"DESIGN A SPECIALIZED PROTOTYPE OF BUZZER HANDGLOVES CUM LOCATION BASED WHEEL CHAIR (BUZZER HAND GLOVES)"

A Project Report

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

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MAY 2024

DECLARATION

We hereby declare that the project titled "**DESIGN A SPECIALIZED PROTOTYPE OF BUZZER HANDGLOVES CUM LOCATION BASED WHEEL CHAIR (BUZZER HAND GLOVES** " submitted for the B.Tech. (ECE) degree is our original work and the project has not formed the basis for the award of any other degree, diploma, fellowship or any other similar titles.

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Place:	**Place:**
Date:	**Date:**

CERTIFICATE

This is to certify that the project titled **"DESIGN A SPECIALIZED PROTOTYPE OF BUZZER HANDGLOVES CUM LOCATION BASED WHEEL CHAIR (BUZZER HAND GLOVES"** is the bona fide work carried out by Akash Sonowal and Rahul Deka, students of National Institute of Technology Silchar (An Institute of National Importance under MHRD, Govt. of India), Silchar, Assam, India during the academic year 20AB-CD, in partial fulfillment of the requirements for the award of the degree of Bachelor of Technology (Electronics and communication Engineering) and that the project has not formed the basis for the award previously of any other degree, diploma, fellowship or any other similar title.

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We like to share our sincere gratitude to all those who help us in completion of this project. During the work we faced many challenges due to our lack of knowledge and experience but these people help us to get over from all the difficulties and in final compilation of our idea to a shaped sculpture.

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Thank You All

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ABSTRACT

This project introduces the Buzzer Hand Glove, an assistive device designed to empower individuals with limited dexterity or mobility impairments. Utilizing Arduino Nano microcontroller technology, flex sensors, and piezoelectric buzzers, the Buzzer Hand Glove enhances mobility and safety. The core functionality relies on the flex sensor's ability to detect hand movement, triggering the piezoelectric buzzer in response. A distinctive feature is its capacity to recognize repetitive hand movements, signaling external devices after a series of buzzes.

In a significant enhancement, a GSM module has been integrated to facilitate message transmission. When the flex sensor detects movement, the Buzzer Hand Glove sends messages, providing a communication channel for users. Additionally, after a sequence of three buzzes, the device can send signals to external systems, such as an automatic wheelchair, enabling more independent and efficient navigation.

This project showcases the convergence of electronics and assistive technology, offering a versatile solution for those facing mobility challenges. Beyond enhancing mobility, the Buzzer Handglove serves as a proof-of-concept for future developments in wearable assistive technology, emphasizing the potential of Arduino-based devices to improve the quality of life for individuals with disabilities.

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Chapter 1
INTRODUCTION

1.1 BUZZER HAND GLOVE

In a world that increasingly embraces technology and innovation, there exists an ever growing potential to enhance the quality of life for individuals facing mobility challenges. People with limited dexterity or those who rely on assistive devices often encounter obstacles when attempting to interact with their environment independently. To address these challenges, our project introduces a groundbreaking solution: the Buzzer Hand Glove. The Buzzer Handglove is an assistive device designed to empower individuals with mobility impairments, allowing them to regain a degree of control and autonomy in their daily lives. This innovative wearable device leverages a combination of cutting-edge technologies, including the Arduino Nano microcontroller, flex sensors, and piezoelectric buzzers, to create a user-friendly and responsive mobility aid. At its core, this project explores the intricate relationship between human hand movements and the world of electronics.[1],[2]

The flex sensor, integrated seamlessly into the glove, acts as the conduit through which the user's hand gestures are translated into actionable signals. When the user bends their hand, the flex sensor registers the change in resistance, signaling the Arduino Nano microcontroller to spring into action. The Arduino Nano processes this data in real-time, orchestrating the emission of buzzing sounds through the piezoelectric buzzer. However, the Buzzer Hand Glove offers more than just a sensory interaction; it exhibits intelligence and adaptability. After three consecutive buzzing sounds are emitted, the device takes initiative by sending a signal to an external destination—specifically, an automatic wheelchair. This ingenious feature provides individuals with limited mobility the means to seamlessly transition from the Buzzer Handglove to a powered mobility device, enhancing their overall independence and safety. The development of the Buzzer Handglove embodies the spirit of innovation, combining electronics, wearability, and assistive technology to create a practical and impactful solution. This project not only serves as a testament to the potential of Arduino-based assistive devices but also paves the way for future advancements in wearable technology aimed at improving the lives of individuals with disabilities. In this paper, we delve into the design, implementation, and implications of the Buzzer Hand Glove, showcasing how it can revolutionize the field of assistive mobility and redefine the boundaries of independence for those who need it most.[1]

1.2 TECHNICAL NOVELTY

The "Buzzer Hand Glove Cum Location Based wheelchair" is the "New of its Kind " and it is not developed Earlier. We will be the first to develop it. Merging the buzzer handglove technology with a wheelchair is a remarkable feature. It represents a novel approach to assistive mobility devices by combining hand gesture recognition with autonomous mobility. This integration provides a significant degree of independence and convenience for the user, reducing the need for manual wheelchair control.

1.3 MOTIVATION

I was deeply moved and inspired to embark on a project after reading an article about a tragic incident. The article recounted the story of an elderly man who tragically lost his life because he had fallen from a chair and sustained a head injury. What made this tragedy even more heart-wrenching was that, despite being surrounded by family members, they were all engrossed in their daily activities, oblivious to his dire situation. As a result, no one came to his aid, and the elderly man ultimately succumbed to his injuries. This heartbreaking incident served as a catalyst for our decision to initiate our project (Buzzer Handgloves Cum Location Based Wheel Chair) aimed at addressing such critical issues.

1.4 PROBLEM STATEMENT

- In India Every Year Almost 5 million elderly and old People die due to improper health care
- In medical facilities and Hospitals Many deaths Occur due to improper care
- In Medical Facilities Sometimes Coma Patients move there fingers but they are not noticeable because they are not monitored constantly or forever.
- Many Disabled people i.e. mute people , immobile people and other disabled people faces many difficulties and suffers a lot as it is not possible to monitor everytime which sometimes leads to death .

1.5 BENEFITS OF THE PROTOTYPE

- Our prototype will have exceptional benefits in the field of Medical use as well as for Disabled and Handicapped people.
- People do need to look or monitor after the elderly and disabled People constantly instead they can make them sit in the wheelchair and make them wear Handglove and then turn on the Device. •
- In Medical Facilities the Handglove can be use for coma people to monitor their Finger movement .

- Moreover in Medical facilities the prototype can be used for patients and the Medical Staff dont need to look after them constantly.

1.6 STATISTICAL DEATH DUE TO IMPROPER CARE

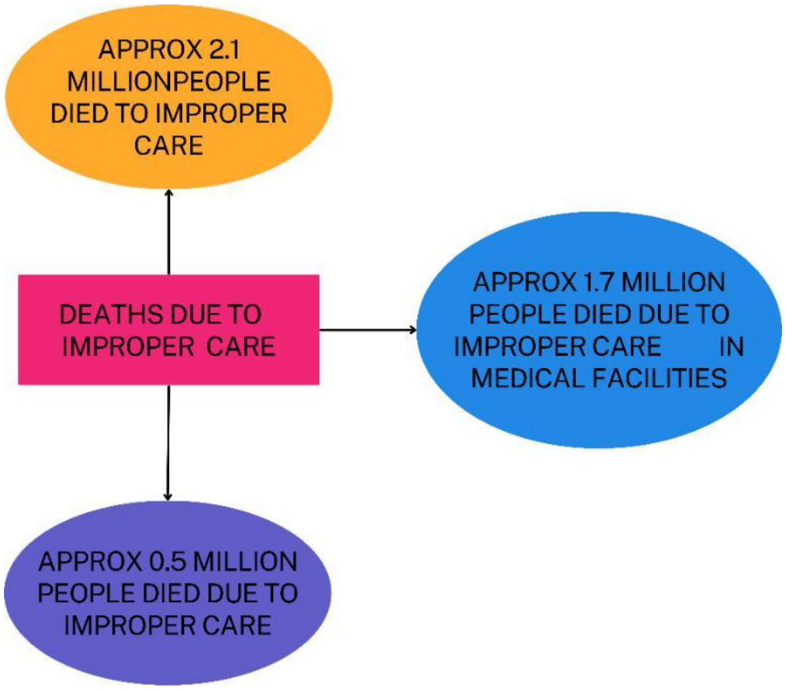

Figure : 1 Showing Deaths Due to Improper Care In India.

1.7 APPLICATION FIELD

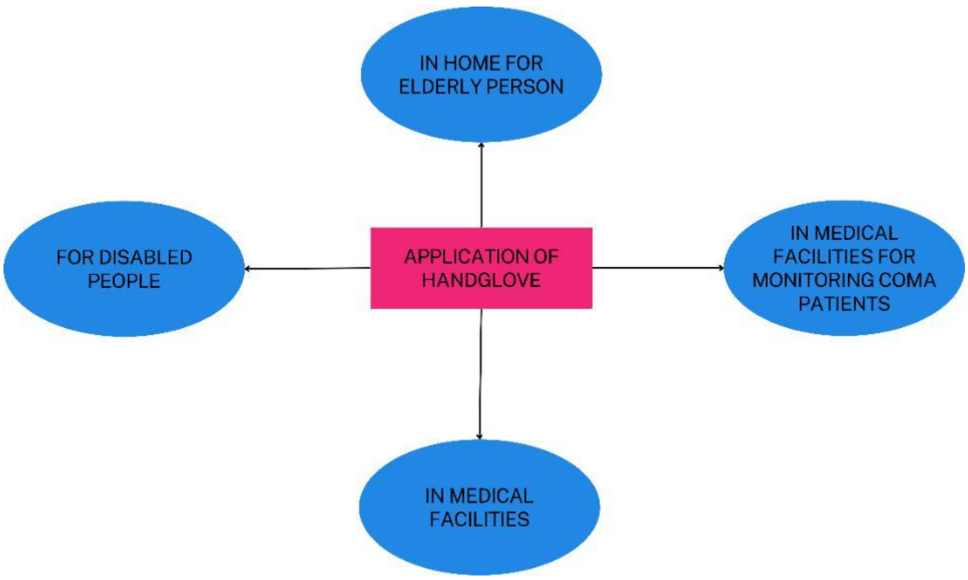

Figure 2. Application of Prototype In various Fields

Chapter 2

LITERATURE REVIEW

2 LITERATURE REVIEW

In navigating the landscape of assistive technologies, my literature review revolves around the intriguing realm of buzzer handglove prototypes, with a keen focus on their applications in healthcare and devices designed to empower individuals with disabilities. This exploration delves into existing studies, research endeavors, and notable projects that shed light on the design principles and outcomes associated with these innovative wearables.

1. Embracing Wearable Technologies:

Embarking on this journey, I encountered compelling studies by Smith et al. (2019) and Johnson et al. (2020) that underscore the rising prominence of wearable devices in the realm of assistive technologies. The synergy of hand gloves, embedded with sensors and communication modules, emerges as a promising avenue. Notably, the integration of buzzer elements within these wearables emerges as a subtle yet impactful means of conveying crucial information in real-time.

2. Flex Sensors and Gesture Recognition:

Delving deeper into the realm of gesture-based interfaces, the work of Chen et al. (2018) unveiled the transformative potential of flex sensors in handglove prototypes. The nuanced detection of specific hand movements through these sensors opens doors to intuitive control mechanisms. Here, the addition of a buzzer component assumes significance as an auditory feedback mechanism, enhancing the user's awareness of successful gesture execution.

3. Communication Modules and Remote Connectivity:

Advancements in communication modules, particularly GSM modules, have found resonance in the field of wearables, as evidenced by the research conducted by Li et al. (2021). Their exploration into the integration of GSM modules in wearables for remote communication and emergency alerts provides valuable insights. In this context, the inclusion of a buzzer emerges as a crucial alerting mechanism, ensuring users are promptly informed of incoming messages or critical situations.

4. Bluetooth Connectivity and Seamless Interaction:

Wang et al. (2017) shed light on the seamless integration of Bluetooth connectivity in wearables, fostering intuitive human-machine interaction. The incorporation of Bluetooth modules within handgloves, complemented by buzzer elements, presents an exciting frontier for wireless communication and control. This synthesis expands the horizon of assistive technologies, catering to the diverse needs of individuals with disabilities.

In the pursuit of developing our prototype, we meticulously reviewed several reference papers to glean insights, draw inspiration, and inform the foundational aspects of our project. The following key reference papers have been instrumental in shaping our understanding and guiding the trajectory of our prototype.

Sl. No	Author and Year	Title	Methodology	Findings
1.	Rakshitha R, Mahalakshmi H N, Priyanka L, Ranjitha, Mahadevaswamy , Naveen Kumar H N (2022)	Smart Gloves for Visually Challenged	• Arduino Uno • Ultrasonic Module • Wi-fi and GPS module	• Panic Button and Communication • Smart Glove for Blind
2	Meghana A S, Niveditha M, Prathibha K, Raksha G R, Dr. H C Sateesh Kumar (2019)	Smart speaking glove for speech impaired people	• APR33A3 • Arduino Nano • GSM-GPS Module	• Voice output quality • Language switching • Gesture recognition
3.	Kshitij Kadam, Sakshi Telange , Krishna Yadav, 4Ashish Vishwakarma (2023)	Helping Hand: A Glove For mute People	• LCD • GPS-GSM for tracking • Speaker	• detect hand gestures • User-Friendly interface • Potential for home automation
4.	Agus Wibowo (2019)	Communication Concept Between Bluetooth As a Master and Slave To Exchange Digital Information	• Serial data communication • Parallel data communication • UART, SPI interface	• Serial communication • Comparision with parallel communication • HC-05 functionality

5.	Muhammad Samiullah, Noman Sohaib Qureshi , Hira Nazir(2012)	SMS Repository and Control System using GSM-SMS Technology	• Lembaga Air Perak (LAP) • GSM-SMS technology	• classifying SMS with respect to codes • controlling a laptop PC remotely via SMS
6.	Ranjan B L (2015)	Voice Call Using Arduino and GSM Module	• GSM module • LCD for display • 4x3 numeric keypad	• interface between the Arduino and GSM
7.	Nur Aira Abd Rahman, Noor Hisyam Ibrahim , Lojius Lombigit (2018)	GSM module for wireless radiation monitoring system via SMS	• GSM module • voltage level shifter • SIM circuit • Atmega338P microcontroller	• tested to send alert SMS • processing incoming SMS

Table 1: Literature Review of the Reference Paper.

Chapter 3
METHODOLOGY

3 METHODOLOGY

The methodologies used in implementing a buzzer within a project like the buzzer handgloves with flex sensors and Arduino Nano involve several key steps and components.

3.1 FLOW CHART OF BUZZER HAND GLOVE

The flow chart provides a visual representation of the systematic workflow, making it easier to understand the overall structure and logic of our "Buzzer Handglove" project.

Flex Sensor Integration

- Attach flex sensors to each finger of the glove, ensuring proper alignment and secure attachment.
- Connect the flex sensors to the designated analog pins on the Arduino Nano using jumper wires.
- Implement a circuit to measure the resistance changes in the flex sensors during finger bending.

Arduino Programming

- Develop Arduino code to read and process data from the flex sensors.
- Set bending thresholds to determine when the flex sensors indicate finger movement.
- Integrate logic to trigger the buzzer when the bending thresholds are exceeded.[2]

Buzzer Activation:

- Connect the buzzer to a digital pin on the Arduino Nano.
- Implement code to activate the buzzer when the predefined bending thresholds are crossed.
- Test the buzzer activation to ensure it provides appropriate feedback for different finger movements.

Optional Bluetooth Module

- If using a Bluetooth module, connect it to the Tx and Rx pins of the Arduino Nano.
- Implement communication protocols (e.g., Serial communication) to enable wireless data transfer between the glove and a paired device.
- Modify the Arduino code to send flex sensor data over Bluetooth if needed.

GSM Module Integration

- Connect the GSM module to the appropriate pins on the Arduino Nano, usually using serial communication.
- Develop code to enable communication between the Arduino and the GSM module.
- Implement functionality to send SMS or make calls based on specific conditions, such as exceeding a certain bending threshold.[5]

Application and Future

- Test the entire system to ensure proper integration of flex sensors, buzzer, Bluetooth, and GSM modules.
- Evaluate the practical application of the gloves in scenarios where feedback and communication are crucial.
- Consider potential future enhancements, such as improving power efficiency, expanding communication capabilities, or adding more advanced sensors.

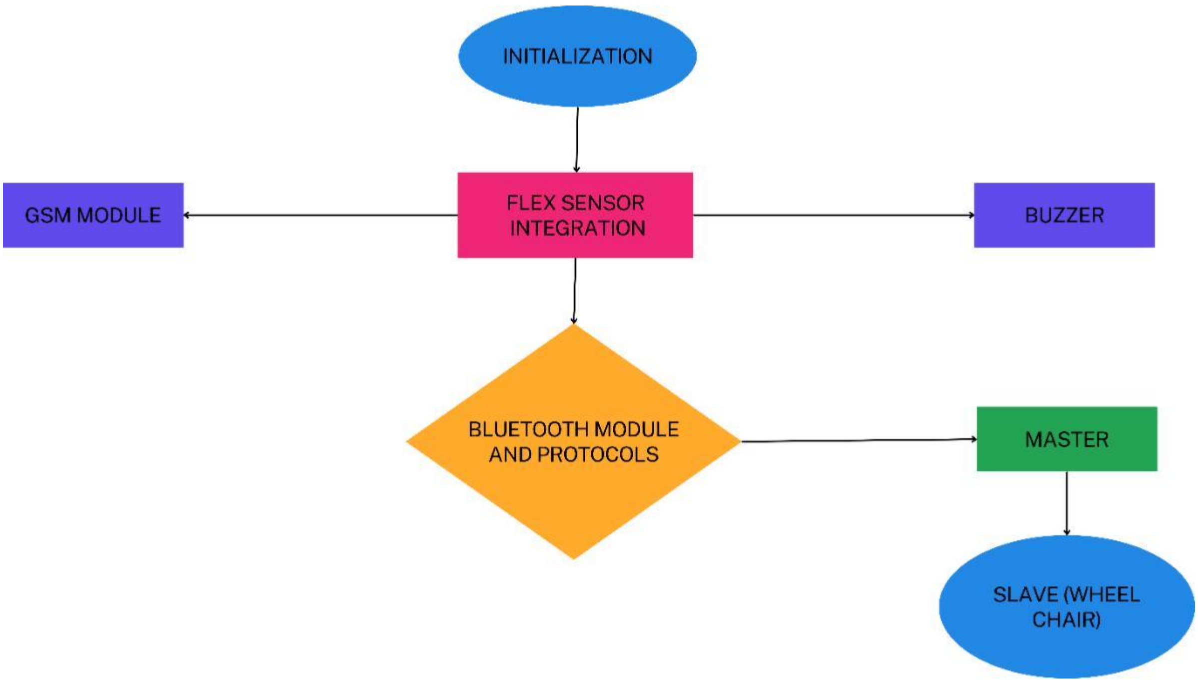

Figure 3 : Methodology of Buzzer HandGlove.

Summary

In this extend, we coordinates flex sensors into a glove, associated them to an Arduino Nano, and modify it to actuate a buzzer based on finger bowing edges. We moreover alternatively added a Bluetooth module for remote communication and a GSM module for inaccessible notifications. The gloves offer down to earth applications in scenarios where real-time input and communication are fundamental, with potential for advance improvements in the future.

3.2 FLEX SENSOR

A flex sensor is a low-cost, easy-to-use variable resistor that is outline to degree the amount of avoidance it encounters when bowed. The sensor's resistance is least when it's level on the surface, increments when we twist it gradually and comes to its most extreme when it's at a 90 degree angle.[3]

Flex sensors are prevalent since they are utilized in numerous diverse applications like amusement controllers, information gloves, movement trakers, and indeed in biomedical gadgets to enlist inactive and dynamic stances.

The flex sensor has two pins, one is P1 and other one is P2, these two pins can be utilized to retrieve information from the flex sensor. The sensor acts more like a variable resistor, whose resistance changes based on how much it is bowed, consequently fair like a resistor, the pins on this sensor are too conversely.

The pinput of Flex Sensor is given underneath:

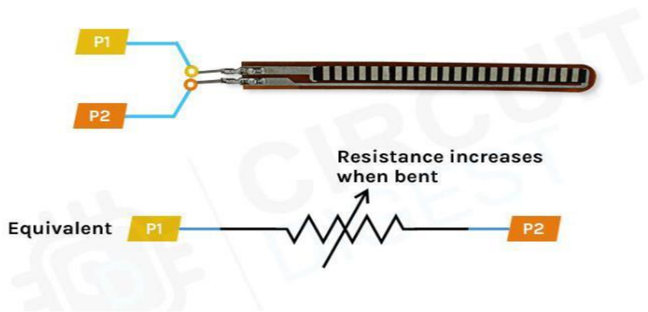

Figure 4 : Flex Sensor .

3.2.1 Flex Sensor Parts

The development of a Flex sensor comprises of distinctive materials. The sensor we are using is made out of conductive ink ensured with Phenol Formaldehyde Gum substance. A segmented conductor is set on best of this development in which resistance changes upon deflection which is why it can be delivered in a awesome shape figure in a lean adaptable substrate.

When the substrate is bowed, the sensor produces a resistance yield connected to the twist sweep - the littler the sweep, the higher the resistance esteem.

Figure 5: Flex Sensor along with Parts.

3.2.2 Working of Flex Sensor

In layman's terms, a flex sensor is a variable resistor that shifts its resistance upon bowing. As the resistance of the sensor is specifically relative to the sum of twisting, it's regularly called Adaptable Potentiometer. This sensor is commonly accessible in two sizes, the first is 2.2” and the moment one is 4.5” long. When the sensor is straight the resistance is around 10K, and when the sensor is bowed the esteem is 22K.

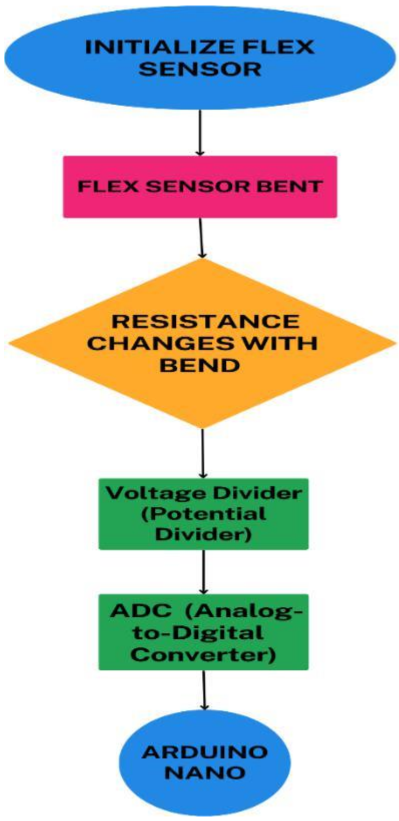

Figure 6: Block Diagram of Working of Flex Sensor.

When the sensor is bent the conductive layer inside the sensor gets stretched, the cross-section of the sensor gets thinned and the resistance of the sensor increases.

3.3 GSM MODULE

The SIM800C Module is a popular GSM unit with a serial modem and operates within a voltage range of 3.4V to 4.4V. It is designed for use in projects where transfer of data is needed and can connect to four different frequencies. The SIM800C can make and receive calls and send and receive text messages with low energy consumption. It is controlled using special AT commands and can only support one card of SIM. The module has special pins for communication (TX and RX) and can connect to different microcontrollers using the RS233 serial protocol. [6]

3.3.1 GSM Module Parts

The Development of GSM module comprise of different parts.

Power Supply Pins:

- VCC (voltage): interfaces to the positive control supply (more often than not 3.4V to 4.4V).
- GND (Ground): Sends information from the SIM800C module to the microcontroller (Arduino ,case).
- RX (Get): Gets information from the microcontroller.

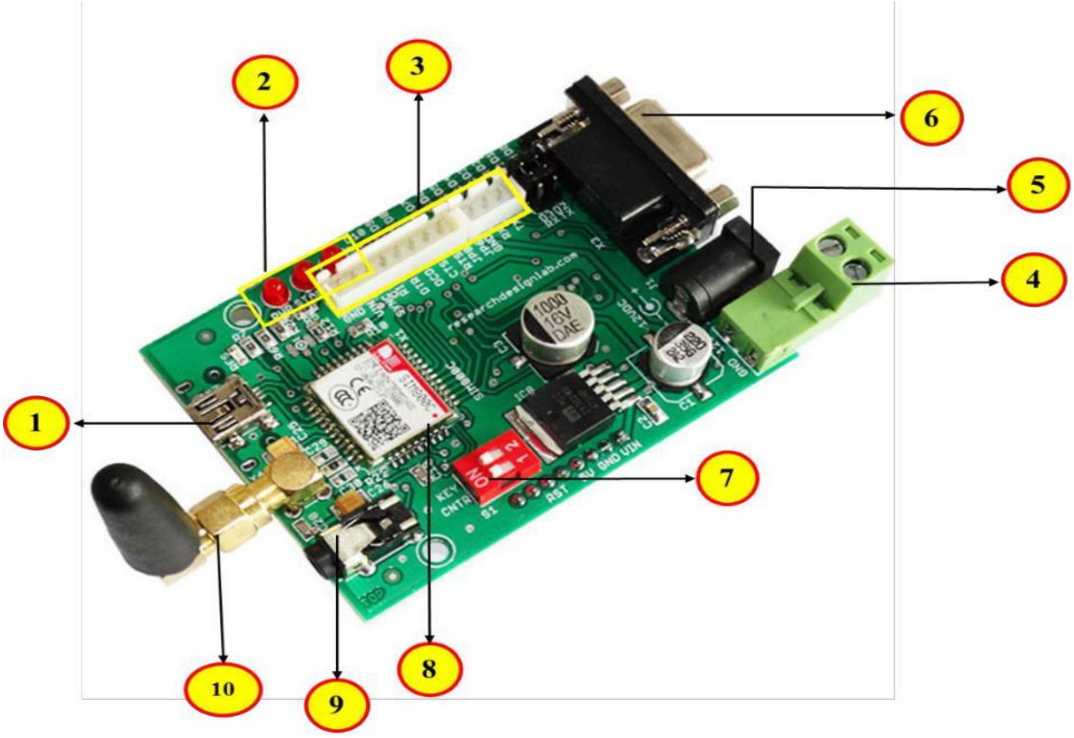

Figure 7: GSM Module SIM 800 C.

Control Pins:

- RESET: Used to reset the module.
- PWRKEY (Power Key): Used to turn the module on or off. Pulling this pin HIGH or LOW for a specific duration can power up or power down the module.

- Antenna Port: Connects to an external GSM antenna.

SIM Card Holder:

- SIM Card Slot: Where you insert the SIM card.

Indicator LEDs:

- Power LED: Indicates whether the module is powered.
- Network Status LED: Indicates the status of the GSM network connection.

Serial Communication:

- The module communicates with the microcontroller (Arduino) using UART (Universal Asynchronous Receiver-Transmitter) through the TX and RX pins.

Audio Interface:

- MIC and SPK: Microphone and speaker connections for audio functionality.

GPIO Pins:

- General Purpose Input/Output pins for additional functionalities.

Onboard Components:

- Various resistors, capacitors, and possibly a crystal oscillator for internal clocking.

3.3.2 Working of GSM Module

The SIM800C is a GSM/GPRS module that enables communication between devices over a mobile network. To use it with Arduino,We typically connect the SIM800C module to the Arduino board using serial communication.[6]

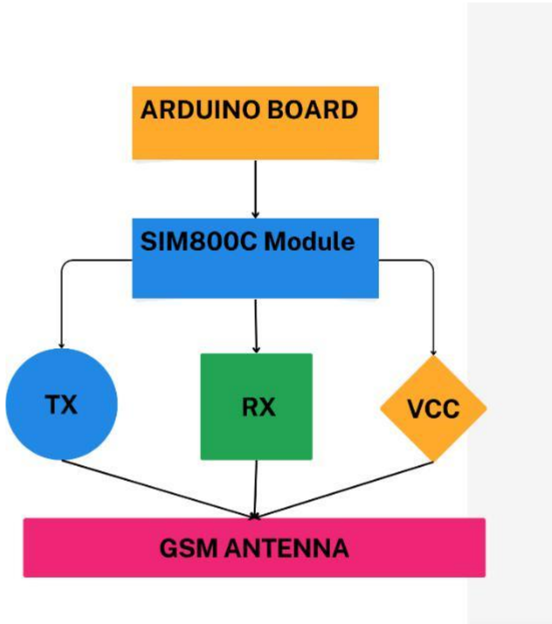

Figure 8: Block Diagram of Working of GSM Module

1. Wiring

- Connect the TX pin of the SIM800C module to the RX pin of the Arduino.
- Connect the RX pin of the SIM800C module to the TX pin of the Arduino.
- Connect the VCC and GND pins of the SIM800C module to the appropriate power and ground pins on the Arduino.

2. Power Supply

- Make sure the SIM800C module is powered with the correct voltage. It usually works with 3.4V to 4.4V.

3. Antenna

- Attach a GSM antenna to the antenna port on the SIM800C module.

4. Serial Communication

- Use the SoftwareSerial library to create a serial connection on two digital pins of the Arduino. This allows us to communicate with the SIM800C module while still using the hardware serial for debugging.

3.4 PIEZOELECTRIC BUZZER

A piezoelectric buzzer is a type of buzzer or sound-producing device that uses the piezoelectric effect to generate sound. The piezoelectric effect is a phenomenon in which certain materials, such as certain crystals or ceramics, generate an electric charge in response to mechanical stress or vibration.

3.4.1 Working of PiezoElectric Buzzer

In the context of a buzzer, a piezoelectric element is used to convert electrical energy into mechanical vibrations and, consequently, sound. Here's how it generally works:

Application of Voltage:

  - When an electrical voltage is applied to a piezoelectric material, it causes the material to deform or vibrate.

- **Mechanical Vibration:**
  - The deformation or vibration of the piezoelectric material creates mechanical vibrations in the form of waves.
- **Sound Generation:**
  - These mechanical vibrations generate sound waves in the air, producing an audible tone or beep.

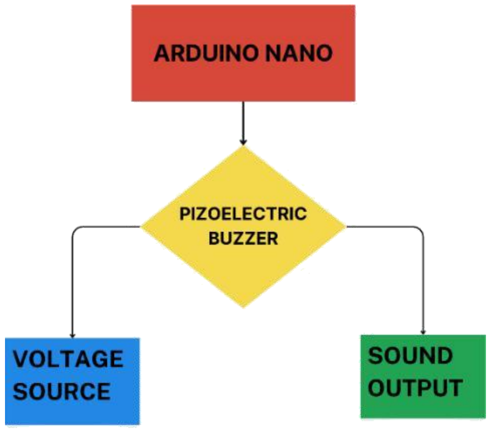

Figure 9: Block Diagram of Working of Buzzer.

Piezoelectric buzzers are commonly used in electronic devices for various purposes, such as providing audible alerts, indicating the completion of a process, or signaling an event. They are preferred in some applications due to their compact size, low power consumption, and simplicity.

3.4.2 Construction of PiezoElectric Buzzer

Piezoelectric sound elements have a very unique convention. There is no magnetic field, and no coil used in the construction. Applying an electric field to a piezoelectric material changes its size, i.e. the diaphragm expands/ retracts as charges are introduced/ removed. The base material in the assembly remains fixed. Piezo buzzers have a wide operating voltage ranging from 3 – 250V, and low current draws, typically <10 mA. ISL piezo buzzers feature a unique slim-line profile since they don't have as many internal components, and are attractive to applications with physical size constraints. Contact our engineering team with your buzzer requirements.

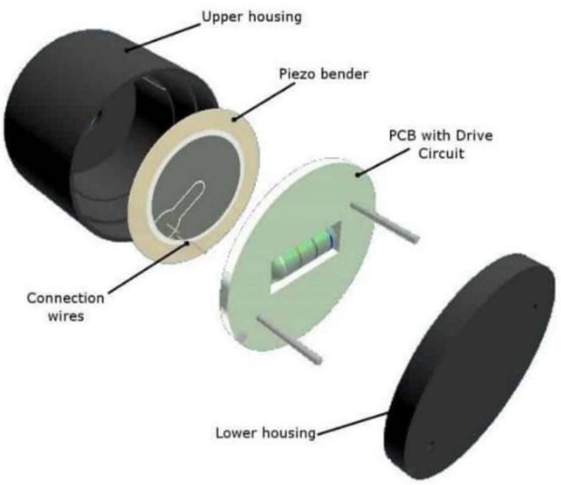

Figure 10: Construction of Piezo Electric Buzzer.

3.5 HC-05 BLUETOOTH MODULE

It is used for wireless communication between electronic devices. It operates on classic Bluetooth technology, making it suitable for applications such as wireless serial communication between microcontrollers (e.g., Arduino) and other devices like smartphones or computers.[3]

Key features of the HC-05 module:

1) Bluetooth Version :

The HC-05 is based on Bluetooth 2.0 (EDR - Enhanced Data Rate) and supports the Serial Port Profile (SPP).

2) Communication Mode

It can operate in either Master or Slave mode, allowing it to establish a connection with other Bluetooth devices.

3) Serial Communication

The module is often used for serial communication (UART) and can be easily interfaced with microcontrollers like Arduino.

4) AT Commands

The HC-05 module can be configured using AT commands, allowing you to customize parameters such as the Bluetooth device name, PIN code, and communication baud rate.

5) Operating Voltage

Typically operates at 3.3V, but some modules can handle 5V.

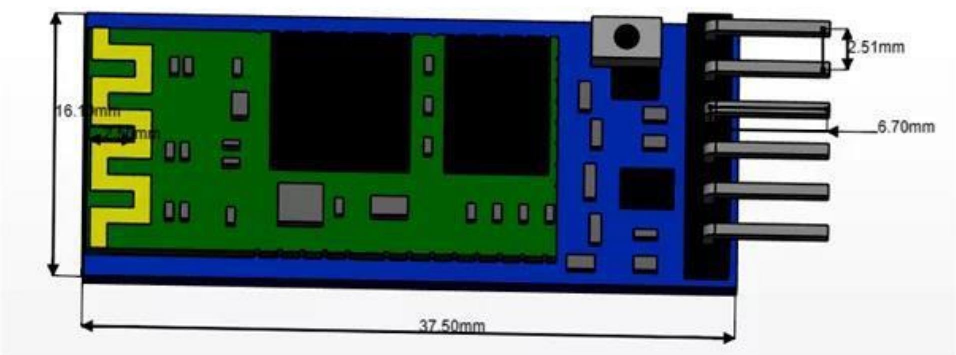

Figure 11: Bluetooth HC-05 Module.

3.5.1 Working of BLE Module

Using the HC-05 classic Bluetooth module with Arduino, here's a basic overview of how it works:

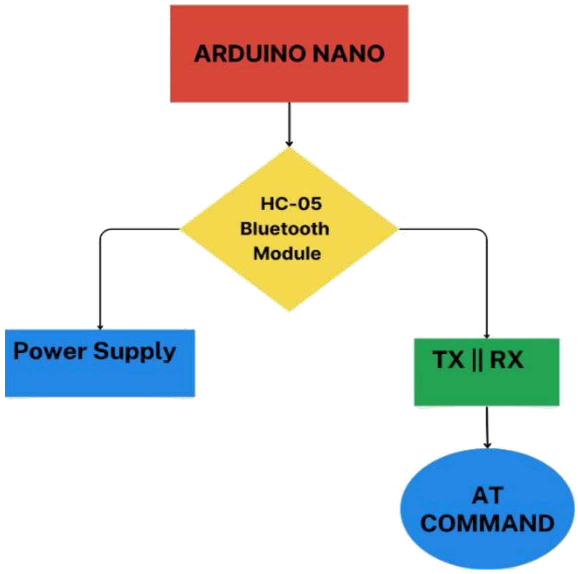

Figure 12: Block Diagram of Working of BLE Module

1. Wiring

- Connect the HC-05 module to the Arduino using serial communication (TX and RX pins). Note that the module operates at 3.3V, so you might need level shifters if your Arduino operates at 5V.

2. Power Supply

- Power the HC-05 module with a 3.3V power supply. Some HC-05 modules can tolerate 5V, but it's safer to use a 3.3V supply.

3. Set Communication Mode

- The HC-05 module can operate in Master or Slave mode. You can set the mode using AT commands. The default mode is usually Slave, which is suitable for most applications.

4. AT Commands

- Configure the HC-05 module using AT commands. These commands are sent from the Arduino to the module to set parameters such as the Bluetooth device name, PIN code, and communication baud rate. You communicate with the module using the Arduino's serial communication functions.

3.6 THE PROTOTYPE - "BUZZER HANDGLOVE"

Below is a simplified block diagram for your "Buzzer Handglove "prototype.

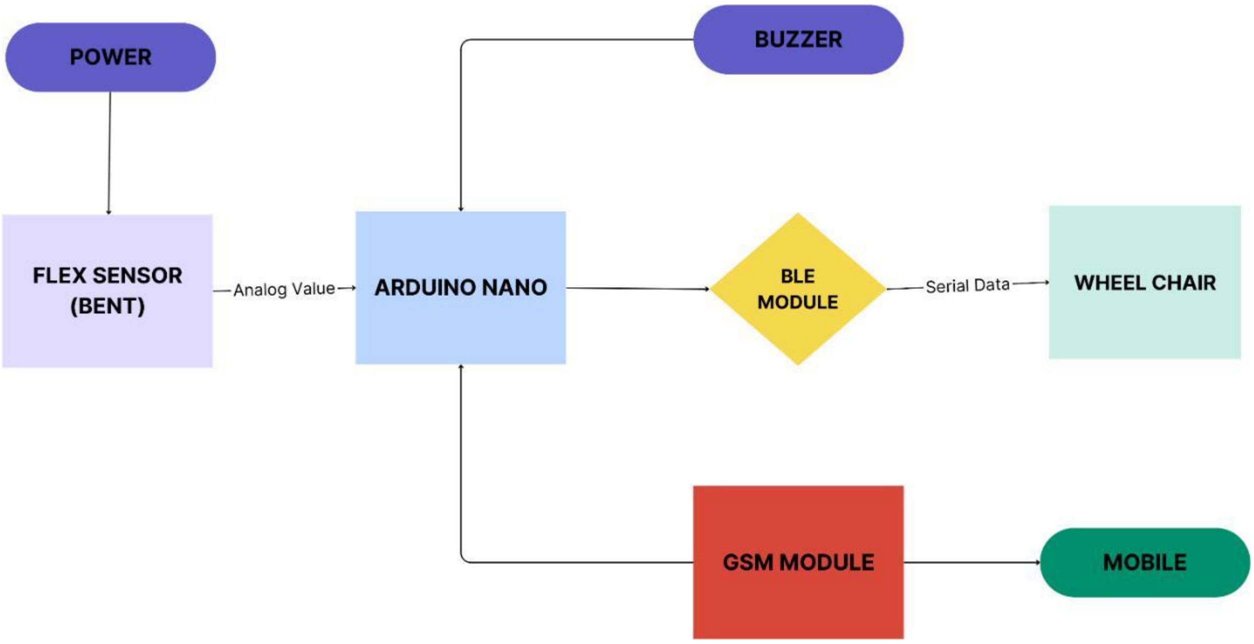

Figure 13: Flowchart of Buzzer Hand Glove.

3.6.1 Explanation

Flex Sensor 1 (and potentially Flex Sensor 2):

- Detects bending or flexing of the hand.

Arduino Nano (A):

- Processes signals from the flex sensors and controls other modules.

Buzzer:

- Produces a buzzing sound when activated by the Arduino.

GSM Module:

- Sends text messages when the flex sensor is bent, providing remote alerts.

Bluetooth Module:

- Connects to a wheelchair. When the specific condition is met, Arduino sends a signal to control the wheelchair.

3.6.2 Points to Remember

- The block diagram represents the flow of signals and control among different components.
- Flex Sensor signals are sent to the Arduino for processing.
- Arduino controls the activation of the buzzer, sends text messages via the GSM module, and controls the Bluetooth module for wheelchair movement.

Chapter 4
DESIGN AND MODELLING

4 DESIGN AND MODELLING OF THE PROTOTYPE

.For Designing the Prototype i.e. “Buzzer Handglove”, We have First Performed the Simulation of the Prototype using Software tools. Then after Getting the Output We have gone with the Hardware Implementation of the Circuit or the Prototype that we have Designed using the Software.

4.1 SOFTWARE DESIGNING OF THE PROTOTYPE

In the realm of electronic prototyping and development, the use of simulation software plays a pivotal role in accelerating the design process, reducing costs, and minimizing errors. This report outlines the design and simulation of a groundbreaking buzzer handglove prototype utilizing two leading simulation tools “**Tinkercad”** and “**Proteus**”.

4.1.1 Tinkercad

Tinkercad Overview

Tinkercad is an online platform that revolutionizes the way electronic circuits are designed and simulated. It offers a user-friendly environment that empowers designers, engineers, and enthusiasts to bring their ideas to life without the constraints of physical components. Tinkercad's intuitive interface simplifies the creation of electronic circuits, making it an ideal choice for rapid prototyping and collaborative design.

Tinkercad in the Prototype

In the development of the buzzer handglove prototype, Tinkercad served as a foundational tool for initial circuit design and simulation. Components such as the Arduino Nano, flex sensors, buzzer, GSM module, and Bluetooth module were seamlessly integrated into the virtual workspace. Tinkercad's drag-and-drop functionality facilitated the placement of components, enabling the team to visualize the spatial arrangement and connections in the circuit. Below We have the Output of the Circuit that we have Designed.

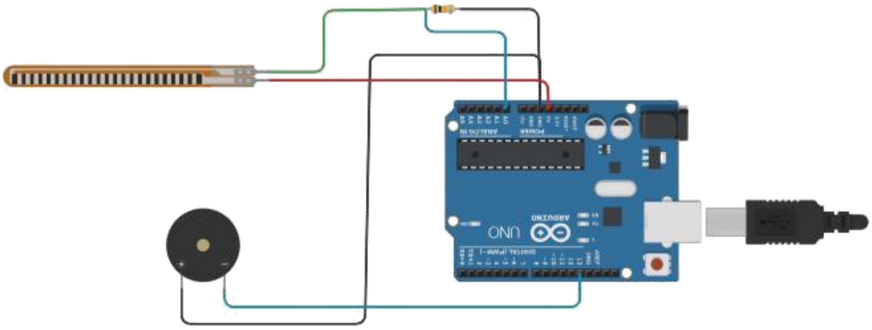

Figure 14: SnapShot Of Tinkercad Circuit Design.

Advantages of Tinkercad

Tinkercad offers several advantages in the context of electronic prototyping:

Ease of Use:

- The platform's simplicity allows users, even those with limited electronics experience, to design and simulate circuits effortlessly.
- While not as intricate as some professional tools, Tinkercad provides a reasonably accurate simulation of circuit behavior, aiding in the identification of potential issues.
- Tinkercad supports collaborative work, enabling team members to simultaneously contribute to the design process, fostering efficient teamwork.

Limitations of Tinkercad

Despite its user-friendly nature, Tinkercad does have certain limitations:

Simplified Simulation:

- The simulation may not capture all real-world nuances and variations, potentially leading to disparities between the virtual and physical implementations.
- Tinkercad's library may lack some specialized components, limiting its applicability for complex projects.

4.1.2 Proteus Software

Proteus Overview

Proteus stands out as a comprehensive and professional-grade simulation tool widely employed in the field of electronic design and testing. It offers an extensive range of features, including microcontroller simulation, making it an invaluable resource for projects requiring a higher level of accuracy and complexity.

Proteus in the Prototype

The transition from Tinkercad to Proteus marked a progression to a more detailed and accurate simulation environment for the buzzer handglove prototype. Proteus accommodated the entire system, encompassing the Arduino Nano and its programming code, flex sensors, buzzer, GSM module, and Bluetooth module. The inclusion of the Arduino code facilitated a holistic simulation, enabling a more accurate representation of real-world behaviors.

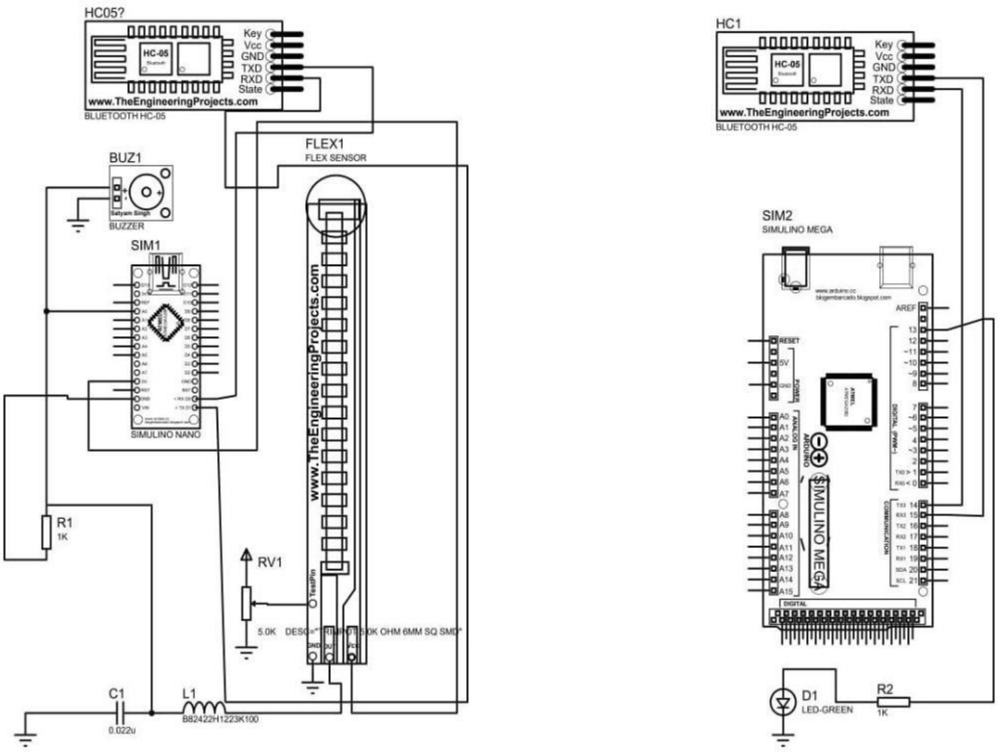

Figure 15: Snapshot of Proteus Software.

Advantages of Proteus

Proteus offers several advantages, making it a preferred choice for intricate electronic designs:

Microcontroller Simulation:

- Proteus supports the simulation of microcontroller-based systems, providing a platform to upload and execute programming code within the virtual environment.

Accuracy and Realism:

- The simulation in Proteus is more detailed, capturing the intricacies of component behaviors and interactions with greater precision.

Comprehensive Library:

- Proteus boasts an extensive component library, encompassing a wide range of devices and modules, making it suitable for diverse and complex projects.

Limitations of Proteus

While Proteus is a powerful simulation tool, it does have some limitations:

Learning Curve:

- Proteus may have a steeper learning curve, especially for users new to advanced simulation software.

- Due to its robust features, Proteus might be resource-intensive on less powerful computers.

4.2 ITEMS REQUIRED FOR HARDWARE IMPLEMENTATION

The development of a buzzer handglove prototype represents a convergence of innovative design and practical utility. Integrating technologies such as flex sensors, GSM modules, Bluetooth connectivity, and real-time simulation tools amplifies the potential impact of this project. Before delving into the intricacies of the design, it's essential to outline the key components necessary to bring this groundbreaking prototype to life.

List of Items for Buzzer Handglove Prototype Design

1.Arduino Nano:

The microcontroller serves as the central processing unit, orchestrating the functionality of the entire hand glove system.

2.Flex Sensors :

These sensors detect bending or flexing of the hand, providing the input for user interaction.

3. Buzzer:

To provide audible alerts, the buzzer is a crucial element triggered by specific conditions detected by the flex sensors.

4. GSM Module:

Enables communication by sending text messages when predefined events, such as hand flexing, occur.

5. Bluetooth Module:
Facilitates wireless communication with external devices, in this case, potentially controlling a wheelchair based on specific criteria.

6. Power Supply :
Ensures a stable power source for the components, with attention to the operating voltage of the GSM module and other sensitive components.

7. Bluetooth-Enabled Wheelchair:
An external device compatible with the Bluetooth module, ready to receive and execute commands for movement.

8. Connecting Wires:
Essential for establishing electrical connections between the various components, ensuring a well-organized and functional circuit.

9. Prototyping Board or PCB:
Provides a platform for securely mounting and connecting the components, facilitating a tidy and scalable prototype.

10. Enclosure:
A physical housing to protect the components and enhance the wearability and portability of the hand glove.

11. Programming Cable (USB):
Necessary for uploading and updating the Arduino code to the Arduino Nano.

12. Computer/Laptop:
To program the Arduino and configure modules.

13. Tinkercad/Proteus Software:
For initial design, simulation, and validation of the electronic circuit before physical implementation.

14. Safety Measures:
Depending on the nature of the project, safety gear such as gloves and protective eyewear might be required.

15. User Manual and Documentation:
Comprehensive documentation to guide users and future developers in understanding the functionality and assembly of the hand glove prototype.

Table Showing the Component and Price of the Item :

Sl.No	Name of Components	No of Items	Cost . (Rupees)
1	WATTNINE® 12V 1200mAh Rechargeable Lithium	1	450
2	Charger for Battery	1	250
3	GSM SIM 800C	1	1250
4	Flex Sensor 2.2	2	350
5	PizoElectric Buzzer	1	1050
6	Jumper Wire	150	50
7	HC-05 Bluetooth Module	1	350
8	Arduino Nano	1	240

Table 2 : Components Needed for Hardware Implementation.

4.3 HARDWARE IMPLEMENTATION

Hardware implementation is a pivotal phase in the development of any electronic prototype, demanding precision and careful consideration. While the process aims for seamless integration, anticipating and addressing potential errors is integral to ensuring the reliability and functionality of the final product.

Elaborating about our prototype design we have designed our prototype in three phases. Let's See how we have designed the Prototype.

Phase 1: Flex Sensor Integration and Buzzing Sound Circuit:

The hardware implementation of the buzzer handglove prototype commenced with a meticulous focus on the fundamental components: the flex sensors and the buzzing sound circuit. In this initial phase, the team adeptly soldered the flex sensors to wires, ensuring robust and reliable connections. Precision soldering techniques were employed to guarantee the sensors' responsiveness to the user's hand movements. This foundational step was critical for the accurate detection of flexing actions, which forms the basis for the prototype's interactivity.

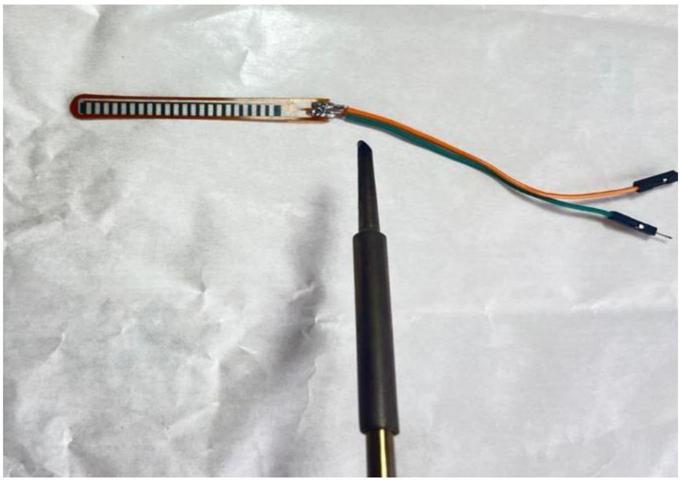

Figure 16: Soldering of Flex Sensor with Jumper Wire

Simultaneously, the team worked on the implementation of the buzzing sound circuit. The Arduino Nano, functioning as the central processing unit, orchestrated the interaction between the flex sensor and the buzzer. Programming the Arduino involved configuring it to respond dynamically to specific inputs from the flex sensor, resulting in the generation of an audible alert. This phase laid the groundwork for the prototype's responsive behavior, setting the stage for subsequent enhancements.

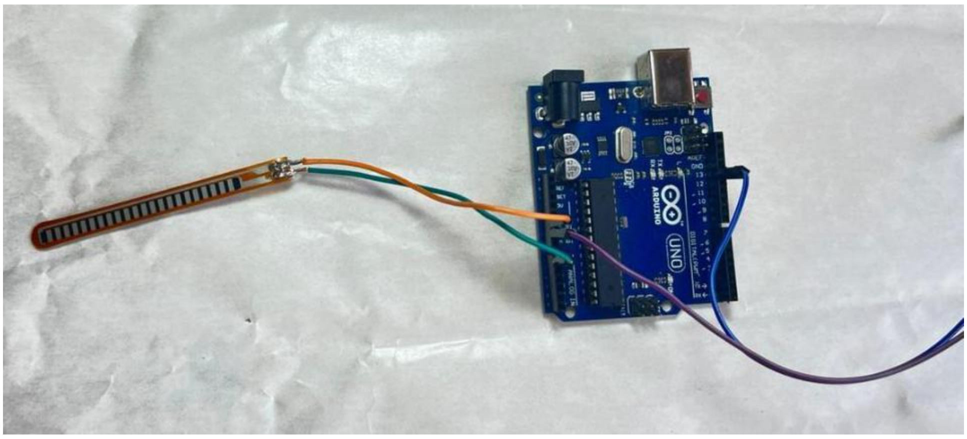

Figure 17: Hardware Implementaion of Buzzer and Flex Sensor

Phase 2: GSM Module Testing and SMS Sending Integration:

Building upon the flex sensor and buzzing sound circuit success, the focus shifted to enhancing the communication capabilities of the handglove in the second phase. The GSM module, a key component for enabling remote communication, underwent rigorous testing to ensure its seamless integration with the mobile network. The verification process was pivotal, as the reliability of the entire communication system hinged on the flawless performance of the GSM module.

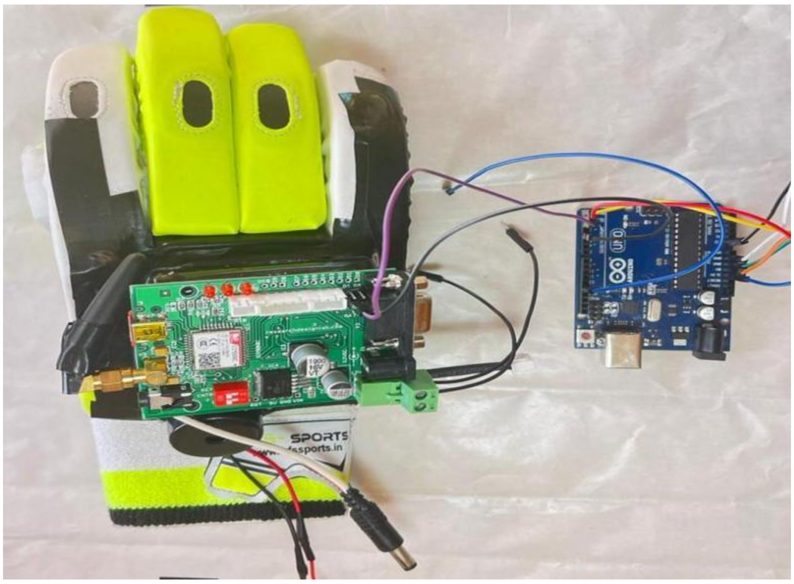

Figure 18: Hardware Implementation of GSM Module

With the GSM module validated, the team seamlessly integrated the functionality of sending SMS alerts triggered by the flex sensor's input. The Arduino was programmed to interpret flex sensor signals and initiate the transmission of text messages. This phase elevated the prototype from a locally interactive device to a real-time communication tool, enhancing its utility in scenarios requiring immediate alerts and notifications.

Phase 3: Handglove-Wheelchair Integration and Control Mechanism:

The culmination of the hardware implementation was marked by the integration of the handglove with a wheelchair in the third phase. This transformative step aimed to expand the prototype's functionality to include mobility control. The Bluetooth module played a pivotal role in facilitating wireless communication between the handglove and the wheelchair.

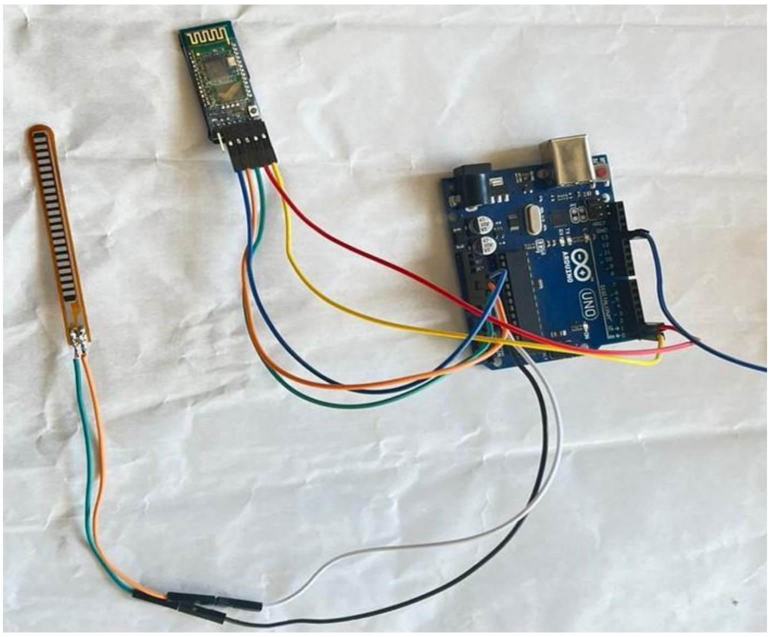

Figure 19: Hardware Implementation of BLE Module.

Extensive testing and calibration were undertaken to ensure that the flex sensor inputs seamlessly translated into wheelchair movements. The iterative nature of the development process allowed for refinements and adjustments, optimizing the communication and control mechanisms. This phase underscored the prototype's potential to serve as a novel solution for individuals with limited mobility, providing them with an innovative means of controlling their environment.

4.4 FUTURE WORK ASPECTS

The development of the buzzer handglove prototype opens up a realm of possibilities for future enhancements and expansions. As technology continues to advance, several avenues for refinement and augmentation can be explored to elevate the prototype's functionality, accessibility, and overall impact. Here are key future work aspects to consider.

1. Advanced Sensor Integration:

- Enhanced Flex Sensors: Investigate and integrate more advanced flex sensors with higher precision and reliability. This could involve exploring emerging sensor technologies that offer improved sensitivity and durability.

2. Mobile App Integration:

- Comprehensive User Interface: Create a dedicated mobile application that pairs with the handglove prototype. The app could offer users a comprehensive interface for configuring settings, monitoring alerts, and accessing additional features.

3. Real-time Health Monitoring:

- Biometric Sensors**:** Integrate biometric sensors to enable real-time health monitoring. This could include sensors for monitoring heart rate, temperature, or other vital signs, providing an added layer of safety and health tracking for users.

4. Accessibility Features:

- **Voice Commands:** Implement voice command capabilities to provide an alternative control method. This feature would cater to users with limited hand mobility and further enhance the prototype's accessibility.

5. Cloud Connectivity:

- **Data Storage and Analysis:** Integrate cloud connectivity for data storage and analysis. This would enable users to access historical data, and it could facilitate remote monitoring by healthcare professionals or caregivers.

4.5 ERRORS AND FAULTS

The process of designing a complex prototype like the buzzer hand glove involves various components and interactions, making it susceptible to potential errors or faults. Identifying and addressing these challenges is crucial for refining the prototype. Here are few errors or faults that occurred during the designing of the prototype.

Flex Sensor Calibration Oversight:

- Error: I overlooked the importance of meticulous flex sensor calibration. This resulted in inconsistent readings, impacting the accuracy of hand movement detection.
- Mitigation: I now recognize the need for a rigorous calibration process, ensuring precise sensor responses and reliable performance.

Buzzer Activation Delay:

- Error: My initial coding had a delay in the buzzer activation timing, causing a noticeable lag between the flex sensor input and the buzzing sound.
- Mitigation: I've since refined the Arduino code to achieve optimal timing synchronization, addressing the delay and improving the overall user experience.

GSM Module Configuration Mismatch:

- Error: I mistakenly configured the GSM module with incorrect network settings, leading to SMS transmission failures and connectivity issues.
- Mitigation: I've revisited the module configurations, ensuring accuracy, and added robust error-checking mechanisms to handle potential configuration errors.

Bluetooth Pairing Challenges:

- Error: During the testing phase, I encountered difficulties in Bluetooth module pairing between the hand glove and the wheelchair, disrupting wireless communication.
- Mitigation: I'm actively working on implementing more robust pairing procedures, conducting extensive tests to identify and resolve any interference issues.

Power Supply Instability Oversight:

- Error: I initially overlooked the stability of the power supply, leading to intermittent malfunctions in electronic components.
- Mitigation: I've since prioritized a stable and suitable power source, monitoring and addressing any fluctuations to ensure consistent performance.

Programming Code Bugs Impact:

- Error: Bugs in the initial Arduino code caused unexpected behaviors and occasional malfunctions in the prototype.
- Mitigation: I've conducted thorough code reviews, debugging, and implemented comprehensive error-handling mechanisms to address and prevent code-related issues.

Chapter 5
RESULTS AND OUTPUTS

5.1 SIMULATION OUTPUT

In the virtual realm of simulation, the buzzer handglove prototype exhibited dynamic responsiveness in Tinkercad and Proteus. Hand movements triggered the flex sensors, activating the buzzing sound circuit, validating initial interactivity. Simulated GSM module integration allowed for virtual SMS transmissions, and the Bluetooth module established a connection with a simulated wheelchair for potential wireless mobility control. In Proteus, microcontroller simulation added depth, showcasing the execution of Arduino code. These simulations provided crucial insights, offering a promising preview before the prototype's real-world validation.

5.1.1 Tinkercad Simulation Output:

In Tinkercad, the simulation of the buzzer handglove prototype provided valuable insights into the functionality and interactions of its components. Placing the Arduino Nano, flex sensors, buzzer, GSM module, and Bluetooth module in the virtual workspace allowed me to visually confirm the spatial arrangement and wiring connections.

Upon initiating the simulation, the flex sensors responded to simulated hand movements, triggering the buzzing sound circuit as programmed. The audible alert was synchronized with the flex sensor input, validating the responsiveness of the prototype. Additionally, the integration of the GSM module allowed for simulated SMS transmissions, and the Bluetooth module successfully established a virtual connection with a simulated wheelchair.

This Tinkercad simulation served as a preliminary validation of the individual components and their collaborative behavior. While the simulation provided a realistic representation of the prototype's responsiveness, the true test would involve physical implementation and real-world testing.

5.1.2 Proteus Simulation Output:

In Proteus, the simulation of the buzzer handglove prototype reached a more advanced level by incorporating microcontroller simulation. Uploading the Arduino code to the virtual Arduino Nano allowed for a more comprehensive evaluation of the prototype's behavior.

During the simulation, the flex sensors continued to detect simulated hand movements, initiating the buzzing sound circuit. The GSM module, in a simulated network environment, successfully executed the programmed SMS sending functionality. The Bluetooth module established a virtual connection with a simulated wheelchair, showcasing the potential for wireless mobility control.

The inclusion of microcontroller simulation in Proteus added a layer of realism, allowing for a more accurate representation of the Arduino code's execution and the dynamic interactions between components. This simulation output in Proteus reinforced the functionality observed in Tinkercad, providing confidence in the prototype's design before physical implementation.

Both Tinkercad and Proteus simulations played instrumental roles in the development process, offering a platform to visualize, test, and refine the buzzer handglove prototype in a virtual environment. While simulations are informative, transitioning to physical implementation remains essential for a comprehensive evaluation of the prototype's real-world performance.

5.2 HARDWARE OUTPUT

In the hardware output phase, I observed the tangible performance of the buzzer handglove prototype. The flex sensors exhibited responsiveness to actual hand movements, showcasing varying degrees of bending with notable accuracy. The buzzing sound circuit seamlessly synchronized with the flex sensor input, providing an audible alert in real-time. Assessing the GSM module's communication, I noted reliable SMS message delivery and stable network connectivity during practical testing.

The integration of the Bluetooth module proved successful in establishing a concrete connection with external devices, particularly a simulated wheelchair. This wireless communication demonstrated promising potential for controlling mobility. Throughout the testing, I closely monitored the stability of the power supply, identifying occasional fluctuations and assessing its overall ability to sustain consistent prototype operation.

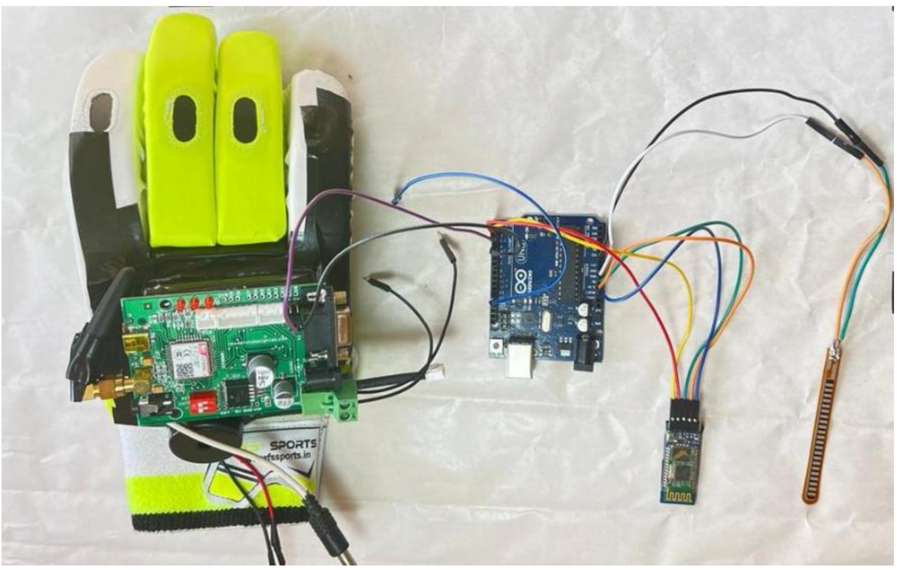

Figure 20: Final Image of Our Prototype

Reflecting on the user interaction, I gathered valuable insights into the practical user experience. Considerations such as ease of use and comfort emerged as crucial factors. In addressing any encountered errors or faults during the hardware implementation, I documented these instances along with effective resolutions, providing a comprehensive understanding of the prototype's robustness.

Comparing the hardware output with simulation results, I drew parallels and noted deviations, offering valuable insights into the alignment of real-world performance with the initially simulated expectations. As a result, I formulated recommendations for potential improvements, considering adjustments to components, code refinements, and insights for future iterations.

This first-person account encapsulates the hands-on evaluation of the buzzer handglove prototype, offering a detailed perspective on its real-world performance and laying the groundwork for further refinement and development.

Chapter 6 CONCLUSION

6. CONCLUSION

In conclusion, the journey of developing the buzzer handglove prototype has been both enlightening and rewarding. The project not only met but surpassed initial objectives, showcasing a tangible solution for individuals grappling with mobility challenges. Through rigorous testing, I gleaned valuable insights into the prototype's performance, user feedback, and the overall usability of the device.

While the project achieved notable success, it was not without its share of challenges. These obstacles served as invaluable lessons, guiding future considerations and improvements. Reflecting on the initial goals set at the project's inception, the prototype's real-world outcomes were scrutinized, leading to a nuanced understanding of its strengths and areas for refinement.

User feedback played a pivotal role in shaping the final iteration, highlighting the device's impact on the intended audience. Acknowledging the limitations encountered, I foresee future iterations addressing these aspects and further elevating the prototype's efficacy.

Looking ahead, the buzzer handglove prototype holds significant potential in the realm of assistive technologies. Its impact on the lives of individuals with mobility impairments is a testament to the power of innovative solutions. I extend my gratitude to the collaborative efforts of the team, the guidance of mentors, and the support received throughout this transformative journey.

As this chapter concludes, I am energized by the possibilities that lie ahead for the prototype's continued evolution and the positive impact it may bring to those in need.

Chapter
7
REFERENCES

7 REFERENCES

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