Project Synopsis

On

Smart Wheel Chair

Group No. 06

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DECLARATION

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person nor material which to a substantial extent has been accepted for the award of any other degree or diploma of the university or other institute learning, except where due acknowledgement has been made in the text.

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CERTIFICATE

This is to certify that the Project Report entitled "Smart Wheel Chair" which is submitted by Mohd Ammar Ahmad (2004500100034), Mohd Gulrez Ansari (2004500100036), Anubhav Singh (2004500100012), in partial fulfilment of the requirement for the award of degree B. Tech in Department of Computer Science and Engineering of SRMS College of Engineering, Technology and Research affiliated to Dr. A.P.J Abdul Kalam Technical University, Lucknow (U.P.), is a record of the candidates own work carried out by them under my supervision. The matter embodied in this work is original and has not been submitted for the award of any other work or degree.

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ACKNOWLEDGEMENT

It gives us a great sense of pleasure to present the report of the B. Tech Project undertaken during B. Tech. Final Year. We owe special debt of gratitude to Assistant Professor Ms. Neha Sharma, (CSE), S.R.M.S C.E.T&R, Bareilly for her constant support and guidance throughout the course of our work. Her sincerity, thoroughness and perseverance have been a constant source of inspiration for us. It is only her cognizant efforts that our endeavours have seen light of the day.

We also take the opportunity to acknowledge the contribution of Prof. Dr. L. S. Maurya, Principal, S.R.M.S C.E.T&R, Bareilly for his full support and assistance during the development of the project. We also do not like to miss the opportunity to acknowledge the contribution of all faculty members of the department for their kind assistance and cooperation during the development of our project. Last but not the least, we acknowledge our friends for their contribution in the completion of the project.

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ABSTRACT

The voice-controlled wheelchair is a groundbreaking innovation in assistive technology, aimed at enhancing the mobility and independence of individuals with disabilities. This abstract provides an overview of the key features and advantages of voice-controlled wheelchairs, highlighting their potential to redefine the way users interact with their mobility aids.

Voice-controlled wheelchairs leverage advanced speech recognition technology to provide an intuitive and natural mode of interaction for users. Through simple voice commands, users can seamlessly navigate their environments, overcoming obstacles and accessing various functionalities with ease. This technology not only enhances mobility but also promotes a sense of autonomy and empowerment among users, as it reduces the reliance on physical interfaces.

The voice-controlled wheelchair's integration with Internet of Things (IoT) technology enables connectivity and remote monitoring. Caregivers and healthcare professionals can remotely assist users, track their movements, and receive alerts in case of emergencies, further enhancing user safety and peace of mind. Real-time data and analytics can also be provided to users, helping them make informed decisions about their mobility and environment.

LIST OF FIGURES

CHAPTER: 01

1.1 Introduction

In a rapidly advancing world, the quest for improved accessibility and enhanced quality of life for individuals with mobility challenges has led to remarkable innovations in assistive technology. Among these innovations stands a remarkable and transformative creation - the Smart Wheelchair. Unlike traditional wheelchairs, the Smart Wheelchair is a cutting-edge marvel that seamlessly integrates technology to empower users with greater independence and autonomy.

With the global population aging and the incidence of mobility impairments on the rise, the need for innovative solutions to address these challenges has never been more pressing. The Smart Wheelchair represents a significant step forward in achieving this goal. By incorporating a multitude of sensors, artificial intelligence, and connectivity features, it not only facilitates smooth and intuitive navigation but also enhances the overall user experience.

In this exploration of the Smart Wheelchair, we will delve into the remarkable features and benefits that make it a game-changer for those with mobility impairments. From its ability to adapt to different environments and situations to its intuitive controls and the potential to connect with other smart devices, the Smart Wheelchair opens up a world of possibilities for individuals seeking to regain their mobility and independence.

1.2 Motivation

The primary motivation behind smart wheelchairs is to empower individuals with mobility impairments to regain their independence. These innovative devices enable users to navigate their environments, whether indoors or outdoors, with increased autonomy, reducing their reliance on caregivers and enhancing their overall quality of life.

One of the critical motivations behind smart wheelchairs is to facilitate social engagement and participation in society. These devices empower users to join family gatherings, attend events, visit public spaces, and interact with peers, reducing the isolation that can often come with mobility impairments.

These wheelchairs seamlessly integrate with other assistive technologies, such as voice-controlled systems, home automation, and smart communication devices. This integration extends the user's control and connectivity, making it easier to interact with their surroundings and interact with others.

The development of smart wheelchairs represents the marriage of cutting-edge technology and a commitment to improving the lives of individuals with mobility challenges. The motivation to push the boundaries of what is possible drives continuous innovation in the field, leading to even more advanced and capable devices.

1.3 Problem Statement

Traditional wheelchairs require helping hand to navigate, limiting the mobility and independence of users and there is nothing which can monitor patient health. Smart wheelchairs must overcome these limitations to provide users with access to a broader range of environments.

Users' needs vary greatly, and smart wheelchairs must offer a high degree of customization to accommodate different preferences and requirements, from seating arrangements to control interfaces.

Ensuring that smart wheelchairs can seamlessly integrate with smart home systems and other assistive technologies is vital to provide a holistic and comprehensive solution.

1.4 Objective

- To implements smart wheelchairs which can provide Patient with mobility impairments the ability to move more freely and independently in various environments, both indoors and outdoors.
- To Integrate Wheelchair with other assistive technologies, such as voice-controlled systems, environmental controls, and communication devices, thereby extending the user's control over their surroundings.
- To synchronize the patient health with the smart devices.
- To improve energy efficiency and extend battery life to minimize disruptions due to recharging and enhance reliability for users

1.5 System Requirement

Designing a Smart Wheelchair involves specifying system requirements to ensure the successful development and functionality of the device. The following are key system requirements for a Smart Wheelchair

1.5.1 Hardware Requirement.

- **Single Shaft Stepper Motor**
  A single-shaft motor is a type of electric motor that is characterized by having only one central shaft extending from the motor body. This shaft is responsible for transmitting mechanical power from the motor to the connected load or device. Single-shaft motors are commonly used in various applications where a straightforward and direct mechanical connection is required.

  In a single-shaft motor, the rotor and the output shaft are typically integrated into a single component, simplifying the mechanical structure. This design is commonly found in small to medium-sized motors used in appliances, tools, and other devices where space and simplicity are key considerations.
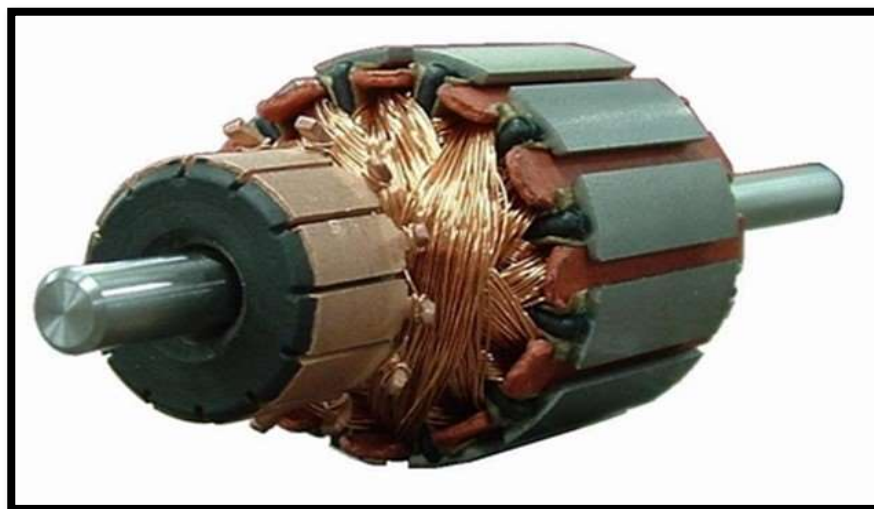
Single Shaft Motor
Fig. 1

The operation of a single-shaft motor involves the conversion of electrical energy into mechanical energy. When electric current flows through the motor's winding, it generates a magnetic field that interacts with the motor's rotor, inducing rotational motion. The rotation of the rotor is then transferred directly to the output shaft, providing mechanical power to drive the connected equipment.

One of the advantages of a single-shaft motor is its compact design and ease of integration. The simplified structure makes these motors cost-effective, reliable, and suitable for applications where space constraints are critical. Additionally, the direct connection between the rotor and the output shaft reduces the number of components and points of failure, contributing to the motor's overall durability.

Single-shaft motors find applications in a wide range of devices, including fans, blowers, pumps, power tools, and various household appliances. Their versatility and simplicity make them a popular choice in situations where a straightforward and efficient mechanical output is required.

The operation of a single-shaft motor involves the conversion of electrical energy into mechanical energy. When electric current flows through the motor's winding, it generates a magnetic field that interacts with the motor's rotor, inducing rotational motion. The rotation of the rotor is then transferred directly to the output shaft, providing mechanical power to drive the connected equipment.

- **Lithium Iron Phosphate (LiFePO4) Battery.**
  Lithium Iron Phosphate (LiFePO4) batteries are a type of rechargeable lithium-ion battery known for their high energy density, long cycle life, and enhanced safety characteristics. The cathode material in LiFePO4 batteries is composed of lithium iron phosphate, which is more stable than traditional lithium cobalt oxide used in some other lithium-ion batteries. This stability contributes to a lower risk of thermal runaway and improved safety, making LiFePO4 batteries particularly suitable for various applications.
  One notable feature of LiFePO4 batteries is their flat discharge curve, providing a consistent voltage throughout most of their

discharge cycle. This makes it easier to estimate the remaining battery capacity accurately. LiFePO4 batteries are also known for their longer cycle life, with the ability to withstand a large number of charge and discharge cycles without significant degradation.


Lithium Iron Phosphate (LiFePO4) Battery
Fig. 2

These batteries find applications in diverse fields such as electric vehicles, renewable energy storage systems, portable electronics, and backup power systems. Their durability, safety, and environmental friendliness contribute to their popularity in scenarios where a reliable and long-lasting power source is essential. Despite being slightly heavier than some other lithium-ion batteries, LiFePO4 batteries are valued for their balance of performance, safety, and sustainability.

- **Relay Module.**
  A relay module is an electrical device that incorporates one or more relays, which are electromagnetic switches, into a single package. These modules are commonly used for controlling high-current or

high-voltage electrical circuits with low-voltage microcontrollers or other control systems.
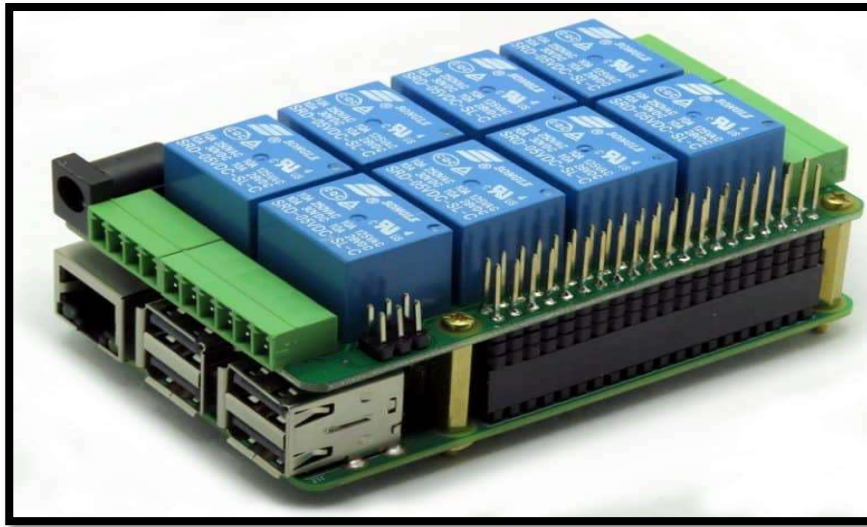

Relay Module
Fig. 3

- **Arduino Uno**
  The Arduino Uno is a foundational microcontroller board widely recognized for its simplicity, versatility, and popularity among electronics enthusiasts and beginners. Developed by the Arduino project, the Uno serves as an entry point into the world of embedded systems and programming. At its core lies the ATmega328P microcontroller, which provides a balance of computational power and ease of use. The board features 14 digital input/output pins, six analog input pins, and a USB connection that facilitates programming and power supply. With a user-friendly design and an open-source philosophy, the Arduino Uno enables users to create interactive projects, ranging from basic LED blinkers to more complex applications involving sensors, actuators, and communication modules. Its compatibility with the Arduino Integrated Development Environment (IDE) simplifies the programming process, allowing individuals to write code in a language similar to C/C++.
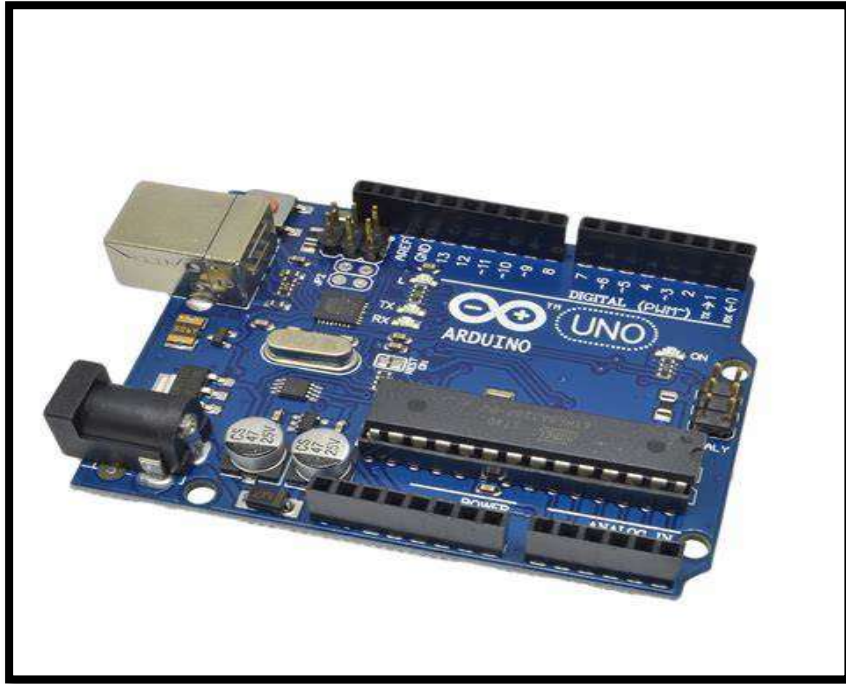
Arduino Uno
Fig. 4

- **Espressif System's Processor 32.**
  The ESP32, developed by Espressif Systems, stands as a highly versatile and powerful microcontroller that has gained widespread popularity in the realm of embedded systems and Internet of Things (IoT) applications. Leveraging the dual-core Xtensa LX6 microprocessor, the ESP32 offers a significant boost in processing capabilities compared to its predecessor, the ESP8266. This microcontroller is equipped with a rich set of peripherals, including GPIO pins, analog-to-digital converters, pulse-width modulation, and various communication interfaces such as UART, I2C, and SPI. One of the standout features of the ESP32 is its built-in Wi-Fi and Bluetooth connectivity, making it well-suited for IoT projects that demand wireless communication capabilities. The inclusion of Bluetooth Low Energy (BLE) support further extends its applicability to diverse applications, including wearable devices and smart home automation.
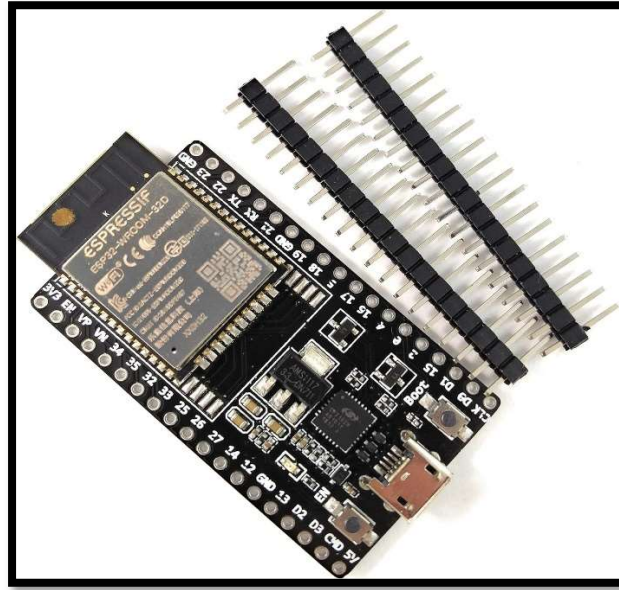
Espressif System's Processor 32
**Fig.5**

- **Pulse Rate Sensor.**

  A pulse rate sensor, also known as a heart rate sensor, is a device designed to measure and monitor an individual's heart rate in real-time. It typically employs optical or electrical technology to detect the pulsatile blood flow caused by each heartbeat. These sensors are commonly used in various applications, including fitness trackers, smartwatches, medical devices, and sports equipment.

  Optical pulse rate sensors often utilize light-emitting diodes (LEDs) to illuminate the skin and photodetectors to measure the amount of light that is absorbed or reflected by the blood vessels. The variations in blood volume with each heartbeat result in detectable changes in the light absorption or reflection, allowing the sensor to calculate the pulse rate.

  Electrical pulse rate sensors, on the other hand, may use electrodes to detect the electrical signals generated by the heart. These sensors can provide accurate heart rate measurements by analyzing the electrical activity associated with the cardiac cycle.

  The information collected by pulse rate sensors is valuable for assessing cardiovascular health, tracking fitness levels, and optimizing exercise routines. Many modern wearable devices integrate pulse rate sensors to provide users with real-time heart rate

data, enabling them to monitor their physical exertion, set fitness goals, and maintain a healthy lifestyle.
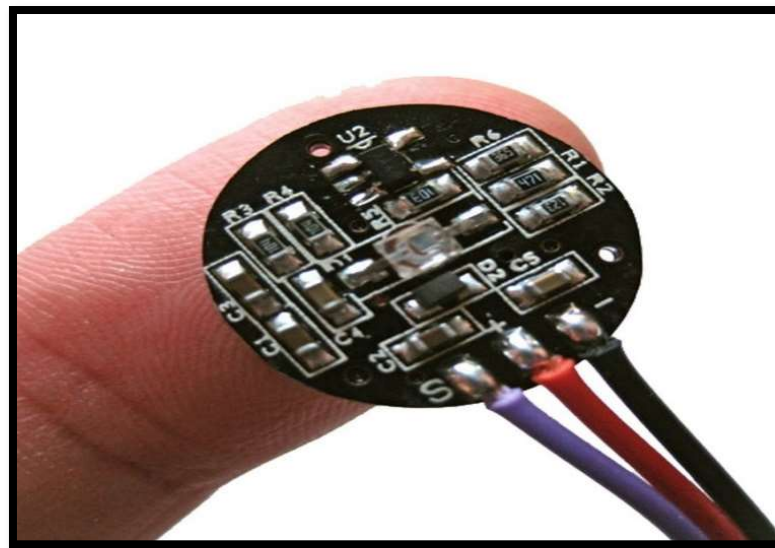
Pulse Rate Sensor
Fig. 6

Pulse rate sensors are non-invasive and convenient, making them widely adopted in consumer electronics. They contribute to the growing field of digital health by empowering individuals to monitor and manage their heart health with ease. Additionally, medical professionals may use pulse rate sensors in clinical settings for patient monitoring and diagnosis.

- **Thermometer Sensor**
  A body thermometer sensor is a vital component in modern temperature measurement devices designed for human use. Utilizing advanced sensing technologies, these sensors play a crucial role in providing accurate and non-invasive temperature readings. Infrared thermometers, for example, often incorporate body thermometer sensors to detect infrared radiation emitted by the human body. These sensors convert the received thermal radiation into electrical signals, enabling the thermometer to quickly and precisely measure body temperature without direct contact. The integration of such

sensors has become particularly significant, especially in the context of health monitoring and


Thermometer Sensor
Fig. 7

medical diagnostics. With rapid response times and high levels of accuracy, body thermometer sensors contribute to the development of reliable and user-friendly temperature measurement devices, offering a valuable tool for monitoring health conditions, detecting fever, and contributing to overall public health and safety.

- **Voice Recognition Module.**
  A voice recognition module is a specialized electronic component designed to interpret and process spoken words or commands into actionable signals within an electronic system. These modules leverage advanced signal processing algorithms and pattern recognition techniques to identify and respond to specific spoken words or phrases. Typically used in applications where hands-free or voice-controlled interactions are essential, voice recognition modules have found applications in various fields, including home automation, robotics, security systems, and consumer electronics.

The functionality of a voice recognition module involves several key components, including a microphone to capture audio signals, an analog-to-digital converter (ADC) to convert the analog
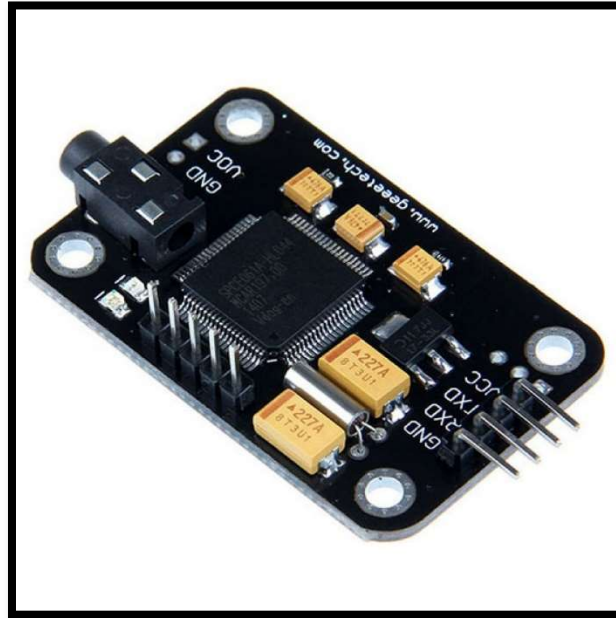
Voice Recognition Module

Fig. 8

audio signals into digital data, and a processing unit that employs algorithms to analyze and recognize specific speech patterns. Some advanced modules may include built-in features like noise cancellation to enhance accuracy in diverse environments.

Users can program voice recognition modules to respond to specific voice commands or trigger predefined actions based on the recognized speech. For instance, in a home automation system, a user might use voice commands to control lights, thermostats, or other smart devices. In robotics, voice recognition can be employed for tasks such as navigation or manipulation.

1.5.2. Software Requirement.

- **Arduino IDE.**

  The Arduino Integrated Development Environment (IDE) is a user-friendly software application that serves as the primary platform for programming and uploading code to Arduino microcontroller boards. Designed to simplify the process of writing and uploading code for both beginners and experienced developers, the Arduino IDE provides a comprehensive set of tools and features. It includes a text editor for writing code in the Arduino programming language, which is a simplified version of C/C++.

  The IDE also facilitates the compilation and uploading of code to Arduino boards with just a few clicks, making the development process accessible to those with varying levels of programming expertise. Beyond code management, the Arduino IDE includes a serial monitor for debugging and monitoring communication between the computer and the Arduino board. Its open-source nature encourages community collaboration, allowing users to contribute to its development and customize it according to their needs. Overall, the Arduino IDE serves as a fundamental tool in the Arduino ecosystem, enabling users to bring their electronic projects to life through seamless programming and interaction with Arduino microcontrollers.

- **Visual Studio Code.**

  Visual Studio Code, commonly known as VS Code, is a powerful and widely-used source-code editor developed by Microsoft.
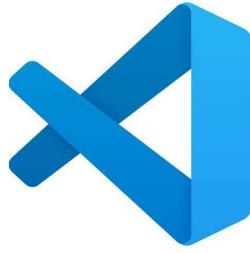
Recognized for its versatility, efficiency, and extensive customization options, VS Code has become a popular choice among developers for a diverse range of programming languages and frameworks. Built on the Electron framework, it combines a lightweight yet feature-rich interface with robust functionality, catering to the needs of developers across various platforms, including Windows, macOS, and Linux. VS Code supports an extensive set of extensions, allowing users to tailor the editor to their specific workflow and coding preferences. Its IntelliSense feature provides intelligent code completion and suggestions, enhancing productivity and reducing coding errors. Furthermore, VS Code seamlessly integrates with version control systems such as Git, making it a comprehensive solution for collaborative development projects. With its constant updates, vibrant community support, and a plethora of features designed to streamline the development process, Visual Studio Code has positioned itself as a go-to choose for developers seeking an efficient and adaptable code editor.

- **Embedded C Programming Language:**
  Embedded C software is a specialized programming language and set of tools tailored for developing software for embedded systems—small-scale computing devices that are an integral part of larger systems or products. Written in the C programming language, embedded C is optimized for resource-constrained environments, focusing on efficiency and close interaction with hardware components. The software developed using embedded C is often used in microcontrollers, microprocessors, and other embedded systems to control, monitor, and manage various functions. Embedded C programmers work closely with hardware

specifications, utilizing low-level programming techniques to access and manipulate device registers, memory, and I/O ports. This close integration with hardware allows for precise control and efficient utilization of system resources. Embedded C software is crucial in diverse applications, including automotive systems, medical devices, industrial automation, consumer electronics, and IoT devices. Its ability to operate in resource-limited environments and provide real-time control makes it a fundamental tool in the development of robust and reliable embedded systems that power many aspects of our daily lives.

- **Python Programming Language:**
  Python is a versatile and high-level programming language that has gained widespread popularity for its readability, simplicity, and flexibility. Known for its emphasis on code readability and ease of use, Python is a preferred language for a diverse range of applications, from web development and data analysis to artificial intelligence and scientific computing. Its extensive standard library provides pre-built modules and packages, facilitating efficient development and reducing the need for developers to create code from scratch.

Python's syntax allows developers to express concepts in fewer lines of code compared to other languages, promoting a clean and expressive coding style. Additionally, Python supports multiple programming paradigms, including procedural, object-oriented, and functional programming, making it adaptable to various project requirements. With a vibrant and supportive community, frequent updates, and a wealth of third-party libraries, Python continues to be a go-to choice for both beginners and experienced developers,

contributing to its widespread adoption in the software development landscape.

- **Django Framework:**
Django is a high-level, open-source web framework for building robust and scalable web applications in the Python programming language. Known for its emphasis on simplicity, efficiency, and the "don't repeat yourself" (DRY) principle, Django provides developers with a comprehensive set of tools and features to streamline the web development process. Its "batteries-included" philosophy includes an integrated Object-Relational Mapping (ORM) system, a powerful template engine, and a built-in administrative interface.

Django follows the Model-View-Controller (MVC) architectural pattern, organizing applications into models for data handling, views for user interface logic, and templates for presentation. The framework also prioritizes security, offering protection against common web vulnerabilities. With Django's modular design and extensive documentation, developers can rapidly create dynamic and data-driven web applications, making it a popular choice for projects ranging from small-scale applications to large-scale, enterprise-level systems. Additionally, Django's active community, frequent updates, and adherence to best practices contribute to its enduring popularity and effectiveness in the web development landscape.

- **HTML & CSS:**
HTML (Hypertext Markup Language) and CSS (Cascading Style Sheets) are foundational technologies in web development, working in tandem to structure and style the content of websites. HTML

serves as the structural backbone, providing a markup language that defines the elements and layout of a web page, such as headings, paragraphs, images, links, and more. It establishes the hierarchy and relationships between these elements, forming the basic structure of a document.

On the other hand, CSS complements HTML by handling the presentation and visual styling of web pages. Through a separate stylesheet, CSS allows developers to define the colours, fonts, spacing, and positioning of HTML elements. This separation of concerns between HTML and CSS follows the principle of maintainability and scalability, making it easier to update the visual aspects of a website without altering its underlying structure.

Together, HTML and CSS enable the creation of responsive and visually appealing websites. HTML provides the semantic structure, ensuring accessibility and proper organization of content, while CSS enhances the user experience by applying styles that cater to different screen sizes and devices. The combination of these technologies forms the backbone of the World Wide Web, facilitating the creation of dynamic, interactive, and aesthetically pleasing web pages that cater to a diverse range of users and devices.

- **Thing Speak Cloud.**
  Thing Speak is an Internet of Things (IoT) platform that allows users to collect, analyse, and visualize data generated by IoT devices. Developed by MathWorks, Thing Speak provides a cloud-based infrastructure for managing and interacting with IoT data streams.

ThingSpeak

Thing Speak serves as a platform to connect and manage IoT devices, sensors, and data. It enables users to capture and store real-time data from various sources, such as environmental sensors, weather stations, or any internet-connected device capable of generating data. The platform utilizes channels to organize and store this data, with each channel representing a unique data stream associated with a particular IoT device or application.

One of Things peak's key features is its ability to analyse and process the collected data using MATLAB, a high-level programming language widely used in engineering and scientific applications. This integration allows users to apply complex data analytics and visualization techniques to derive meaningful insights from their IoT data.

Thing Speak also provides a user-friendly interface for creating customizable charts, graphs, and visualizations based on the collected data. This makes it easy for users, including developers, researchers, and hobbyists, to monitor and understand trends, patterns, or anomalies in their IoT data.

Moreover, Thing Speak supports the integration of third-party services and applications, enabling users to extend the functionality of their IoT projects. It allows for real-time alerts, webhooks, and communication with other IoT platforms and devices.

CHAPTER 02: Literature Review

Kedar Sukerkar, "Smart Wheel Chair" August 2018, DOI:10.11591/ijict.v7i2.pp63-66 . In this research paper they presented a design of a cost-effective smart wheelchair that combines several facilities to help them move safely, freely. The design of the wheelchair was mainly focused on the people who have a disability in their lower limb. In the controlling part, the system was based on an Arduino board with joysticks attached to it, to give the user the control to move manually. The design is also consisting of an obstacle detection sensor which the obstacles.[1].

Mohammed Hayyan Alsibaix, "A study on smart wheel chair system" December 2015, DOI:10.15282/ijets.4.2015.1.4.1033. In this Research paper they introduce the joystick control to wheel chair as well as sitting posture can also be changed using joystick[2].

Imtiaz Rehman "Design of An Intelligent Wheelchair for Handicap People Conducting by Body Movement", July 2020, DOI:10.1109/ICCCNT49239.2020.9225663. In this research paper they introduce the smart wheelchair which can be controlled with based on palm and finger movement[3].

CHAPTER 03: Methodology

A smart wheelchair operates on an innovative combination of advanced technologies to enhance mobility and autonomy for individuals with limited physical abilities. Equipped with a sophisticated sensor system, the smart wheelchair perceives its environment in real-time, utilizing pulse rate sensor, temperature sensor. The gathered data is processed through an intelligent control system.
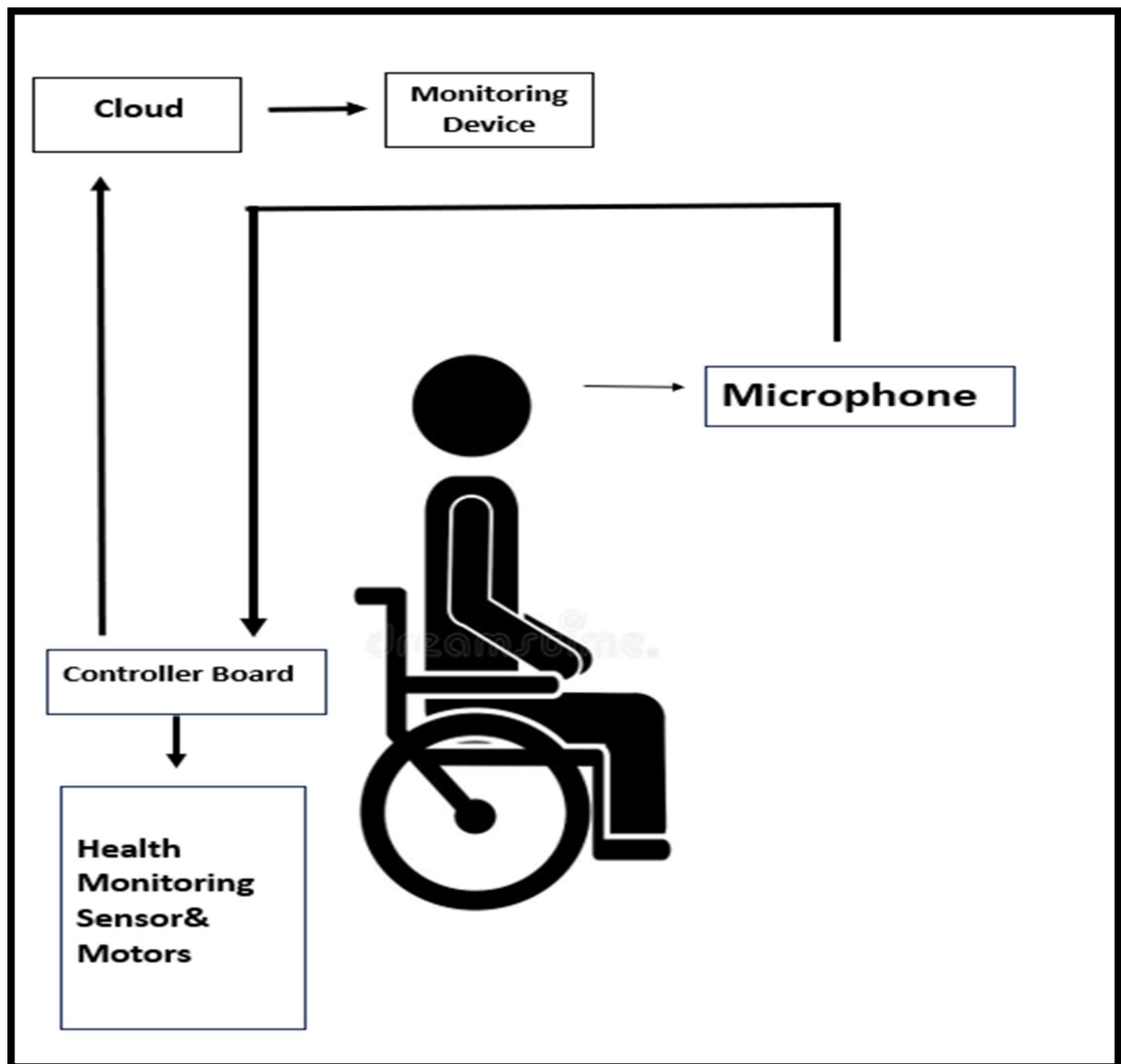
Working of Smart Wheel Chair

Fig. 9

User interaction with the smart wheelchair is facilitated through an intuitive interface, incorporating features such as voice commands. The wheelchair is designed not only for ease of operation but also to adapt to the user's preferences over time.

Smart chair consists of multiple components which are inter-connected to each other the voice module continuously detects the voice commands and sends to the controller and controller verifies it and controls the motors according to it.

The chair also contains health monitoring sensors which are connected to the controller which continuously monitors heart rate and body temperature and sync it with the care taker device.

CHAPTER 04: Result

Executive Summary

The Smart Wheelchair project aimed to develop an intelligent mobility solution for individuals with limited physical abilities. Leveraging advanced sensor technologies, adaptive controls, the smart wheelchair aimed to provide Voice Control user experience with remote health monitoring.

Key Achievements

Voice Control user experience: An intuitive user interface was implemented, featuring voice commands. Users found the interface easy to use, and the system adapted to individual preferences through learning algorithms.
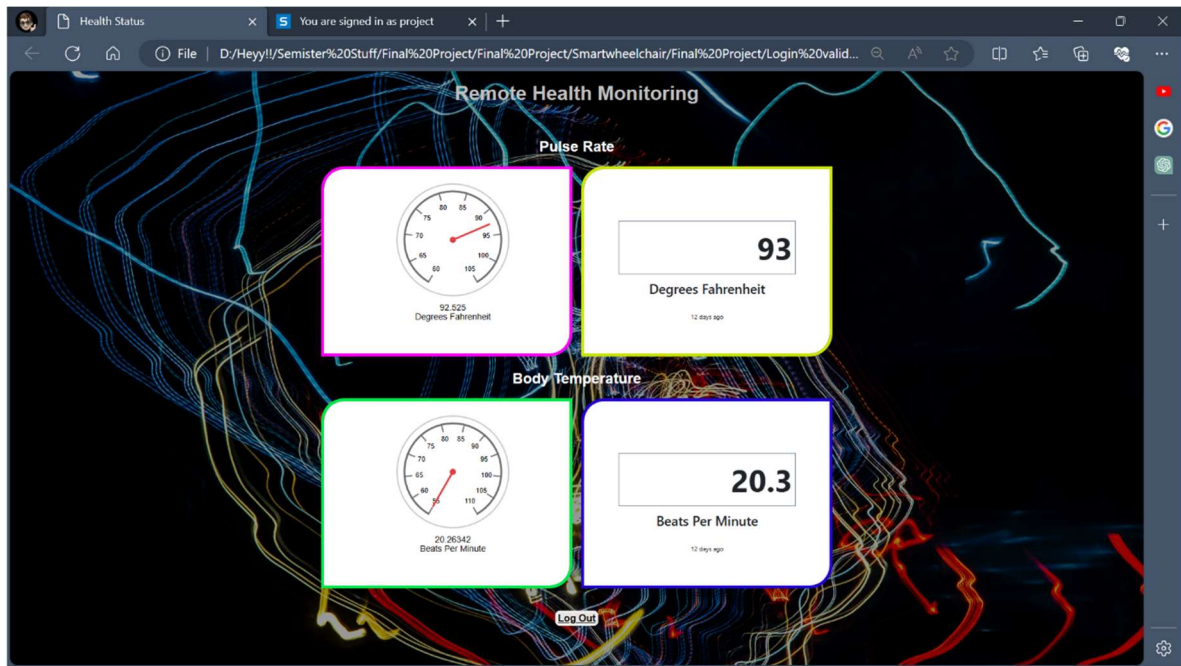
Remote Health Monitoring: Sensors collect patient pulse rate and body temperature which is synchronized with the website accessible globally.

Project Snapshots
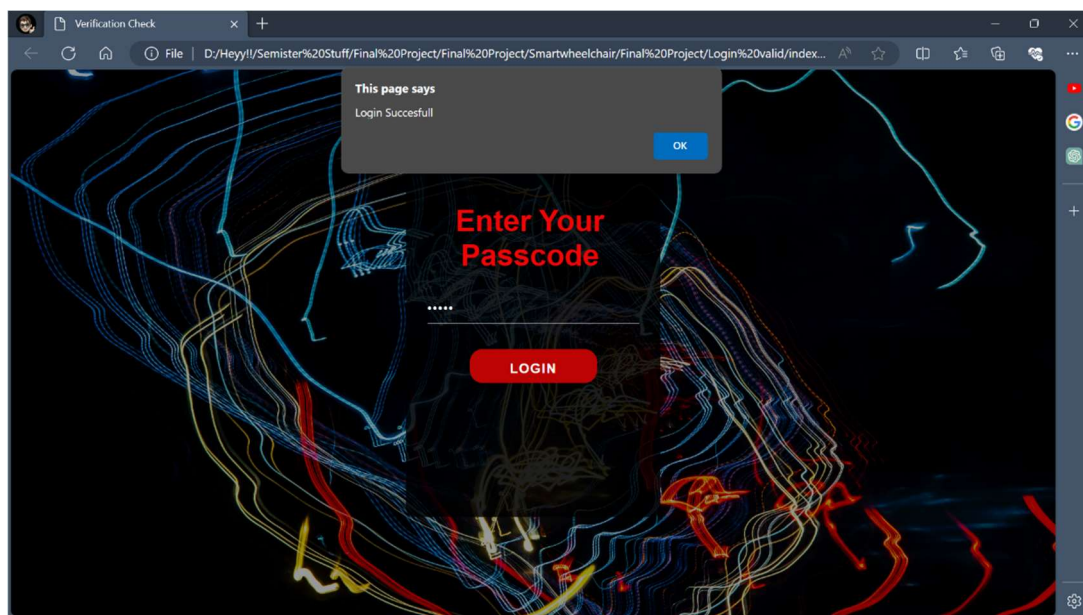
Remote Monitoring GUI

Fig 10(a)

Remote Monitoring GUI

Fig 10(b)

CHAPTER 05: Future Enhancement

- **Integration with IoT and Smart Homes:** Smart wheelchairs can be integrated into the Internet of Things (IoT) ecosystem, allowing users to control their wheelchairs and interact with their surroundings through voice commands or smartphone apps. This integration can also enable automatic adjustments of home devices like lights, thermostats, and doors.

- **AI-Powered Assistance:** is a software application or program that leverages artificial intelligence (AI) and natural language processing (NLP) technologies to provide users with information, perform tasks, or assist with various functions. These assistants are designed to interact with users in a human-like manner, making them a valuable tool for a wide range of applications.

- **Telehealth Integration:** Smart wheelchairs can be designed to facilitate telehealth consultations. This can include video conferencing capabilities, allowing users to easily communicate with healthcare providers from their wheelchairs.

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APPENDIX

In the development of the Smart Wheelchair, several essential sensors and control mechanisms were integrated to enhance its functionality and user experience. The following appendix provides detailed information about the key components incorporated into the smart wheelchair system.

A. Pulse Rate Sensor

The Pulse Rate Sensor is a critical component designed to monitor the user's heart rate in real-time. This sensor contributes to the overall health monitoring system of the smart wheelchair, allowing caregivers and users to assess physiological well-being during operation.

Specifications:

Type: Photoplethysmography (PPG) sensor

Location: Strategically placed on the armrest or another accessible location for optimal pulse rate detection.

Interface: Connected to the main control unit for data processing and interpretation.

Purpose:

Continuous monitoring of the user's pulse rate.

Integration with safety features to alert caregivers in case of abnormal heart rate patterns.

B. Temperature Sensor

The Temperature Sensor is integrated to monitor and ensure the comfort and well-being of the user. It enables the smart wheelchair to adapt to environmental conditions, providing a more personalized and comfortable user experience.

Specifications:

Type: Infrared (IR) or Thermocouple sensor

Location: Positioned within the seating area or another suitable location for accurate temperature readings.

Interface: Connected to the main control unit for real-time temperature data processing.

Purpose:

Monitoring the ambient temperature around the user.

Automatic adjustment of the wheelchair's environment (e.g., heating or cooling) based on temperature readings.

C. Voice Control

Voice control is implemented to enhance the accessibility of the smart wheelchair, allowing users to operate and control various functionalities through natural voice commands.

Specifications:

Speech Recognition System: Utilizes advanced algorithms for accurate interpretation of voice commands.

Integration: Connected to the main control unit for seamless integration with the overall control system.

Purpose:

Hands-free operation, providing convenience and independence for users.

Integration with navigation, safety features, and environmental controls.