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NON-AMBULATORY INDIVIDUAL LOCOMOTION WITH VOICE CONTROL SYSTEM

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ABSTRACT

The widespread occurrence of limb loss and sensory system impairment is a significant concern in today's society, often resulting from accidents, aging, and health issues. In order to aid individuals with such disabilities, an innovative intelligent wheelchair system has been developed, incorporating dual control mechanisms for navigation within familiar surroundings. This system allows users to operate the wheelchair through either voice recognition or a touch screen interface. By utilizing the touch screen, users can change directions by pressing different quadrants on the screen, each programmed with specific values corresponding to different directions. Alternatively, users can simply give voice commands to control the wheelchair. The voice recognition system stores a single letter for each direction, reducing recognition time and enabling quick navigation to the desired destination. The wheelchair is equipped with DC brushless motors at the rear, controlled using PWM technology, and includes a brake mechanism for added safety. Previous research indicates that the touch screen accuracy is 50%, whereas in this new system, the accuracy for movement in all directions is an impressive 94.6%. Additionally, the voice recognition accuracy stands at 80.8%, a 30% improvement over previous studies. This innovative device facilitates automatic movement for individuals with disabilities along predefined paths within indoor environments.

Keywords: ARM Microcontroller, Touch-Screen, Wheelchairs, Bluetooth , BT VOICE App.

I. INTRODUCTION

The project "Revolutionizing Care: Smart Health Solutions for Wheelchair Patients" introduces an innovative healthcare system tailored for individuals who rely on wheelchairs for mobility. This system utilizes state-of-the-art technology to address the specific healthcare requirements of this group, ultimately improving their overall well-being and quality of life. At the core of this advancement is a micro-controller serving as the central control unit, overseeing all operations. It incorporates smart sensors, such as MEMs for wheelchair movement detection and a heart rate sensor. Through the integration of advanced technology and personalized monitoring, this system marks a significant advancement in enhancing the lives of individuals confined to wheelchairs.

II. LITERATURE SURVEY

Title 1: Voice Recognition based Intelligent Wheelchair and GPS Tracking System.

Author: Nasrin Aktar1 , Israt Jahan2 , Bijoya Lala3.

Year : 2019

Description:

Development of a voice recognition based intelligent wheelchair system for physically handicapped people who are unable to drive the wheelchair by hand is represented in this paper where the patient can operate the wheelchair using voice commands and the location of patient can be traced using GPS module in the wheelchair that tracks and sends the information to smartphone application (app) via Firebase. Voice module V3 is used to record patient's voice and recognize that voice to follow the instructions of the patient. This kit converts the voice commands to hexadecimal numbers and then the data is fed to the Wi-Fi module to control the wheelchair. Wi-Fi module directs the motor driver IC to move the wheels in desired direction. Motor speed can also be controlled

in three stages-low, medium, high. This system also offers obstacle detection automatically using IR sensor and a smartphone app has been developed for the family members of patient to know about the location of the patient. Use of firebase makes the system fast and android app offers low cost and user friendly environment than the conventional GSM based navigation systems. As this system simultaneously offers voice operated wheelchair, motor speed control, obstacle detection and GPS tracking of patient using android app, hopefully it will be a fruitful system for the handicapped people worldwide.

Title 2: Smart Wheelchair- An Implementation of Voice and Android Controlled System.

Author: Muhammad Saad Amin, Syed Tahir Hussain Rizvi, Sameer Malik.

Year : 2021

Description:

The inspiration driving android and voice automated smart wheelchair venture is to construct a smart wheelchair that helps physically impaired people to locomote from one spot then onto the next. To overcome this disability, a smart voice-controlled fully automated wheelchair is designed for physically disabled, patients, or pregnant women. This smart wheelchair will help them move from one place to another without any problem. Numerous wheelchairs are accessible with various running advancements, yet the expense is high and it isn't much successful. For the most part, designing voice and android control wheelchairs is to conquer a few burdens of the current frameworks. The customer needs to interact with the wheelchair with the help of the application. This framework enables the client to vigorously communicate with the wheelchair at various dimensions of the control (turn left, turn right, proceed, return and stop). This task utilizes a microcontroller circuit and motor drivers to make the development of the wheelchair.

Title 3 Design and Development of Voice Controllable Wheelchair.

Author: Polash Pratim Dutta *, Abhishek Kumar, Aditi Singh, Kartik Saha.

Year : 2020

Description:

In this work a voice controlled wheelchair is made for physically challenged peoples or patients whose hind limbs are not in working condition. Hence, he or she can control the wheelchair by own voice commands or of the family members. To accomplish the task Arduino microcontroller board is used which receives the voice commands either from Bluetooth module via smartphone or from voice recognition module from microphone attached to it. Further matching it with preloaded voice commands and develop movement accordingly. In the subsequent sections of the paper give more concentration on further objectives to achieve reduction in motor speed smooth movement of vehicle by two motors and the wheels as per the command. The main objective of current work is to make it as simple as possible. Certain theoretical results are also obtained by formulation and design calculation.

III. MODULE NAME

VOICE CONTROLLING WHEEL CHAIR

The voice recognition module for getting the voice data from the user and it will be passing that data to Arduino and micro controller. It is center of the system like a CPU. Controller will be sending the data to the motor driver; it will be getting the command to the controller and it will be controlling the dc motors. These all-

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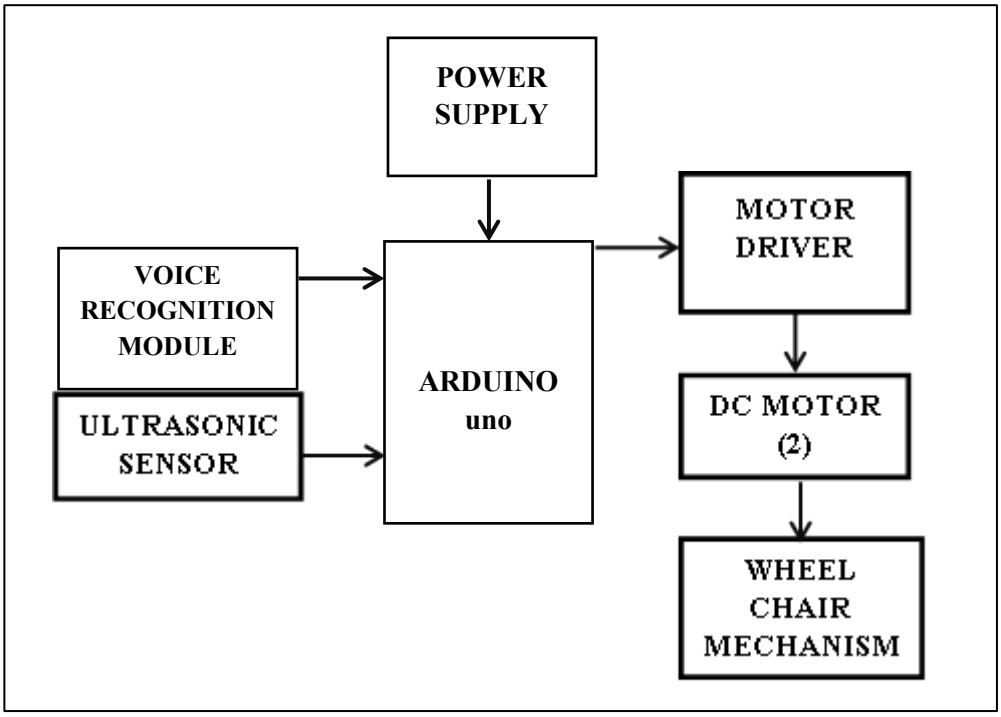
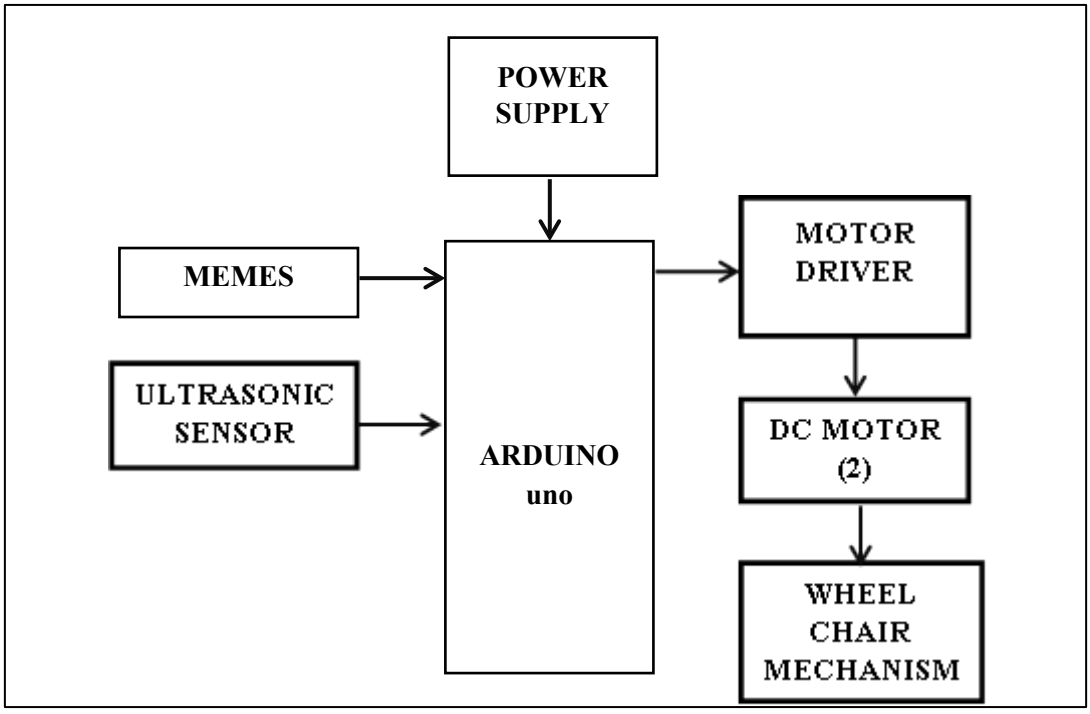
electronic components fixed on wheel chair. The ultrasonic sensor is used for auto braking system of the wheelchair to avoid obstacle collision.



ANGLE OF THE WHEELCHAIR

In this system we are ARDUINO NANO microcontroller as the brain of this proposed system so that all program coding are stored in it. Gyroscope Sensor is used to give directions to the robot. The controller will send the data to the motor driver. The ultrasonic sensor is used to detect the object in front of the robotic wheel chair.



ANALYZING THE DATA

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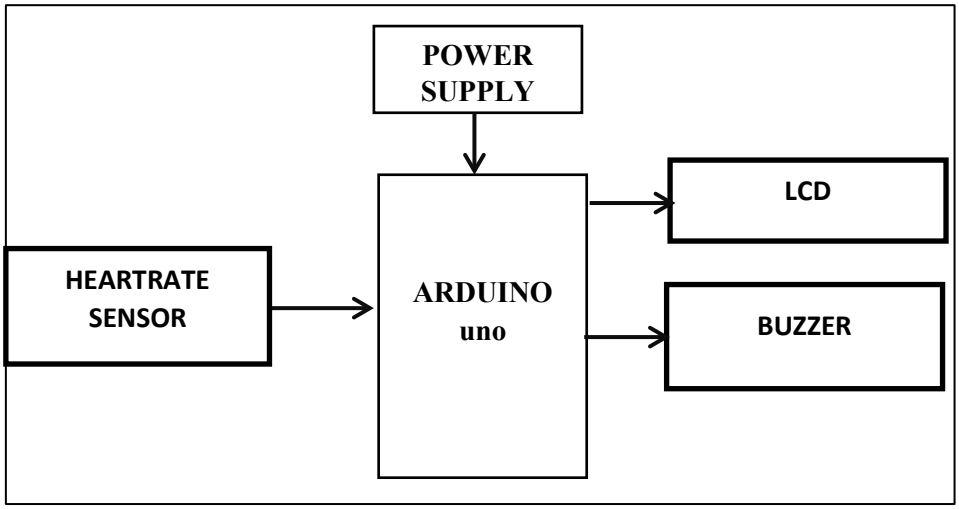
Heart rate sensor for monitoring the patent heart beat leave. And it will be updated on LCD , the buzzer will be alert detecting any abnormal.



WORKING PRINCIPLE

In this system, the entire process is operated and controlled by the micro-controller which acts as a brain of the system. All the instructions of the process are programmed into the controller. Voice recognition module is used to control the movement of the wheelchair. The ultrasonic sensor is used for auto braking system of the wheelchair to avoid obstacle collision. The gyro scope sensor for additional controlling of the wheel chair. Heart rate sensor is used to measure the heart rate of the patient. Buzzer is widely used to notify various events such as end of any process or as an alarming on emergency situation. LCD is used to show project.

HARDWARE AND SOFTWARE DESCRIPTION

HARDWARE DESCRIPTION

- **ARDUINO**

  Arduino is an open-source electronics platform that consists of a microcontroller board and a development environment that enables users to write, upload, and execute code to control electronic devices and interact with the physical world. Key components include Arduino Boards, which are physical circuit boards with microcontrollers and input/output pins, Arduino IDE, a software tool for writing, compiling, and uploading code to Arduino boards, and Arduino Libraries, pre-written code modules that extend the functionality of Arduino boards. Arduino is popular among hobbyists, students, educators, and professionals due to its accessibility, versatility, and extensive community support. It is widely used in applications such as robotics, home automation, interactive art installations, IoT projects, and prototyping for commercial products. Arduino's popularity is due to its accessibility, versatility, and extensive community support.

- **POWER SUPPLY**

  The power supply section is the important one. It should deliver constant output regulated power supply for successful working of the project. A 0-12V/1 mA transformer is used for this purpose. The primary of this transformer is connected in to main supply through on/off switch& fuse for protecting from overload and short circuit protection. The secondary is connected to the diodes to convert 12V AC to 12V DC voltage. And filtered by the capacitors, which is further regulated to +5v, by using IC 7805.

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- **BUZZER**

  A buzzer or beeper is audio signalingdevice, whichmaybe mechanical, electromechanical,or piezoelectr ic (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.

- **MEMS SENSOR**

  Microelectromechanical systems (MEMS) are small electromechanical and mechanical devices that have revolutionized the development of versatile products. MEMS technology allows for the integration of mechanical devices like accelerometers and gyroscopes with consumer electronics. These sensors are packaged similarly to other ICs and are typically used together. Accelerometers measure linear acceleration, while gyroscope sensors measure angular velocity or tilt. MEMS technology also offers gyroscope sensors for multiple axes.

- **Gyroscope Sensor**

  A gyroscope sensor is a device that measures and maintains an object's orientation and angular velocity, surpassing the capabilities of accelerometers. It measures tilt and lateral orientation, unlike accelerometers which only measure linear motion. Gyroscope sensors, also known as Angular Rate or Angular Velocity Sensors, are used in applications where object orientation is difficult to sense by humans. Angular velocity is measured in degrees per second.

- **HEART BEAT SENSOR**

  This project uses bright infrared (IR) LED and a phototransistor to detect the pulse of the finger, a red LED flashes with each pulse. Pulse monitor works as follows: The LED is the light side of the finger, and phototransistor on the other side of the finger, phototransistor used to obtain the flux emitted, when the blood pressure pulse by the finger when the resistance of the photo transistor will be slightly changed. The project's schematic circuit as shown, We chose a very high resistance resistor R1, because most of the light through the finger is absorbed, it is desirable that the phototransistor is sensitive enough. Resistance can be selected by experiment to get the best results. The most important is to keep the shield stray light into the phototransistor. For home lighting that is particularly important because the lights at home mostly based 50HZ or 60HZ fluctuate, so faint heartbeat will add considerable noise.

- **MOTOR DRIVER IC**

  Common DC gear head motors require current above 250mA, which IC 74 series cannot supply. Direct connection to these ICs can cause damage. To address this, a motor control circuit is needed to bridge the motors and integrated circuits. H-bridge motor control circuits can be made using transistors, relays, and L293D/L298.

- **H-BRIDGE CIRCUIT**

  An H bridge is an electronic circuit that allows voltage to be applied across a load in any direction, commonly used in robotics and other applications. These circuits are used in various power electronic converters, such as DC-DC, DC-AC, and AC-AC converters. A bipolar stepper motor is typically driven by a motor controller with two H-bridges. An H-bridge is made up of four switches: S1, S2, S3, and S4. When closed, a positive voltage is applied across the motor, which is inverted by opening and closing the

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switches. The H-bridge motor driver circuit is used to reverse the motor's direction and break it when the motor comes to a sudden stop or when it is detached from the circuit.

SOFTWARE REQUIREMENTS

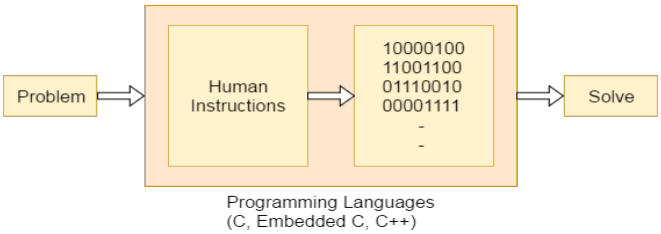
- **EMBEDDED C**

  Embedded C is a widely used programming language for developing electronic gadgets, with each processor associated with embedded software. It plays a crucial role in performing specific functions by the processor. In everyday life, devices like mobile phones, washing machines, and digital cameras rely on microcontrollers programmed with embedded C. The code in the block diagram is used to blink an LED connected to Port0 of the microcontroller.

- **EMBEDDED SYSTEM PROGRAMMING**

  a. Basic Declaration

  Let's see the block diagram of Embedded C Programming development:

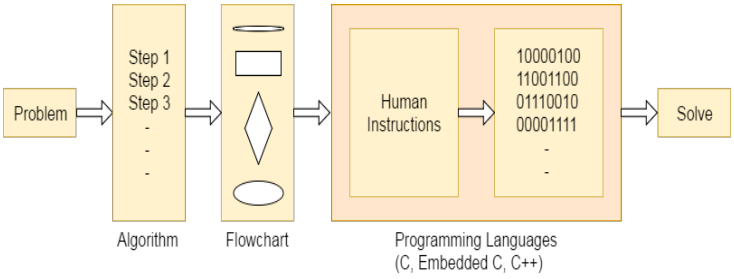


  Function is a collection of statements that is used for performing a specific task and a collection of one or more functions is called a programming language. Every language is consisting of basic elements and grammatical rules. The C language programming is designed for function with variables, character set, data types, keywords, expression and so on are used for writing a C program.

  The extension in C language is known as embedded C programming language. As compared to above the embedded programming in C is also have some additional features like data types, keywords and header file etc is represented by #include**<microcontroller** name.h**>**.

  b. BASIC EMBEDDED C PROGRAMMING STEPS:

  Let's see the block diagram representation of Embedded C Programming Steps:



  The microcontroller programming is different for each type of operating system. Even though there are many operating system are exist such as Windows, Linux, RTOS, etc but RTOS has several advantage for embedded system development.

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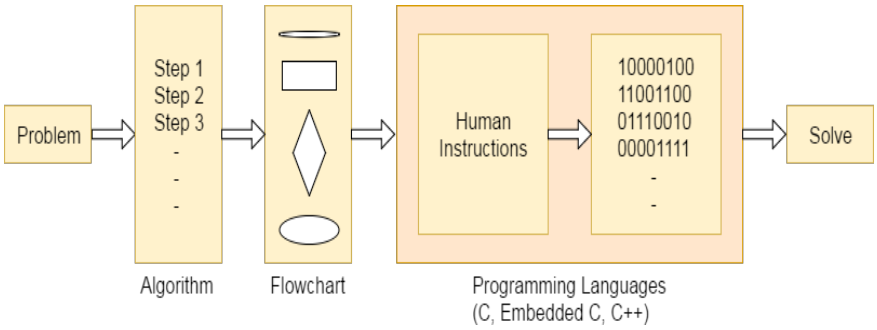
c. **BASIC EMBEDDED C PROGRAMMING STEPS:**

Let's see the block diagram representation of Embedded C Programming Steps:



The microcontroller programming is different for each type of operating system. Even though there are many operating system are exist such as Windows, Linux, RTOS, etc but RTOS has several advantage for embedded system development.

- **MICROCONTROLLER STARTER KIT:**

For developing an embedded system based project a complete microcontroller starter kit is required. The major advantage of this kit over simulator is that they work in real-time operating condition. Therefore it allows the easy input/output functional verification. Consider a microcontroller starter kit consists of:-

- Hardware Printed Circuit Board (PCB)
- In-System Programmer (ISP)
- Some embedded system tools like compiler, assembler, linker, etc

The above component available in microcontroller starter kit is completely enough and the cheapest option available for developing simple microcontroller projects.

Emulators:

An emulator is a software program or a hardware kit which emulates the functions of one computer system into another computer system. Emulators have an ability to support closer connection to an authenticity of the digital object.

It can also be defined as the ability of a computer program in electronic device to emulate another program or device. It focusing on recreating the original computer environment and helps a user to work on any type of application or operating system.

- **PERIPHERAL DEVICES IN EMBEDDED SYSTEMS:**

Communication of an embedded system with an outside environment is done by using different peripheral devices as a combination with microcontroller.

Let's see the different peripheral devices in embedded system are:-

a. Universal Serial Bus (USB)
b. Networks like Ethernet, Local Area Network(LAN) etc
c. Multi Media Cards (SD Cards, Flash memory, etc)
d. Serial Communication Interface (SCI) like RS-232, RS-485, RS-422, etc
e. Synchronous Serial Communication Interface like SPI, SSC and ESSI
f. Digital to Analog/ Analog to Digital (DAC/ADC)

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g. General Purpose Input/Output (GPIO)
h. Debugging like In System Programming (ISP), In Circuit Serial Programming (ICSP), BDM Port, etc

- **CRITERIA FOR CHOOSING MICROCONTROLLER:**

Choosing a microcontroller is essential process in designing of embedded system. While selecting a microcontroller, make sure that it meets the system need and it must be cost effective. We need to decide whether an 8-bit, 16-bit or 32-bit microcontroller is best suitable for the computing needs of a task.

In addition to above, the following points need to be kept in mind while selecting a microcontroller:-

a. Speed: The operational speed of the microcontroller or the highest speed microcontroller can support.
b. Packaging: Packaging is important for improving the assembling, space and prototyping of an end-product.
c. RAM and ROM: On the basis of operation of embedded system and memory need for storage data and programs the type of microcontroller required for designing system is decided.
d. Count of I/O pins: The number of input and output devices connected with the system plays an essential role in choosing the type of microcontroller.
e. Cost per unit: It is important in terms of final cost of the product in which the microcontroller is to be used.
f. Power consumption: Power consumption plays an important role for maintaining the efficiency of an embedded system

IV. FUTURE ENHANCEMENT

APPLICATIONS

- It is used for physically handicapped persons transportation without any others help.
- It is Effortless transport
- A Safe option for physically handicapped persons.

FUTURE ENHANCEMENT:

- By using this wheel chair mechanism we can do transportation through this wheel chair physically handicapped.

ADVANTAGES:

- Physically handicapped person feels good in wheelchair.
- No need for labour to take care of the person.
- Assuring collision-free travel.
- Autonomously transporting the user between locations.

V. CONCLUSION

The project "Revolutionizing Care: Smart Health Solutions for Wheelchair Patients" has showcased a remarkable progress in healthcare for individuals who rely on wheelchairs. By utilizing smart sensors, wearable devices, and real-time monitoring technologies, the integrated system has displayed great potential in addressing their specific healthcare requirements. Acting as the central control unit, the micro-controller effectively coordinates

various sensors to continuously track vital health metrics. Incorporating MEMs for wheelchair movement detection and a heart rate sensor for cardiac monitoring, this intelligent alert system has proven to be invaluable in promptly notifying caregivers and professionals of any deviations from baseline health parameters, thereby reducing the risk of complications. Not only does this system represent a significant technological advancement, but it also promotes patient autonomy and independence. Through its tailored monitoring and advanced technology, it has the potential to greatly enhance the overall well-being and quality of life for individuals bound to wheelchairs. The successful implementation and promising outcomes of this project highlight its potential for wider adoption in healthcare settings.

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