISH

The inner and working module of the helmet is shown below-

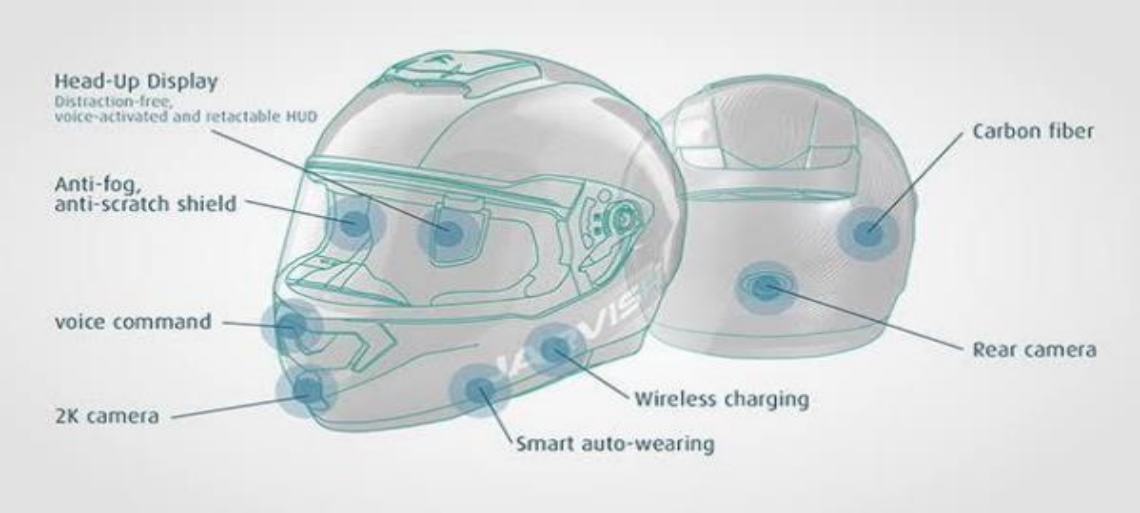

Figure 2.2.2.b Smart helmet for bikers (inner and working module).

2.3. Validity and Accuracy of Existing Solution

From related recent research works or recent most of the research works about smart helmet, it is found that those research works don't fill all the requirements which is mentioned earlier in our project goal in the case of complex engineering problems. As the name of this project is 'A Multifunctional Smart Helmet for bike riders' here is a term which is being focused is 'Multifunctional'. That means this project is well capable of all types of solutions which is needed badly for riders. Whereas, in those related research works, not all the multifunctionality has been observed and which is the main problem of those related research works. Besides, the point of building 'A Multifunctional Smart Helmet for bike riders' for forestalling mishaps raises various designing issues to execute, all things considered. Managing such delicate issues, it requires an adequate number of advances to work with. The fundamental thought of the smart helmet is to have a 'Transmitter' for converting signals produced by sensors into a standardized instrumentation signal and have a 'Receiver' for receiving those signals mounted on the bike which requires several sensors, batteries, buzzers and detectors to make it smart and useable. To ensure proper safety a sensor called 'PIR (Passive

Infrared)', MQ-3 sensor, ADXL sensor, GPS locator, buzzer sensor etc. sensors has been used in it. So, having all the technologies in this project will resolve the non- multifunctionality problem of the related research works. After that, in those related research works, the battery which were used are not able supply huge amount of power, so charge deficiency problem is stated in related research works. But in this current project, a heavy mounted battery provides enough power to the helmet to sustain for long period of time without external charging also A solar panel will be continuously charging the helmet without producing excessive heats be used. By using that heavy mounted battery and solar panel, the problem of charge deficiency problem can be solved. The next problem which is noticed on the related research works are not having the technology which will prevent the security threat or damage. To resolve the problem buzzer has been used to give alert if the bikes under any security threats or damages have been done. Last of all there is no such technology can be found in related research works which is able to reduce the loss of life due to the late arrival of the ambulance. Regarding on this issue, Ambulance calling technology by using GPS/GSM technology has been implemented in this project to reduce the loss of life due to the late arrival of the ambulance if bikers meet an accident. So, implementing this technology will also resolve the problem addressed in related research works. The Solutions which are mentioned above is enough because those solutions can handle all kinds of major problems while riding a bike. It can be stated that, the existing solutions are adequate and sufficient to provide safety for every bike rider.

2.4. Wide Range of Conflicting Research Works

In Bangladesh context bikers are increasing day by day also the rate of death is increasing because of late emergency response. At this point smart helmet can solve this problem. There are no smart helmet gadgets used for emergency safety in Bangladesh, hence there are no research conflicts there. However, there are many ongoing and implemented research projects around the world.

2.5. Critical Engineering Specialist Knowledge

As it is mentioned that a microcontroller and multiple sensors are used in this project, having knowledge about the working principle and functionality of those are specially required to solve engineering problem. Firstly, having knowledge about ARDUINO is needed to make this project successful. ARDUINO works here as a microcontroller and all the sensors are placed on it. In addition, the knowledge about 'PIR (Passive Infrared)', MQ-3 sensor, ADXL sensor, GPS/GSM locator, Buzzer sensor are essential to fulfill the project. Secondly, combining all the technologies in the project is quite challenging. To implement the sensors, the

method of installing those in Arduino board and relate them with the controlling system through hardware and software is much required.

2.6. Stakeholders from Research Literatures

The benefits and beneficiaries of our smart helmet are numerous. In this project several stakeholders and their requirements linked with the project are identified. Bikers, Helmet shop and traffic police are the main three stakeholders of this project. The direct users will be the bikers to ensure extra precautions and safety. They will buy the product from any helmet shop.

2.7. Summary

Accidents are increased because of the absence of helmet or by the usage of alcoholic drinks. In our project we have a tendency to develop an electronic smart helmet system that efficiently checks the wearing of helmet and drunken driving. We presented a smart helmet that results as a lifesaving, self-sustainable, wearable device, which the user can always rely on during the driving experience. To achieve this goal, it includes dual-source energy harvesting (solar and kinetic) to guarantee self-sustainability in the application scenario. Experimental results on the developed prototype demonstrated both the functionality of the system and the self-sustainability when the helmet is worn on the motorbike's head. The basic idea of a smart helmet is to have a Transmitter mounted on the bike to collect necessary data and a 'Receiver' mounted on the Helmet. These systems are all made up of microcontroller. Through which this system would relate to mobile phone via Bluetooth connection. A such kind of smart helmet requires several sensors, batteries, buzzers and detectors to make it smart and useable. To ensure proper safety a sensor called 'PIR (Passive Infrared)', MQ-3 sensor, ADXL sensor, GPS locator etc. sensors would be used. There will be a mounted battery which will provide enough power to the helmet to sustain for long period of time without external charging. A solar panel will be continuously charging the helmet without producing excessive heats. The helmet will be light weight and easy to use, ensuring riders safety is the main motive with smart technologies to make bike riding more convenient and safer to all riders.

Chapter 3

PROJECT MANAGEMENT

3.1. Introduction

Like science and technology, modern life and technology are closely related. Technology and invention are all around us. Modern civilizations have benefited from technological advancements, inventions, and engineering uses. Our daily lives now incorporate it. Without the aid of technology, we are unable to envision a single day. Smart and Artificial Intelligence (AI) is one of the greatest technological innovations for mankind. These innovations have a great impact on making human lives smarter more and more nowadays. The proposed project also has the aim to build a smart helmet for people to make bike ride smarter than before and make it an efficient material for its users. This project has been developed in both simulation and hardware. The simulation was done first and according to the simulation the hardware implementation was done very carefully.

Each project requires an effective management system. One needs careful planning and a good timetable in order to properly complete a project. There are a few techniques that ensure proper project management and its appropriate forecasting in order to achieve the desired goal. Several management techniques, including SWOT and PEST analyses, will be covered in this chapter. We'll show how to conduct a SWOT analysis to identify the strengths, weaknesses, opportunities, and threats facing our project, and how to conduct a PEST analysis to determine how our project will affect the political, economic, social, and technological spheres. This analysis will aid in generating an appropriate project conclusion and can highlight potential internal and external elements that may have an impact on our project.

3.2. S.W.O.T. Analysis of the Project

Our project's SWOT analysis has been provided here. SWOT analysis is a strategic planning exercise that identifies a company's internal strengths and weaknesses as well as external opportunities and threats. The internal analytical specs make use of an efficient method to look into economic, management, infrastructure, production, distribution, reputational components, and revolution. They also consider assets, abilities, necessary competences, and competitive advantages. In order to identify the source of competitive advantage, the internal study is essential. By examining the competitors' ambiance, the industry's ambience, and the overall ambience, the outside review identifies market possibilities and dangers. This analysis is an internal project research that can be based on surveys, but we choose to base it on information we could find online. An important step in the project planning process is the SWOT analysis

.

3.2.1. Strengths

The following strengths of this project are given below:

- Designed to perform multiple tasks like- alcohol detection, sensing vibration and immediately notifying via mobile message, detecting eye blink of the rider, indicator lights and intercom communication with other fellow riders within a specific limit.
- It can work with IoT (Internet of Things).
- Uses Image Processing Technology to detect eye blinking of the rider.
- It reduces the possibility of life loss of the rider by providing with enough smart facilities.

3.2.2. Weaknesses

The following weakness of this project are given below:

- Slightly expensive rather than traditional helmets.
- New technology need time to adjust within the consumers.
- Battery efficiency might be a concern for long route riders.

3.2.3. Opportunities

Every scientific endeavor has some potential outcomes in the future that show what advancements might be realized in the near future. As a smart helmet the future development includes these objectives:

- Helping riders from severe injury caused from accidents.
- Preventing a drunk rider from riding.
- Call for immediate help automatically when the rider is down.
- Tracking the location of bike if stolen.
- Image processing preventing bikers from falling asleep while on riding mood.

3.2.4. Threats

This project contains a number of opportunities as well as specific threats, which are listed below.

- The vibratory sensors may give away false notifications sometimes due to heavy shakes even if it’s not due an accident.

- There is no such practice of using such helmets in the country which will need ample amount of time to make it habitable for everyone.
- Although this helmet may provide enough protection to the bike rider but may lack in providing enough facility for the passenger riding behind the rider.
- This technology might increase the price which will not be appreciated by minimal number of riders.

3.3. Schedule Management

Table 1: Gantt chart / Project timeline for our project

Tasks \ Date	Dec'21	Dec'21	Jan'22	Sep	Oct	Oct	Nov	Nov	April	Dec	Dec	Jan'22	Jan'22	Jan'22	Jan'22	Feb'22	Mar'22	April'22		May'22
	20	21-31	31 - 9	17-30	15-Jan	16-31	13-Jan	14-30	7	16-30	31	2-Jan	3	6	31-Jul	28-Jan	31-Jan	30-Jan		6-Jan
Orientation																				
Online Proposal Submission Deadline																				
Background Study & Survey																				
Preliminary Code & Equipment's																				
Finally, Code Writing and Implementation																				
Chapter 1 & 2 Submission deadline to Supervisor																				
Online Chapter 1 & 2 Submission Deadline																				
Thesis Book writing																				
Testing & optimization																				
Attend Final Defense (of Summer'21 groups)																				
Progress Defense																				
Features Addition & Implementation																				
Device testing & System upgradation (if necessary) & Survey																				
Draft Project Book Submission to Supervisor																				
Draft Project Book Submission to External																				
Finalizing the device, and Poster, Book, Summary & Submission to Supervisor																				
Final Defense (Hardcopy of Books DUE)																				

3.4. Cost Analysis

Table 1: costing of all equipment used in our project

Name	Brand	Quantity	Total Estimated Price (BDT)	Source
Buck Converter	LM2596 DC to DC Module	1	60	http://swadeshelectronicsbd.com/home/product_detail/51
Microcontroller	Arduino Uno R3	1	940	http://swadeshelectronicsbd.com/home/product_detail/16
ADXL Sensor	ADXL345 HMC5883L	1	280	http://swadeshelectronicsbd.com/home/product_detail/119
Gas/alcohol/ smoke detection Sensor	MQ-3	1	110	http://swadeshelectronicsbd.com/home/search_product
Buzzer Sensor	Active Buzzer V_{cc} 5 v	2	10 x 2 =20	http://swadeshelectronicsbd.com/home/product_detail/139
Sim Shield GSM Module	SIM 900A	1	750	http://swadeshelectronicsbd.com/home/product_detail/21
Display	16x2 Serial LCD Module	1	200	http://swadeshelectronicsbd.com/home/product_detail/32
Battery	Lipo Battery 900mAh 11.1 V 3S	1	900	http://swadeshelectronicsbd.com/home/search_product
Battery Charger	Lipo B-3 Battery Charger	1	350	http://swadeshelectronicsbd.com/home/product_detail/105
Jumper Wire	Male to Male Male to Female	2	50 X 2=100	
Total Cost (BDT)			3710	

3.5. P.E.S.T. Analysis

This lesson is a frame that our presented project categorizes macro-environmental influences in strategic planning which is used by formations to detect, evaluate, arrange and track macro-economic elements which can be effective on its business now and in the upcoming future. This framework shows the opportunities and threats due to Political, Economic, Social and Technological units. PEST analysis helps to assess the technique which fits into the broader circumstances and stimulates artistic thinking and also gives an overall essential external and internal impacts that can affect our project. This PEST analysis will be useful for any institutions that need to measure the current and future markets of our project.

3.5.1. Political Analysis

Bangladesh Government has always encouraged making our road and transportation sector smart and developed. The Sustainable Development Goals adopted by UNDP are a landmark step. Where all the state leaders of the world have come together and decided that by 2030, the planet will be protected and all people will enjoy peace and prosperity. In the continuation of which Bangladesh is determined to follow these goals. The goals for " GOOD HEALTH AND WELFARE" talks about ensuring the safety of a bike rider and their welfare throughout. The goal for "DECENT WORK AND ECONOMIC GROWTH" enlarges about the decent work of the riders and making the roads safe for everyone. As a result, the economic growth remains stable and people's prosperity continues. The goal "INDUSTRY, INNOVATION AND INFRASTRUCTURE " helps to ensure the innovation of such kind of technology among common people of a country. Thus, these goals help in to build more sustainable growth of the riders using the technology.

3.5.2. Economic Analysis

This proposed project is an economically stable project. All the sensors and other electronic parts are within affordable price range which will make a positive impact on each economic factor. These components are also easily available in the online and local markets. The technology we are using is not that much expensive. Overall, it's a budget friendly technology that can be smoothly used by the general people.

3.5.3. Social Analysis

Bangladesh is an overpopulated country and bike accident is increasing day by day. In this country there are many people as like they are not interested in using helmet. Our multifunctional smart helmets Attractive features will attract this kind of people. This kind of helmet will Increase our awareness and it gives us the direction of google map by voice and we can reach our destination without any kind of hassle. I think our Multifunctional Smart Helmet will make our society Smarter.

3.5.4. Technological Analysis

There are several conventional Smart Helmet in the market. Our project gratifies advanced technological impacts which may attract the companies. So, there is some risk to sharing our concept because big companies may steal our concept and take advantage of our new technological methods. Technology has always been the best way to research. In future, this multifunctional helmet can be upgraded with the flow of modern technology.

3.6. Professional Responsibilities

Ensuring that a system, method, or product is risk-free and effective in its intended usage is the responsibility of an engineer. For their projects to succeed, engineers need to be able to effectively collaborate with one another and work in teams. All parties involved in engineering, including customers and businesses, must effectively communicate. Along with these duties, engineers are also accountable for the following:

- Creating plans with the use of detailed drawings.
- Creating forecasts and budgets for varied tasks defining the project's scope's boundaries, the process of creating experiments for the engineering field
- Preparing regulatory paperwork that is pertinent to safety initiatives
- Producing technical papers that are targeted at the clients
- Executing projects on time and within budget.
- Sharing analysis's final findings and conclusions with coworkers and clients.

3.6.1. Norms of Engineering Practice

The term "norms" is used to describe moral guidelines. The normative design method is the best way to discover a compromise between the various ethical and technical options, even when it necessitates design compromises. We adhered to the IEEE code of ethics while carrying out this project since engineers are required by law to conduct impact assessments in order to fulfill their obligation to design in a way that ensures the design will have a positive impact on the society in which it is implemented.

One of the most important social characteristics of a company is when employees feel as though their contributions are valued. If engineering managers want to succeed in their roles, they must prioritize the capability development of their personnel. To give employees the idea that the company cares about them, it is essential to create a transparent growth plan and maintain regular communication regarding the employee's capabilities, requirements, improvements, and objectives. During the planning and execution of this study, any form of misconduct, including bribery, was prohibited.

3.6.2. Individual Responsibilities

Any attempt could result in success if teamwork is properly managed. If the team is to succeed, each member must be informed of their respective responsibilities. The project team consists of four people, each of whom has been in charge of a different stage that the project underwent to stand out. The project can stand out from the competition by beginning with a sound strategy, such as developing project ideas, holding a meeting to discuss them, writing a book, conducting research for the book, finding the crucial book template points, properly arranging the book, and checking the book for errors and plagiarism. This project's hardware and circuit simulation components were jointly developed.

Member 1: Quazi Farhan Amer

It was my responsibility to create the electrical simulation parts which were done in Proteus 8.10 Professional for our project. My part in the project was to work with the other team members to produce a book. I worked on several aspects of the book, including the chapter 3 & 5, cost analysis and assistance with hardware preparation. Some of the information and references were gathered, and organized by me for suitable publication. I was also in charge of making sure contributed by writing sections of the book.

Member 2: Md Rashedul Hasan Bhuiyan

It was my responsibility to compute, assess, and evaluate the significant conclusion for our project. It was my responsibility to create the hardware for our project. I wrote my contributions after discussing the book's sections with the other team members. I create the project's block diagram. I also support my teammate during the simulation. I was also in charge of planning and team communication. contributed to the Chapter 6 of the thesis book's composition. helped with the hardware preparation. In addition to the hardware setup and coding, the whole phase has been finished.

Member 3: Taznim Bin Ahmed

It was my responsibility to participated in both the hardware preparation and the writing of chapters 2 and 6 of the thesis books. This project's study and analysis, as well as the gathering of all the parts from various locations, were successfully finished. I completed several sections of the book, including the flowchart and Gantt chart.

Member 4: Farhan-Al-Israque

It was my responsibility to conduct research on many related works to get information for our task. Additionally, I wrote chapters 2 and 6 for my thesis books. I was able to write my sections by distributing bits of the book to the team members. I verified the task's completion date, preparing PowerPoint presentation, make poster and did make sure our collaboration was in order.

3.7. Management principles and economic models

The subject of management economics, a branch of economics, is the application of economic theory and analysis to the issue of managerial decision-making. One of the main duties of economic management is to create a framework for decision-making that is centered on increasing the revenues and outcomes of a company. By maximizing the use of all of its resources to increase productivity while concurrently reducing unproductive operations, an organization can improve its effectiveness. In order to properly optimize economic decisions for management as well as economic ones, you might need to employ a combination of operations research, mathematical programming, strategic decision-making, game theory, and other computer technologies. Managed economics is a synthesis of the economics and management philosophy fields. It facilitates management decision-making and serves as a bridge between real-world experience and theoretical knowledge. Managers gain a substantial edge from management economics because of the approaches and procedures it offers. This is because managers are better equipped to make the most

informed decisions possible in any situation. To execute the project, we have followed some basic principles of project management

- Awareness of the need for change
- As a part of team work support the change
- Knowledge of how to change
- Ability to demonstrate skills and behaviors

3.8. Summary

In this chapter we discuss about our project management. Basically, we analysis S.W.O.T and P.E.S.T system of a multifunctional smart helmet for bike riders. Also, here discussed about the implementation of our project on software. Microstrip patch antenna will have a big impact on economic and social in our country. The project was done with complete project management from the beginning which included various aspects like strategic planning, scheduling, cost analysis, analysis of macro-economic factors, organizing the accountabilities of individuals, maintaining multidisciplinary components and studying the lifecycle of the project. Scheduling project tasks with the distribution of works, equipment and maintaining time table ensured the best utilization of resources as well as finishing all tasks in time. For some technical errors in components our project was delayed for some short period. Distribution of accountabilities resulted in proper utilization of expertise. Efficient use of multidisciplinary components provided advantages while conducting tasks. With proper project management, the project is running with a successful accomplishment of the goals and objectives.

Chapter 4

METHODOLOGY AND MODELING

4.1. Introduction

In the world of technology, the use of different technologies is being increasing day by day. Keeping this technological development on mind, our project tends to develop a smart helmet for the bike riders for ensuring their safety and give them a pleasant experience while riding. In recent times the number of bikes has increased a lot in our country. This increased number of bikes are regularly becoming prone to many accidents. Which is hampering one's personal life and decreasing the productivity of the nation. Maximum number of this accidents occurs due to insincerity of the bike riders [3]. Often most them are seen to ride without helmets or even seen to ride while drunken or fallen asleep while riding the bike. To overcome this type of drawbacks we came up with the idea of the smart helmet. This helmet will protect the rider from serious injuries by notifying the rider with some given applications [4]. The helmet will warn the rider if he is drunk while riding [5]. It will send emergency message to rider's close ones and to specific hospital claiming for help if any kind of accident occurs. Through this helmet it will be easier for anyone to locate them using the GPS. While riding this helmet will prevent the rider from falling asleep, a buzzer will beep after a specific moment if the rider falls to sleep. A Bluetooth device will help the rider to receive calls without using the hand. This way the ride of a bike would be much safer and technologically advanced coping up with the present world.

4.2. Block Diagram and Working Principle

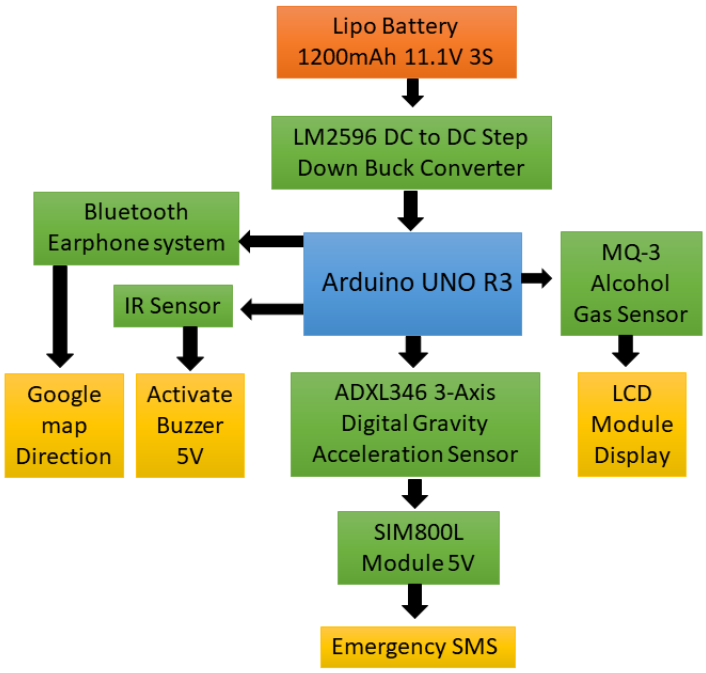

Figure 4.2.a Experimental block diagram

From the figure 4.2.a, It is visible that Li-po Battery 1200mAh 11.1V 3S is used for the power supply of the whole circuit. A microcontroller unit Arduino UNO R3 is being used to control the circuit. The microcontroller that is connected to the infrared sensor, MQ-3 Alcohol Gas Sensor, ADXL346 3-Axis Digital Gravity Acceleration Sensor Module and SIM900A Module 5V. A SIM card is mounted in SIM900A Module 5V.

The microcontroller receives information from the ADXL3 that detects the accidental shake of the helmet, and the SIM900A Module 5V sends emergency SMS and the microcontroller obtains a digital value then the GSM sends the user location data to the contact numbers given on the Arduino UNO R3.

MQ-3 Alcohol Gas Sensor is connected with the Arduino UNO R3. At the input end if any alcohol detected, "Drunk" status will show on the 16x2 Serial LCD Module Display [6]. At the output end, the connected buzzer will be activated and the artificial warning sound will be played.

IR sensors are used to detect if the rider's eye is closed or open. When closed eye is detected by the sensor, the will buzzer alerts the rider to stay focused. The buzzer will be mounted near the ear area of the helmet.

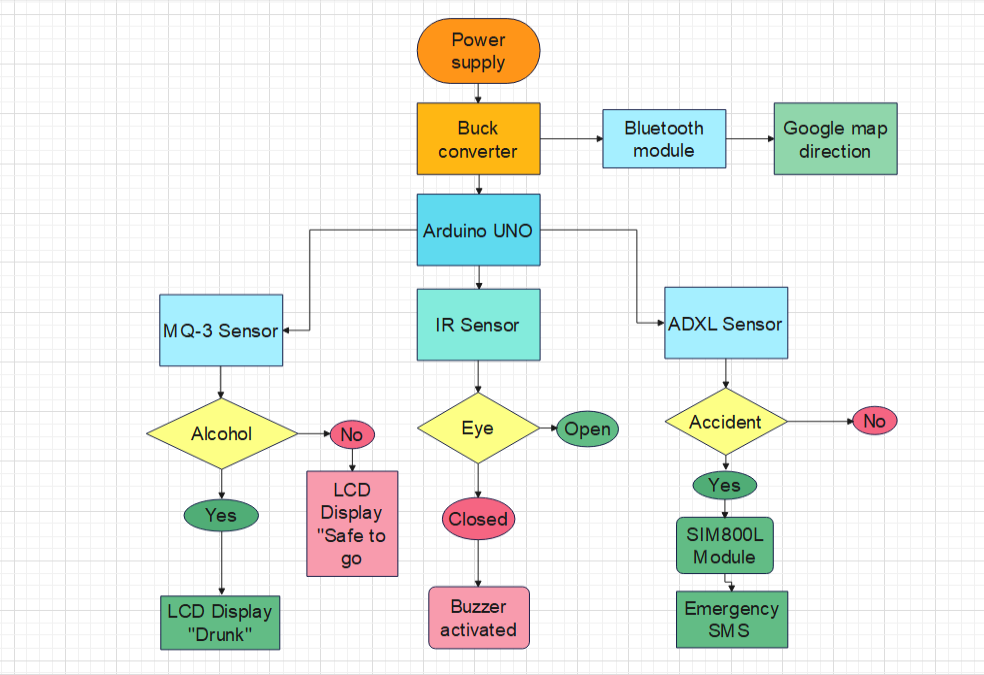

Figure 4.2.b Experimental flowchart.

4.3. Modeling

Based on the design modeling of this project, the smart helmet consists the placement of the component on the helmet. The containing components are

- Arduino UNO
- Gas/Alcohol/Smoke detector (MQ3)
- Vibration Sensor (ADXL)
- Eye Blink Detector (IR)
- Buzzer
- Sim Shield (GSM Module)

Figure 4.3 Experimental setup simulation in Solidworks simulation tool.

4.4. Summary

All of the key components and methodologies were covered in this chapter. The descriptions of block diagrams, flowcharts, and three-dimensional models are typically included in this chapter. This chapter's main goal was to illustrate the modeling approach and project-working methodology. The block diagram and flowchart for the project were initially described. All of the 3D structures were then shown and briefly examined after that. Overall, the working technique and modeling element are successfully covered in this chapter.

Chapter 5

PROJECT IMPLEMENTATION

5.1. Introduction

Any project that is going be successfully carried out must be closely supervised. This chapter discusses the electrical components that were used in accordance with the work that was assigned to us for our project as well as the preparations that have been made for the execution of our suggested project in terms of the parts of the simulation design. Any project that is to be successfully implemented involves diligent supervision. Based on the job that was being done, this chapter discusses the electrical components that were supplied to us for our project, together with the arrangements made for the implementation of our suggested in terms of the aspects of simulation design for the project [7]. The project manager takes into account the types of steps used to complete the hardware and simulation component. As part of this inquiry, simulations based on software were run using Proteus 8.10. project administration includes not only how this is accomplished but also the kind of tactics that have previously been employed for the achievement of comparable objectives by others. Hardware and simulation have both been utilized to take their place inside the project. We shall discuss the many types of components that have been used in this chapter. In order to make the project's hardware a reliable source for a bike rider, this chapter also explains how to integrate these components and operate the hardware.

5.2. Required Tools and Components

Table 3: Inventory of apparatus

S/L	Name of Components	Quantity
1	Arduino Uno R3	1
2	LM2596 DC-DC Step Down Buck Converter	1
3	Lippo Battery 1200mAh 11.1V 3S	1
4	16x2 Serial LCD Module Display for Arduino Assembled	1
5	SIM800L Mini GPRS GSM Module	1

6	Active Buzzer 5V	1
7	MQ-3 Alcohol Gas Sensor	1
8	ADXL346 3-Axis Digital Gravity Acceleration Sensor Module	1
9	Infrared sensors	1
10	Jumper Wire	2-Set

5.2.1. Arduino Uno R3

A microcontroller board called the Arduino Uno is based on the ATmega328. The device contains a 16 MHz resonator, 20 digital input/output pins, 6 PWM outputs, 6 analog inputs, a USB port, a power jack, an in-circuit system programming (ICSP) header, and a reset button [2]. It comes with everything needed to support the microcontroller; to get started, just plug in a USB cable, an AC-to-DC adapter, or a battery. The FTDI USB-to-serial driver chip is not used by the Uno, which is how it differentiates from all earlier boards. Instead, it has an ATmega16U2 that has been configured to act as a USB-to-serial converter. This auxiliary microcontroller has its own USB bootloader, which allows advanced users to reprogram it. The Arduino is a fantastic entry-level platform for embedded electronics since it has a sizable support community, a huge selection of support libraries, and hardware add-on "shields" (for example, you can easily make your Arduino wireless with our Weixel shield). Keep in mind that we also provide a Spark Fun Inventor's Kit that comes with an Arduino Uno and a variety of other parts (such as a breadboard, sensors, jumper wires, and LEDs) that enable you to build a variety of entertaining starting projects.

- This is the 3rd revision of the Uno (R3), which has a number of changes:
- The USB controller chip changed from ATmega8U2 (8K flash) to ATmega16U2 (16K flash). This does not increase the flash or RAM available to sketches.
- Three new pins were added, all of which are duplicates of previous pins. The I2C pins (A4, A5) have been also been brought out on the side of the board near AREF. There is a IOREF pin next to the reset pin, which is a duplicate of the 5V pin.
- The reset button is now next to the USB connector, making it more accessible when a shield is used

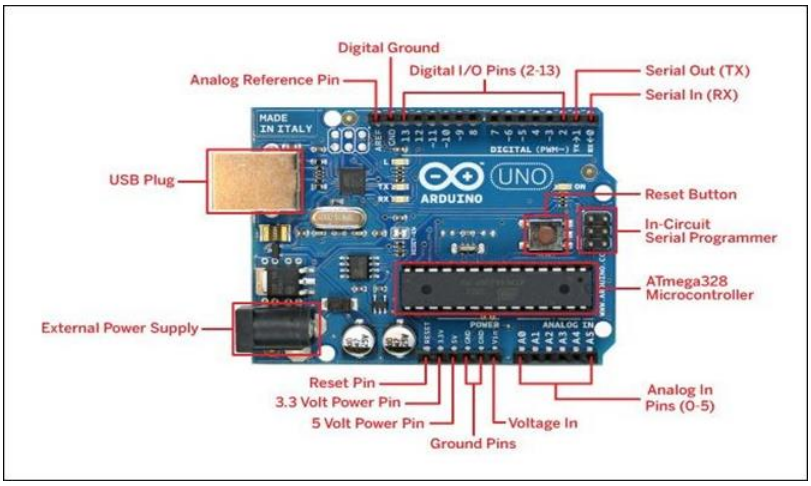

Figure 5.2.1 Arduino Uno R3

5.2.2. LM2596 DC-DC Step Down Buck Converter

DC-DC Buck Converter Step Down Module LM2596 Power Supply is a step-down(buck) switching regulator, capable of driving a 3-A load with excellent line and load regulation. These devices are available in fixed output voltages of 3.3 V, 5 V, 12 V, and an adjustable output version. The LM2596 series operates at a switching frequency of 150kHz, thus allowing smaller sized filter components than what would be required with lower frequency switching regulators.

Specifications of DC-DC Buck Converter Step Down Module LM2596 Power Supply:

- Conversion efficiency: 92%(highest)
- Switching frequency: 150KHz
- Output ripple: 30mA9maximum)
- Load Regulation: ± 0.5%
- Voltage Regulation: ± 0.5%
- Dynamic Response speed: 5% 200uS
- Input voltage:4.75-35V
- Output voltage:1.25-26V(Adjustable)
- Output current: Rated current is 2A, maximum 3A (Additional heat sink is required)
- Conversion Efficiency: Up to 92% (output voltage higher, the higher the efficiency)
- Switching Frequency: 150KHz
- Rectifier: Non-Synchronous Rectification
- Module Properties: Non-isolated step-down module (buck)
- Short Circuit Protection: Current limiting, since the recovery

- Operating Temperature: Industrial grade (-40 to +85) (output power 10W or less)

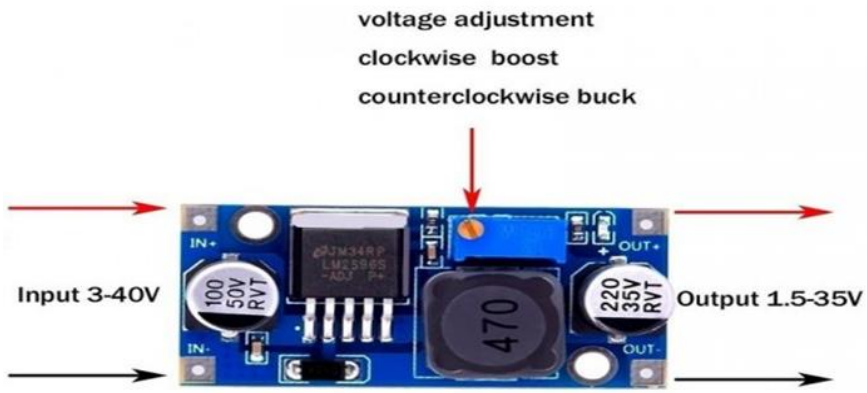

Figure 5.2.1 LM2596 DC-DC Step Down Buck Converter

5.2.3. LM2596 DC-DC Step Down Buck Converter

Batteries made of lithium-ion polymer, sometimes referred to as "lipo" or "lipoly," are small, light, and effective. When fully charged, the output voltage ranges from 4.2V to 3.7V. The 1200mAh capacity of Lithium-Ion Polymer Battery - 3.7V 1200mAh is to 4.5 Wh. The batteries have the required protection circuitry and come pre-attached with an authentic 2-pin JST-PH connector as illustrated. The cable won't snag or become stuck in a matched JST jack since they have a genuine JST connector, not a knockoff; instead, they click in and out smoothly. The built-in protection circuitry prevents the battery voltage from rising too high (from overcharging) or falling too low (from overuse), so the battery will cut out at 3.0V when it is entirely dead. Additionally, it will guard against output shorts. It is crucial to only recharge them with a LiIon/LiPoly constant-voltage/constant-current charger and at a pace of 500mA or less, even with this safeguard. Lithium-Ion Polymer Battery - 3.7V 1200mAh lacks a built-in thermistor, like the majority of lipos. Therefore, charging at 1/2C or even lower is advised (500mA is the maximum you may receive from a USB port).

Figure 5.2.3 LM2596 DC-DC Step Down Buck Converter

5.2.4. 16x2 Serial LCD Module Display for Arduino Assembled

For showing various system parameters and the state of the system, LCDs (Liquid Crystal Displays) are utilized in embedded system applications. A 16-pin gadget called an LCD 16x2 has two rows with room for 16 characters apiece. You can use the LCD 16x2 in either 4-bit or 8-bit mode. Additionally, it is possible to make original characters. It contains 3 control lines that can be utilized for control in addition to the 8 data lines.

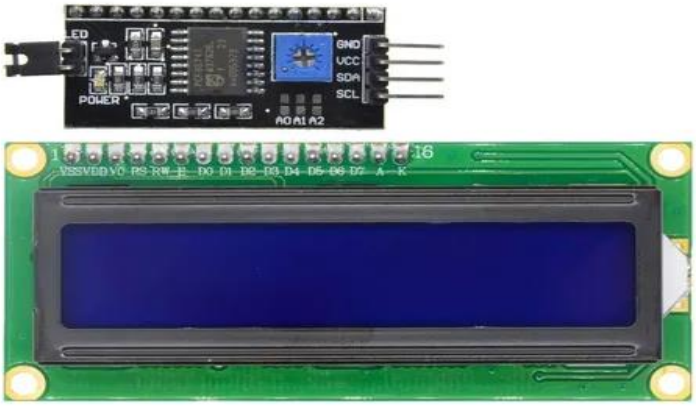

Figure 5.2.4 16x2 Serial LCD Module Display for Arduino Assembled

5.2.5. SIM800L Mini GPRS GSM Module

The SIM800L is a tiny cellular module that supports voice and data conversations, SMS sending and receiving, and GPRS transmission. This module is the ideal choice for any project that needs long distance communication because of its affordable price, compact size, and compatibility for four different frequency bands. When the power is connected, the module starts up, looks for a cellular network, and logs in automatically. Onboard LEDs show the connection status (no network coverage - fast blinking, logged in - slow blinking). There are already two antennas on this module. Wire makes up the initial component, which is connected directly to the NET pin on the printed circuit board. In cramped quarters, this feature is particularly useful. An attached PCB antenna and pigtail cable make up the second component using double-sided tape to connect to an IPX network. One that performs better and makes it possible for you to cover your module in a metal container, provided that the antenna is kept exposed to the atmosphere [9].

Figure 5.2.5 SIM800L Mini GPRS GSM Module

5.2.6. Active Buzzer 5V

This buzzer is an active buzzer, which simply means that even when you just offer steady DC power, it will buzz at a predetermined frequency (2300–300 Hz) on its own. Take a look at our passive buzzer if you're searching for a buzzer that can generate a variety of tones from an oscillating input signal. Some people prefer to purchase active buzzers since they may be operated with constant DC power and can create a variety of tones when an oscillating signal is applied. Compared to their relative, the passive buzzer, which depends on an oscillating signal to produce any tone, some people think they are more adaptable.

Figure 5.2.6 Active Buzzer at 5V supply

5.2.7 MQ-3 Alcohol Gas Sensor

MQ-3 module is suitable for detecting Alcohol, Benzine, CH4, Hexane, LPG, CO. Sensitive material of MQ-3 gas sensor is SnO2, which with lower conductivity in clean air. When the target alcohol gas exists, the sensor's conductivity is higher along with the gas concentration rising. MQ-3 gas sensor has high sensitivity to Alcohol, and has good resistance to disturb of gasoline, smoke and vapor. This sensor provides an analog resistive output based on alcohol concentration. When the alcohol gas exists, the sensor's conductivity gets higher along with the gas concentration rising. There is a resistance across an A and B inside the sensor which varies on detection of alcohol. More the alcohol, the lower the resistance. The alcohol is measured by measuring this resistance. The sensor and load resistor form a voltage divider, and the lower the sensor resistance, the higher the voltage reading will be. Structure and configuration of MQ-3 gas sensor is shown in the figure above for Configuration A or B, sensor composed by micro AL2O3 ceramic tube, Tin Dioxide (SnO2) sensitive layer, measuring electrode and heater are fixed into a crust made by plastic and stainless-steel net. The heater provides necessary work conditions for work of sensitive components. The enveloped MQ-3 have 6 pins, 4 of them are used to fetch signals, and other 2 are used for providing heating current.

Applications of MQ-3 Gas Sensor

- Gas level over-limit alarm
- Breathalyzer
- Portable alcohol detector
- Stand-alone/background sensing device
- Environmental monitoring equipment

	Parts	Materials
1	Gas sensing layer	SnO_2
2	Electrode	Au
3	Electrode line	Pt
4	Heater coil	Ni-Cr alloy
5	Tubular ceramic	Al_2O_3
6	Anti-explosion network	Stainless steel gauze (SUS316 100-mesh)
7	Clamp ring	Copper plating Ni
8	Resin base	Bakelite
9	Tube Pin	Copper plating Ni

Figure 5.2.7 MQ-3 Alcohol Gas Sensor

5.2.8. ADXL346 3-Axis Digital Gravity Acceleration Sensor Module

A three-axis accelerometer with high resolution (13bit) measuring up to 16 G, the ADXL346 is compact, thin, and extremely low power. 16-bit binary digital output data type is available through the SPI (3- or 4-wire) or I2C digital interfaces. The ADXL346 is a good choice for applications on mobile devices. It detects the use of static gravity acceleration in tilt sensing applications as well as the acceleration of dynamic acceleration motion or vibration induced by its high resolution (4mg/LSB), which can measure tilt changes of less than 1 degrees of inclination. There are a few unique induction features offered. For the user to compare with any axial acceleration, comparisons are conducted for the existence or lack of motion acceleration, such as the presence or absence of remote sensing probe activities and the g values. To detect a single or double click in any direction, use click sensing. If the object is falling, a free fall sensor is activated. The concurrent four and six position directional detecting capabilities of the ADXL356 is built-in, and the user may use the designated interrupt notification controller. Each of these features can be assigned to one of the next two interrupt output pins. A 32 first in first out (FIFO) buffer that can be used to store data, reduce host processor activity, and lower overall system power consumption is integrated into a patent-pending memory management system. Low power mode offers extremely efficient intelligent motion power management with threshold detection and active acceleration measures.

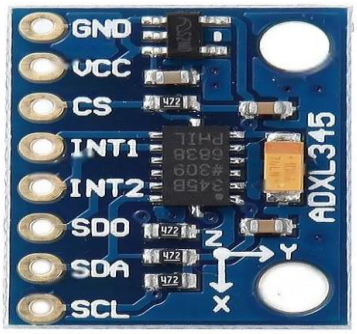

Figure 5.2.8 ADXL346 3-Axis Digital Gravity Acceleration Sensor Module

5.2.9. Infrared sensors

An electrical gadget that produces infrared light to sense certain features of its environment is called a sensor. An IR sensor can monitor an object's heat while also spotting movement. These kinds of sensors are referred to as passive IR sensors since they do not emit infrared radiation; instead, they merely measure it. Typically, all items emit some kind of thermal radiation in the infrared range. An infrared sensor may pick up on these radiations, which are invisible to human vision. An IR LED (Light Emitting Diode) serves as the emitter, and an IR photodiode, which is sensitive to IR light of the same wavelength as that emitted by the IR LED, serves as the detector. The resistances and output voltages when IR light strikes the photodiode change proportionally to the intensity of the IR light received.

An infrared sensor operates on a similar concept as an object detection sensor. The IR LED and IR Photodiode in this sensor can be combined to create a photo-coupler rather than an optocoupler [11]. The physics principles utilized in this sensor include weins displacement, Stephan Boltzmann, and planks radiation. One type of transmitter that generates IR radiations is the IR LED. This LED resembles a typical LED in appearance, and the radiation it produces is invisible to the human eye. An infrared transmitter is primarily used by infrared receivers to detect the radiation. Photodiodes are a kind of these infrared receivers. Because they only detect IR radiation, IR Photodiodes are different from regular Photodiodes. Infrared receivers come in several varieties based on factors like voltage, wavelength, packaging, etc. When utilized as an IR transmitter and receiver pair, the wavelength of the receiver must match that of the transmitter. Here, an IR photodiode serves as the receiver and an IR LED as the transmitter. The infrared light produced by an infrared LED can be detected by an infrared photodiode. The amount of acquired infrared light is proportional to the photodiode's resistance and the change in output voltage. This is the basic idea behind how an IR

sensor works. A portion of the infrared emission will reflect back toward the infrared receiver once the infrared transmitter produces it, after it reaches the object. Depending on the strength of the answer, the IR receiver can choose the sensor output.

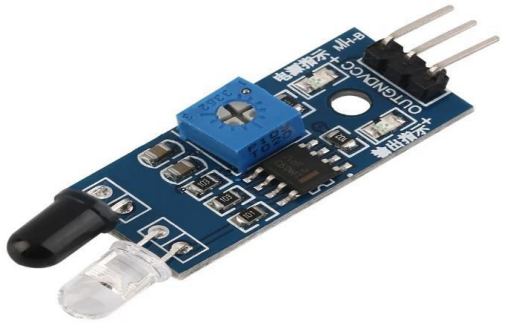

Figure 5.2.9 Infrared sensor

5.2.10. Jumper Wire

An electrical wire used to link several electric circuits on printed circuit boards is referred to as a "jumper wire." By attaching a jumper wire to the electrical circuit and then short-circuiting it, it is possible to produce a short circuit and a jump. You complete a contact when you wish to set a jumper by screwing a plug onto the existing prongs. By totally or partially closing an electrical circuit, a jumper effectively serves as a switch. By inserting or deleting jumpers in the right slots, one can change the performance or functionality of a computer component. A jumper block is a common term for a group of persons that jump together. Jumpers are typically tiny metal connections that are used to either close or open a circuit's segment. To regulate an electrical circuit board, they may have anywhere from two to numerous connecting points. Their responsibility is to modify the settings for the various computer components, such as the motherboard. Consider for a second that your motherboard could allow intrusion detection. By adjusting a jumper, it can be turned on or off.

Figure 5.2.10 Jumper Wires

5.3. Implemented Models

This project implementation is done in two ways, simulation model and hardware model. The simulation model combines the logical and mathematical ideas and uses computer software to try to replicate a real-world system. Contrastingly hardware model consists of the circuit designed to perform the referred operation.

5.3.1. Simulation Model

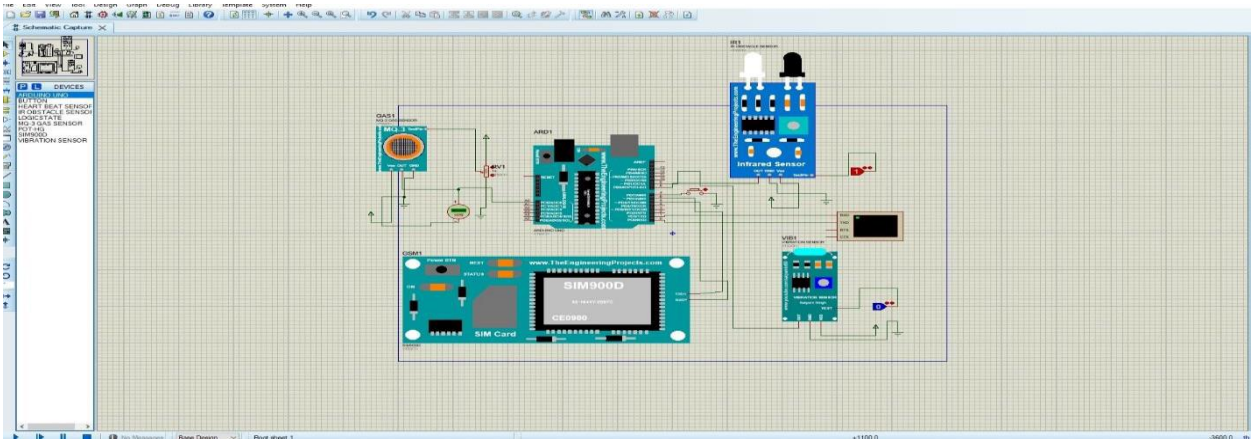

Figure 5.3.1 Simulation of our project on Proteus Simulation tool

The entire simulation diagram for this thesis is displayed in the simulation diagram above to show the procedure. It is only natural to gather simulation data and do an analysis on it when the circuit diagram execution is complete. Depending on the particulars of their circumstances, users could receive various results.

5.3.2. Hardware Model

Figure 5.3.2 Hardware setup of our project

A microcontroller box is shown in Figure 5.3.2. This box is positioned at the upper back side of the helmet. The major components of the project are contained within this box; such as Arduino uno that controls the entire project, as well as a bread board, a Vibration Sensor (ADXL) and a Sim Shield (GSM Module). Whereas a Gas/Alcohol/Smoke detector (MQ3), an Eye Blink Detector (IR) and a Buzzer is placed inside the helmet.

5.4. Summary

A smart helmet can reduce bike accident. A smart helmet can help a person if he accidents and can't call for help. The emergency message system will let their friends and family know that may be an accident occurred. A rider can easily follow the google map direction through Bluetooth earphone module mounted on the helmet. This smart helmet uses the Arduino UNO R3 as a microcontroller, housed inside the controller box.IR sensors, which can detect closed eye and give a warning sound to the user as an indication to be alert. This smart helmet is powered by a LiPo battery. Once the charge is gone, it is possible to recharge with the charger and operate again

Chapter 6

RESULTS ANALYSIS & CRITICAL DESIGN REVIEW

6.1. Introduction

An extremely important part of every project is result analysis, which comes after circuit implementation. This component of the study, which follows the hardware and simulation segment, is essentially a summary of anticipated results. The outcome will be precise if the circuit is linked correctly. Each analysis that has been conducted has revealed that there are a variety of techniques for creating a multifunctional smart helmet for bike riders. The best part about this concept is that it has the potential to be a low-effort solution for many new bike riders for ensuring their life safety. This helmet will be a very useful device for making the driving experience of the riders safer and technologically sound. This project serves as the safety feature for the riders in day-to-day experience. This smart helmet has proven to detect any type of heavy shake on the helmet and send message to the rider's close ones immediately. An IR sensor detects whether the rider has fallen asleep or not, if the sensor detects the eyes of the rider is closed for 2 seconds than a buzzer would beep to awaken the rider immediately. Bangladesh is a developing country, and yet many people in Bangladesh live in poverty. However, the smart helmet is a device of minimal cost which will be affordable for all types of bike riders throughout the country. This Smart helmet serves as a new beginning of the new era on bike riding industry which brings technology closer to the riders. It has now been established that if this project is conducted, it will undoubtedly benefit the bike riders on a great extent.

6.2. Results Analysis

The result of the project will come when the sensors detect the presence of alcohol in the riders breathe or when the IR sensors detect the riders' eyes are closed or when heavy shake is detected. For example, the IR sensor from a certain distance from the eye detects it is closed for 2 seconds than it will simulate the buzzer to beep to awake the rider instantly [8]. The MQ3 sensor will not stop the rider until the breath reading of the rider reaches to a limit of 400 cubic meter, as the reading crosses the limit the LCD display will show that the rider is not ready to drive by displaying "STATUS: DRUNK". A total of five sensors has been used in this project to bring out the desired results. An ADXL sensor, an Infrared sensor, a MQ3 sensor, a

Bluetooth and a GPS sensor. All these sensors are powered using a 12-volt Lippo battery. A buck converter LM 2596 DC-DC is used to control the input voltage to the circuit which limit is around 5 volts.

6.2.1. Simulated Results

The following circuit simulation outputs will be briefly examined in this section. Following the implementation of the circuit diagram, it is only natural to gather and evaluate data from the simulation. Users may receive various results depending on the circumstances.

Simulated result 1: The virtual terminal is showing the output result of Alcohol detection which is performed by the MQ3 sensor.

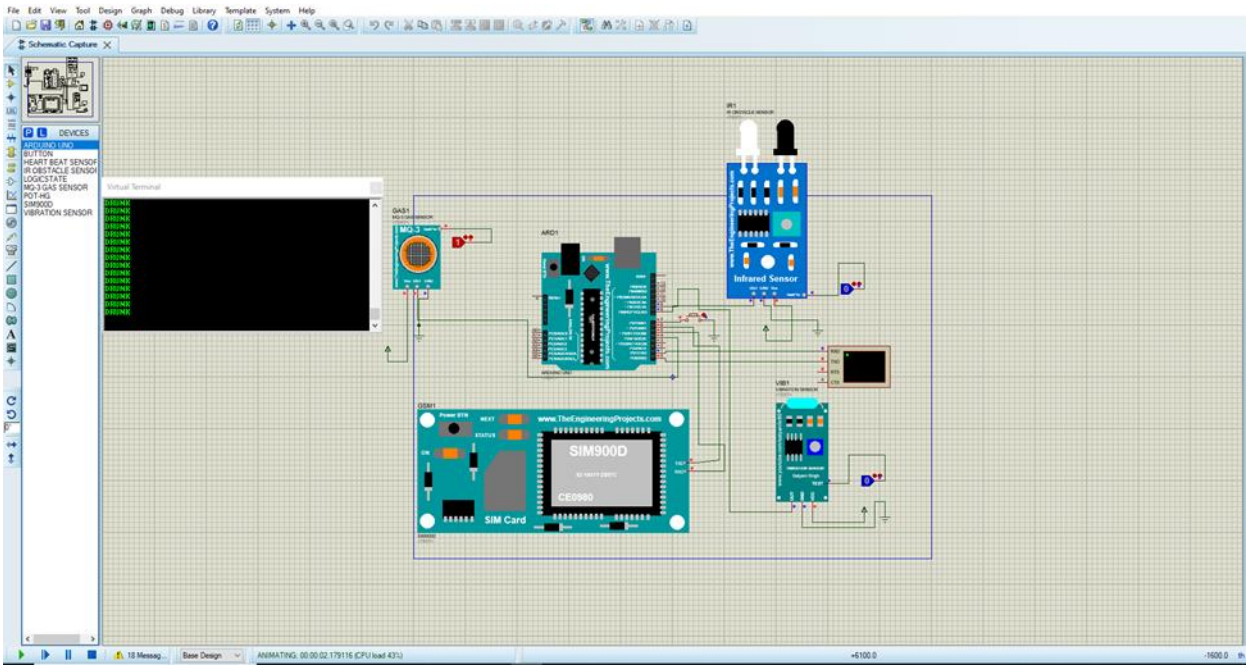

Figure 6.2.1.a Simulated result (output result of Alcohol detection by the MQ3 sensor).

Simulated result 2: The virtual terminal is showing the output result of Eye Blink Detection which is performed by IR sensor.

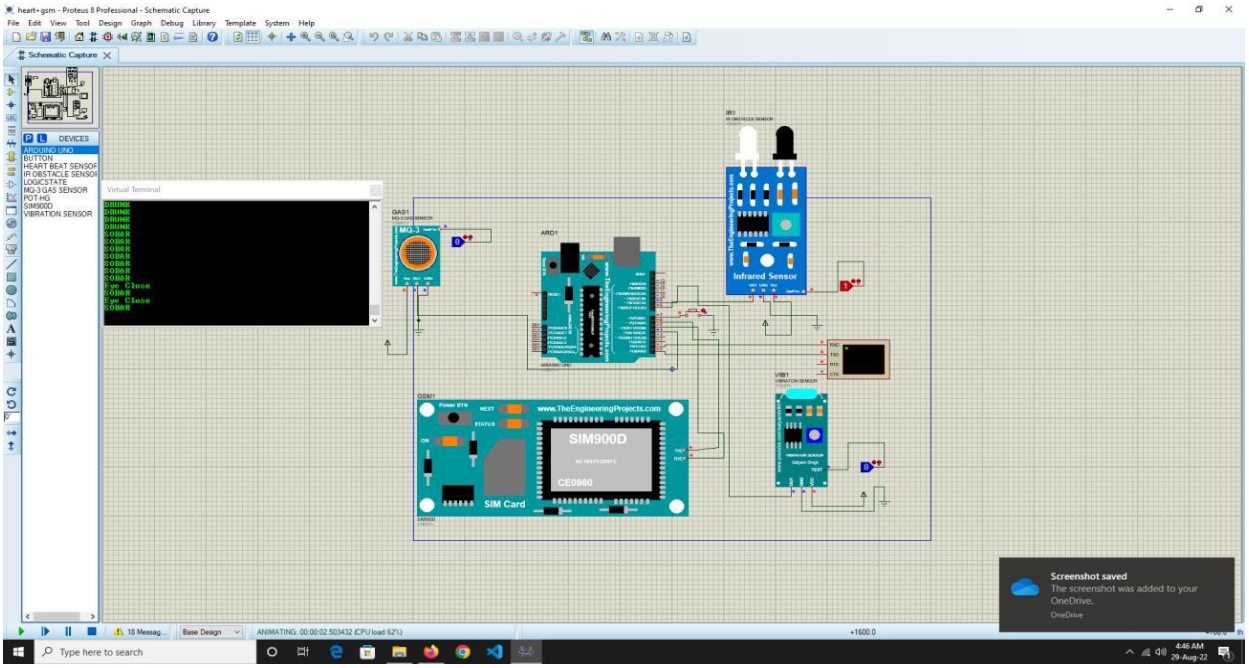

Figure 6.2.1.b Simulated result (output result of Eye blink detection by the IR sensor).

Simulated result 3: The virtual terminal is showing the output result of GSM Module through the vibration of ADXL (Vibration Sensor)

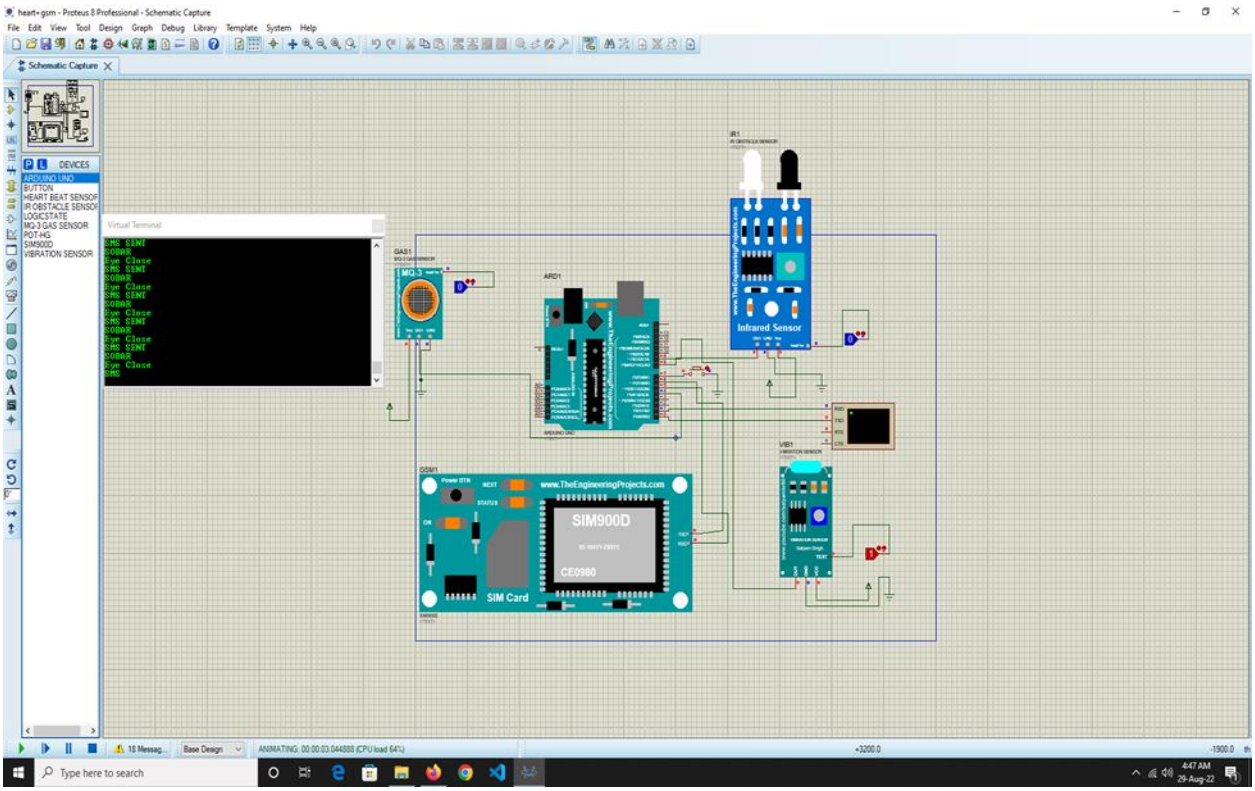

Figure 6.2.1.c Simulated result (output result of GSM Module through the vibration of ADXL (Vibration Sensor)).

6.2.2. Hardware Results

In this project, hardware results and simulation results have been achieved successfully. To achieve the hardware results, the hardware output is acquired by placing the circuit within a circuit board which is placed on a box. The Arduino UNO was used as the microcontroller in the circuit connecting all the sensors. There are several outputs of the project they are shown below-

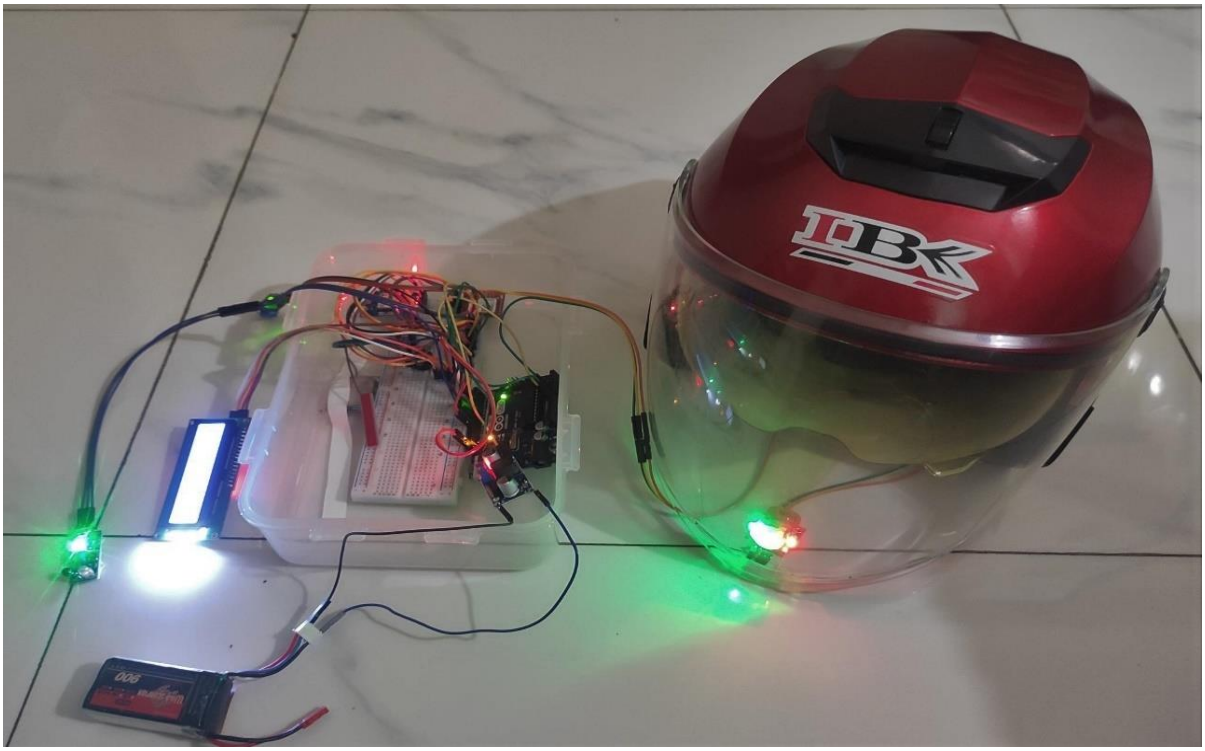

Figure 6.2.2.a Hardware result.

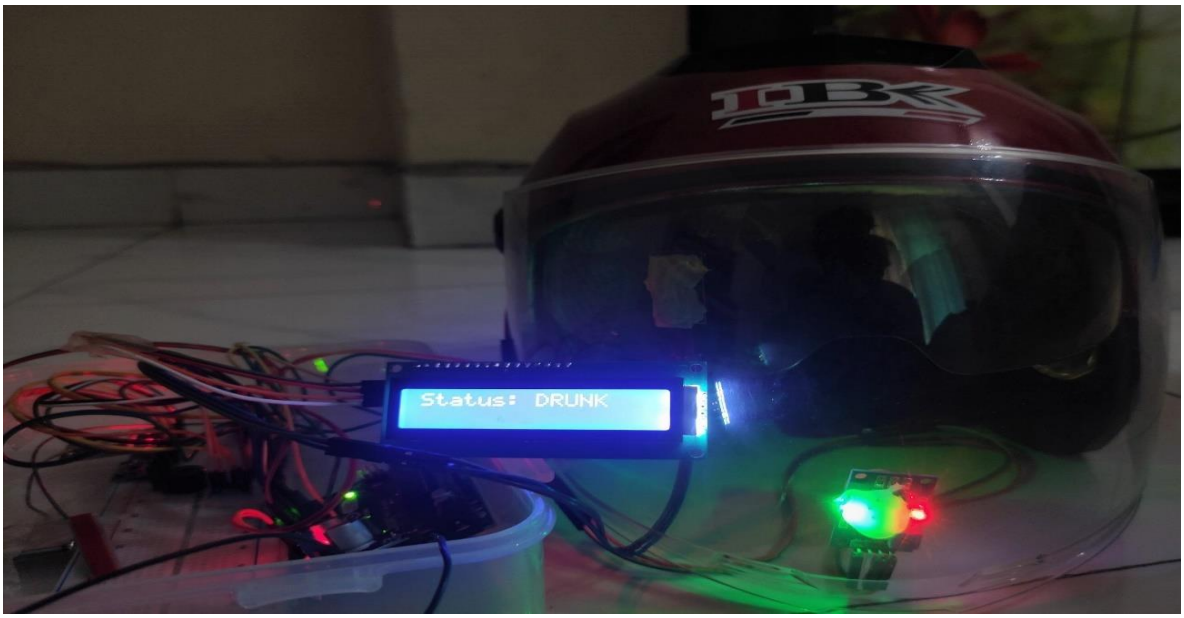

Figure 6.2.2.b Hardware result (alcohol detection).

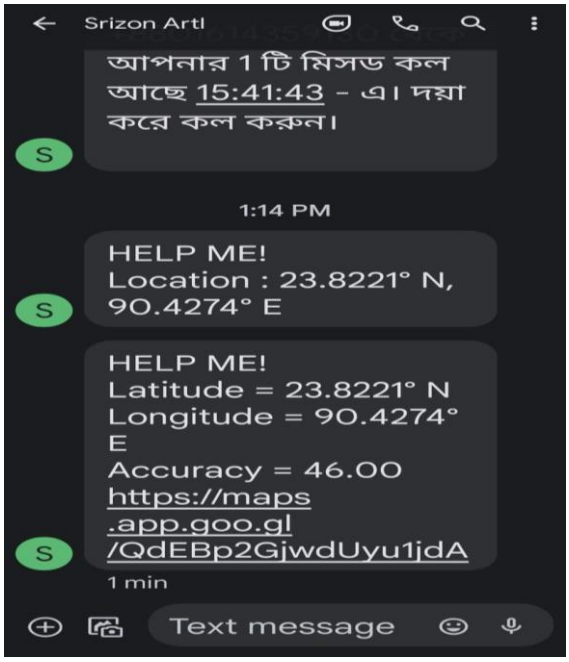

Figure 6.2.2.c SMS notification alert

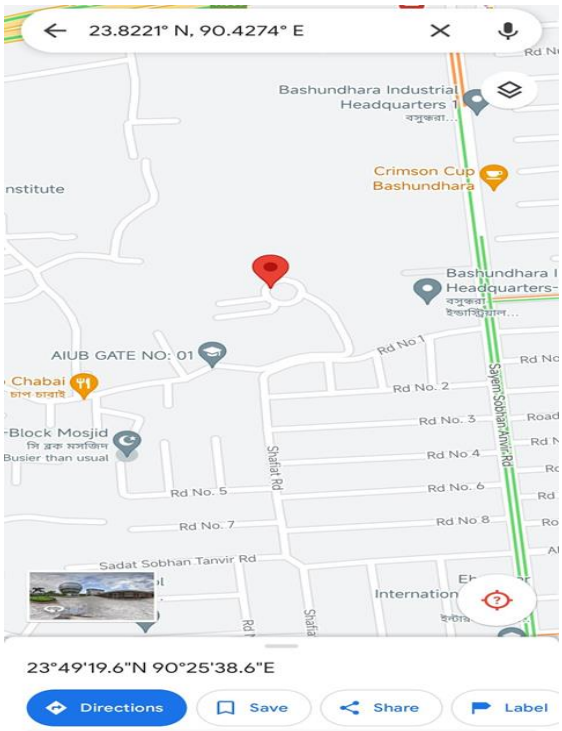

Figure 6.2.2.d Google map location detection

According to the working policy of the project, whenever any heavy shake is detected an emergency message will be sent to the provided number with the location details of the rider [10]. When the MQ3 sensor will detect the presence of alcohol in the rider's breath it will be displaying "Status: DRUNK". The IR sensor mounted before the eyes of the rider will detect the eyes close/off.

Table 4: Data collected from hardware implementation

Sensors	Input / Legal limit value	Output Result
IR sensor	Eye open -1 Eye close- 0	Beep of a Buzzer
MQ3 sensor	200-400 cubic meter = legal limit. Above 400 cubic meters= Drunk	LCD Display- "Status: DRUNK"
ADXL sensor	Shake above 300Hz	Emergency message

6.3. Comparison of Results

In this project, there are some differences between simulation results and hardware results and the other developed system of a smart helmet. Simulation is a demo of this project. And hardware is the implementation of the project. The simulation and hardware implementation were almost similar but there are some differences in result. The comparison of those two results is given below: In the simulation section the IR sensor is displaying the notification of eye close and open on the display monitor but while in hardware implementation there is no such displaying of eye closed or open notification on the LCD display rather a buzzer starts beeping after a specific time. Another difference from the simulation in hardware is that while implementing the hardware we used a Bluetooth earphone for hand free communication which was not implanted while doing the simulation. This project is distinctive in a number of ways that set it apart from similar ones. One of the project's primary elements, to develop technology on a bike helmet is completely a new concept in Bangladesh which comes with offering safety at great extent. The existent helmets are lagging behind from this technology which differs our project from any other products. There are few features which make it unique- Alcohol detection through riders' breath, avoiding riders going to

sleep, detecting heavy shake or vibration and send immediate message for help and tracking down the location of the individual using the helmet. In other parts of the project, the circuit diagram of hardware and simulation is quite the same. Although the whole circuit is placed over the bread board and in the simulation process, we can see the detailed diagram of the circuit. During the hardware test process, we had an additional noise coming up from the buzzer that was due to the IR sensor detecting obstacles in front of it, other than that both the sections of this project are quite the same.

6.4. Summary

The multifunctional smart helmet for bike riders is one kind of project that brings the bike riders close to technology in great extent. This project has been done first through simulation, and then it has been implemented in hardware. The **sole** purpose of the project was to ensure safety of riders by detecting presence of alcohol on riders breathe, sending immediate message to rider's close ones if any heavy shake is detected, preventing rider from falling asleep, hand free communication while riding and GPS to locate the rider easily. These results are obtained and analyzed correctly in simulation. The hardware has been implemented correctly and it has correctly performed the desired operation both on simulation and hardware implementation. The values of simulation and hardware have been adopted in different ways. The simulation part was done by Proteus 8.10. The results of this hardware and simulation are given step by step above.

Chapter 7

CONCLUSION

7.1. Summary of Findings

At this moment, it is possible to say that the project aims of creating and implementing a multifunctional smart helmet for bike riders for ensuring their safety has been totally completed. This helmet is now a technologically advanced helmet which will protect any rider and provide them with the best experience on day-to-day ride. When designing and carrying out this project, we made sure to use a method that was both economical and efficient. This helmet performs a series of job to ensure the safety of the rider. It provides the rider with GPS, prevents the rider from riding bike while drunken, it sends an emergency message to a given number if any kind of heavy shake is detected on the helmet, it also comes with a IR sensor which prevents the rider from falling asleep and a Bluetooth device which helps the rider for hand free communication while riding. This project has a reasonable price tag, is trustworthy, consumes a little amount of power while performing all the given task mentioned above. This helmet will provide with a great deal for the bike riders giving them a huge advantage while riding the bike. In addition, there is a buzzer which will rang on if the driver falls asleep while riding. Thus, this helmet will ensure the safety and provide with an enough technology to make a rider's ride more comfortable throughout.

7.2. Novelty of the work

Every project has its own set of distinctive qualities that distinguish it from other projects, as well as make it more productive and lucrative than those other initiatives. This project now has a contemporary appearance and has reached new heights as a result of the additional modifications. The primary objective of this project is to provide safety to bike rider through using different technologies. The production cost of this helmet is being kept in a minimal limit and the maintenance cost is not so many too. This project is one of a kind which is being distinctive from other helmets for some specific reasons. The helmet can detect the presence of alcohol through the breath of the rider using the MQ3 sensor. It also gives a feature of detecting whether the rider has fallen asleep or not while riding using an IR sensor and gives an alarm with a buzzer to awake the rider immediately. Another special feature of this helmet that it sends message to given numbers using the SIM 800L module seeking for help if any heavy shake is being detected on the ADXL sensor. The helmet comes with a GPS tracker which helps to locate the rider easily through it [12]. A

Bluetooth device is used for hand free communication while riding. All these sensors are attached with the Arduino and the circuit breadboard. It is easy to carry project and handy for all the bike riders. Thus, with this distinctive feature this helmet becomes completely unique from existing helmets.

7.3. Cultural and Societal Factors and Impacts

7.3.1. Cultural and Societal Factors Considered in Design

Special attention has been paid to the cultural and social factors while constructing this project. This project is very different from other available helmets on the market. While production care was taken to make it easy to carry and use for day-to-day rides. This helmet is specially being built keeping in mind the cultural and societal factors of Bangladesh. This type of helmets will be great to use in the roads of Bangladesh. As the number of bikes are increasing day by day with it the number of bike accidents are also increasing in huge number. To irradicate such accidents this helmet will play a vital role. It will ensure the safety of a bike rider in great extent. This thing sets this project apart from all other projects. All modern equipment's like Arduino, GPS, IR, Bluetooth, ADXL, MQ3 sensor has been installed in this helmet. First, Arduino serves as a microcontroller, then the IR sensor detects the eyes condition off or on. The GPS constantly tracks the location of rider. An ADXL sensor detects the heavy shake which allows the SIM 800L module to send immediate message to the provided numbers by the rider seeking for help. The MQ3 detects the presence of alcohol in riders breathe and notifying him not to drive displaying it on an LCD screen. A Bluetooth device enables the rider to receive calls with handsfree while riding. Though this project is completely a new concept in Bangladesh but this is built in such a way that everybody can use it easily. This project will have a significant impact on society. The riders using it will have a better life using it. It will lessen the number of accidents in great extent and provide a safe and better life to the riders. This project's technical system is incredibly effective. This project has been completed by a small group of four persons with varying levels of experience and knowledge. The simulation designers are in frequent touch with the rest of the team members.

7.3.2. Cultural and Societal Impacts of the Proposed Design

An ADXL sensor is employed in the proposed design to detect any heavy shakes which will immediately send messages to the given numbers seeking for help with detecting the location of the

rider through GPS. The sensors are arranged in five different locations in order to cover as many sides as possible while using as few sensors as possible. The sensors were tried to be implemented on the back part of the helmet for easy carrying purpose. A battery charges all these sensors to run properly. Infinite people will be able to travel freely and will be protected from any type of accident by using this smart helmet. They will be able to go wherever they choose without difficulty. They can move about independently with more safety.

7.4. Proposed Professional Engineering Solution

The Multifunctional Smart Helmet was successfully constructed and programmed to meet the requirements, and it has since shown excellent performance. The performance of the smart helmet was put to the test by using a variety of challenges, scenarios, and testing it in a variety of settings. The results showed that the helmet sensors functioned very well. The first thing that has to be considered when analyzing the safety of the rider while riding it detects the heavy shake. Second, identifying the whereabouts of the rider when they are riding the bike. The third issue that has to be addressed is the detection of rider's sleepiness while riding situation. And lastly tracking the rider accurately when he/she seeks help.

7.5. Limitations of the Work

According to the records of a non-government organization Road Safety Foundation, in total 2,078 motorcycle accidents occurred across the country in 2021.A total of 2,214 people died in them, which is 35 per cent of the total road-accident deaths. (Prothom Alo). The technology of multifunctional smart helmet system has the potential to reduce the accident percentage. However, there are certain restrictions placed on the project. At this moment, the smart helmet is not able to provide output in every possible circumstance, and it may be more difficult to get the ideal output at the same time every time. Additionally, since the sensors used in this project are not branded and are very inexpensive, the output system that is a part of this project often generates an additional false buzzer alarm while it is functioning. The wrong warning may give the impression that there is a problem with the system because of the constraints of appropriate quality sensors; however, if there were suitable more accurate and efficient sensors, this issue would be simple to fix. In addition, the implementation of the project's circuit seems to be fairly extensive at first look; however, if the design and implementation are done correctly, it is feasible to position the whole circuit in a single orientation the helmet will look more compact and comfortable to use which will make it more user pleasant. On the other hand, the input approach used in this project brings up concerns that are not pertinent when using standard input. Problems arise for the users to change their habit to use smart helmet. Learning basic

functionalities of the smart helmet is very easy. The detection of eye through the IR sensor is insufficient because sometimes the sensor is unable to distinguish between the eye motions that it is closed or open. As a result, some false waring will be activated on the buzzer but the efficiency and accuracy is quite good. We will also be providing a guide that enables a speedy and simple learning of the use of the smart helmet..

7.6. Future Scopes

In next development, the primary focus will be on enhancing the performance of the system and reducing the amount of error by implementing a more effective programming method that will be able to use the data more efficiently. On the other hand, utilizing sensors of a higher grade in order to reduce the amount of error the potential to significantly improve the usability of this project. In addition, manufacturing the smart helmet on a wide scale and distributing it to the bikers around the country would be a breakthrough step toward allowing the bikers to ride more safely, effectively and reduce the bike accidental death rate. Additionally, we will work on the and the circuit PCB design to make it compact and comfortable to use which will make it more user pleasant. Last but not least we will introduce wireless communication system on helmet.

7.7. Standard Requirements and Ethical Concerns

In the field of engineering, having an ethical concern is an essential quality that not only contributes to the achievement of one's professional goals but also helps one become a better person overall. No estimations or wild guesses were used in any of the measurements that were taken for this study; all of the data were modeled and documented with extreme precision. This project has been carried out in a manner that is both honest and impartial in terms of the research that has been conducted, including planning, modeling, analyzing, and explicating the results. During the course of the investigation, there were no instances of members of the team having competing interests. The research was carried out with the goal of producing the most original results possible, and citations were included where appropriate. During the project's work, each and every rule and regulation was adhered to in the correct manner. The risk of plagiarism was reduced to the greatest degree.

7.7.1. Related Code of Ethics and Standard Requirements

In order to ensure the smooth running of a project, it is essential that engineers adhere to a set of ethical norms. During the course of working on the project, successive phases presented varied

challenges; nonetheless, all of the challenges were given significant consideration, and a solution was found by maintaining them in an intelligent manner. All aspects of this project's operation, from start to finish, have been carried out in a responsible manner. The first aim was to ensure that this endeavor was as enjoyable as possible for everyone involved. In accordance with the IEEE ethical code, the protection of the health, safety, and well-being of those who are silent has been one of the primaries focuses throughout the creation of this project. This project will not have a negative impact on the surrounding environment and will be ongoing. This highly modern and clever piece of technology may be of assistance to people with voice impairments in a number of ways, simplifying their life while also reducing the associated costs. Throughout the course of the development of this endeavor, a range of earlier research papers and projects served as a source of knowledge and information, and everyone involved has been given due credit for their contributions. Every obstacle was overcome with professionalism and openness to the task at hand. In order to get the desired result, the process of designing it was carried out effectively. The construction was done in a safe way during the whole process. There was just a trace amount of plagiarism found in the work. Every ethical commitment was met to the fullest extent possible.

7.7.2. Health and Safety

When carrying out a project, the first thing that must be taken into consideration is the wellbeing of the participants. During the process of developing this idea, it was made very clear that no potentially harmful components or substances that may be harmful to the bodies of customers were allowed to be included. The total project is being created in such a way as to eliminate any potential hazards posed by electronic power or high voltage. The construction was done in a risk-free manner throughout the whole process. This undertaking was carried out without the use of any radioactive components or substances. In addition, the building of this apparatus did not include the use of any combustible components. This endeavor makes use of a gesture-controlled speech system with a sound that is adequately tolerable, with the goal of reducing levels of noise pollution. Last but not least, we check to see that this project does not have any unfavorable effects on either the environment or on people.

7.7.3. Economy, Environment and Sustainability

When creating this project, one of the primary goals was to ensure that the product could be afforded by all of the people who were being targeted. The equipment that was used for this project is straightforward to replace, and there was very little of it. As a consequence of the fact that the costs of all of the instruments and other electronic components are within acceptable parameters, there is a positive impact exerted on each and every economic factor. The technology included into this glove does not come at an especially high price. The productivity of the user may also increase as a result of this. In its most basic form, it is a technology that is both economical and simple to use for those who are deaf or mute.

7.8. Conclusion

This project realizes the objective of contemporary science and technology, which is to bestow ease and comfort onto the user. The creation of a multifunctional smart helmet was supposed to be the end result of this project, which was geared for the bike riders. The bike rider community will benefit tremendously from this endeavor. It is expected to have a major influence on society. This gadget did not include any components that may be considered harmful. This eco-friendly and pollution-free smart helmet also has a low carbon footprint. Because the technology that is employed in this device is not only inexpensive but also simple to replace, it is an appropriate device for an individual who is concern about safety. The simulation model was designed using PROTEUS, and a three-dimensional model was made with Solid Works. Both programs were utilized to produce the model. After the whole of this project's system had been accurately modeled with the assistance of a flowchart in Proteus 8.10 Professional, the hardware was then installed. This smart helmet had a MQ3 alcohol detecting sensor, a global positioning system (GPS), a global positioning system (GMS), an ADXL sensor to sense vibration and an IR sensor. This clever technology can measure the limit of alcohol on a riders breathe. This suggested system can utilize GPS to monitor the present position of a bike rider, and it can use GSM to transmit emergency messages if any heavy shake is sensed in the ADXL sensor. The bike rider would be awakened if fallen asleep while riding bike through the IR sensor and a beep of the buzzer. The choices were programmed using an Arduino UNO R3, which is the device that is in charge of receiving all of the data from the sensors. In conclusion, it has been proved that this smart helmet provides the full answer that bike rider have been looking for to make their lives simpler.

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Appendix A

Datasheet of the ICs used

Arduino UNO R3

- Microcontroller ATmega328
- Operating Voltage 5V
- Input Voltage (recommended) 7-12V
- Input Voltage (limits) 6-20V
- Digital I/O Pins 14 (of which 6 provide PWM output)
- Analog Input Pins 6
- DC Current per I/O Pin 40 mA
- DC Current for 3.3V Pin 50 mA
- Flash Memory 32 KB (ATmega328)
- SRAM 2 KB (ATmega328)
- EEPROM 1 KB (ATmega328)
- Clock Speed 16 MHz

GSM 800L

- IC Chip SIM800L GSM cellular chip
- Operating Voltage range 3.4V ~ 4.4V
- Recommended supply voltage 4V
- Peak Current 2 A
- Power consumption Sleep mode 2.0mA
- Idle mode 7.0mA
- GSM transmission (avg): 350 mA
- GSM transmission (peek): 2000mA
- Transmit Power Class 4 (2W) for GSM850
- SIM card socket Micro SIM card socket

Infrared sensors

- The operating voltage 5VDC.
- I/O pins 3.3V & 5V.
- The range is up to 20 centimeters.
- The supply current 20mA.
- The range of sensing is adjustable.
- Fixed ambient light sensor Yes

Buzzer

- Rated Voltage: 6V DC
- Operating Voltage: 4-8V DC
- Rated current: <30mA
- Sound Type: Continuous Beep
- Resonant Frequency: ~2300 Hz
- Small and neat sealed package
- Breadboard and Perf board friendly

LCD

- The operating voltage of this display ranges 4.7V to 5.3V.
- The display bezel is 72 x 25mm.
- The operating current is 1mA without a backlight.
- PCB size of the module is 80L x 36W x 10H mm.
- LED color for backlight is blue.
- Number of columns 16.
- Number of rows 2.

ADXL

- Wide power range DC3V to 5V.
- Grove outline.
- 3 axis sensing.
- Small, low-profile package: 4×4×1.45mm LFCSP.
- Low power 350µA at 3V (typical).
- Highly sensitive.
- 10,000 g shock survival.
- BW adjustment with a single capacitor per axis.
- RoHS/WEEE lead-free complain.

MQ3

- Sensor Type – Semiconductor
- Easy SIP header interface
- Compatible with most of the microcontrollers
- Low-power standby mode
- Requires heater voltage
- Good sensitivity to alcohol gas
- Fast response and High sensitivity
- Long life and low cost
- Requires simple Drive circuit

GPS

- Standalone GPS receiver
- Anti-jamming technology
- UART Interface at the output pins (Can use SPI ,I2C and USB by soldering pins to the chip core)
- Under 1 second time-to-first-fix for hot and aided starts
- Receiver type: 50 Channels - GPS L1 frequency - SBAS (WAAS, EGNOS, MSAS, GAGAN)
- Time-To-First-fix: For Cold Start 32s, For Warm Start 23s, For Hot Start <1s
- Maximum navigation update rate: 5Hz

- Default baud rate: 9600bps
- EEPROM with battery backup
- Sensitivity: -160dBm
- Supply voltage: 3.6V
- Maximum DC current at any output: 10mA
- Operation limits: Gravity-4g, Altitude-50000m, Velocity-500m/s
- Operating temperature range: -40ºC TO 85°C

Bluetooth

- Product Model: AWEI T26
- Bluetooth Version: V 5.0
- Standby Time :300 hours
- Call Time: About 3.5 hours
- Music Time: 3 hours
- Charging Time: 1 hours
- Charging Capacity: 600 mAh
- Earphone Capacity :35 mAh
- Communication Distance
- Support HSP/HFP/A2DP/AVPCP
- Material: ABS +Silica gel

Lippo Battery

- Model No: XW Power Eagle Lipo 1000mAh 7.4V 2S 25C Lipo Battery (T Plug Connector)
- Weight: 76 gm.
- Voltage: 7.4V.
- Dimensions: 26x34x72 (mm).
- Max Continuous Discharge: 25C(25A).
- Balance Plug: JST-XH.
- Max Burst Discharge: 90 C (50A).
- Discharge Plug: T-Plug

Appendix B

iThenticate Plagiarism Report