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VOICE BASED SMART WHEELCHAIR FOR PHYSICALLY IMPAIRED PERSONS

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Abstract: Speech signals are most significant communication tools in human beings. Nearly all conversations to communicate are carried out through voice signals. Sounds & other speech signals are changed into electrical form by utilizing a microphone. Physical disability may happen due to various reasons such as injury from accident, age-related & health issues. Wheelchair is employed for offering a means of transportation to such disabled individuals with disabilities of hands and legs. Individuals with such conditions such as paralytic individuals have trouble driving the wheelchair by hand or through a remote assembly. For such individuals the project is made to function on voice commands so that the disabled or paralytic individual can issue direction commands by simply speaking into the Android Application.

The voice commands are received by the Wheel chair using an android application with a microcontroller. Voice signal commands are communicated to the Wheel chair directly using Bluetooth. The wheel chair is operated through voice commands obtained from the user.

The system comprised of an Arduino Uno circuit connected to an android application that receives voice commands from the user translates this voice in to digital data which is then debugged by the micro-controller for obtaining directional commands. The app commands are converted in to computerized signals by the Bluetooth RF transmitter for a suitable range (about 100 meters) to the wheelchair. At the receiving end the information is received by the receiver and is looked after to the micro-controller which powers the DC motors for the basic work. The voice-operated wheel chair is implemented and designed to extend the required endeavor by keeping an eye on the instructions of the user.

I. INTRODUCTION

The freedom of movement and self-mobility are basic components of human dignity and health. Yet, tens of millions of people around the world suffer major restrictions in mobility as a consequence of a great variety of diseases and conditions such as spinal injury, cerebral palsy, muscular dystrophy, stroke, and degenerative illnesses of old age. These impairments in mobility can significantly limit a person's capacity to engage in activities of daily living, access education and employment, and social participation, contributing to a compromised quality of life. Though assistive technologies like wheelchairs have been created to mitigate these problems, many solutions available today have considerable disadvantages.

Manual wheelchairs need a great deal of upper body strength and endurance and are not appropriate for those with very limited upper limb function or fatigue-prone users. Power wheelchairs, although providing easier mobility, use joystick control in most cases, which requires a level of fine motor ability and hand-eye coordination that can be difficult or impossible for some individuals with disabilities. Additionally, high-tech "smart" wheelchairs that have advanced capabilities such as avoidance of obstacles and self-navigating are also usually very expensive, making them available to a limited portion of the population. This project, Voice-Assisted Wheelchair, aims to overcome these limitations by creating an innovative, affordable, and accessible mobility aid that harnesses the potential of voice control. By allowing users to control a wheelchair through verbal commands, this project hopes to increase their autonomy, enhance their quality of life, and ensure greater inclusion and participation in society.

II.PROBLEM STATEMENT AND OBJECTIVE

A.PROBLEAM STATEMENT

Physical disabled people, particularly those with poor or no control over their legs or hands, tend to encounter problems when navigating through standard manual-control or joystick-operated wheelchairs. Such conventional

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mechanisms might not serve the requirements of people with disorders such as paralysis or muscular problems. A free-hand wheelchair controlling system is thus urgently needed in order to advance mobility, independence, and lifestyle for such patients.

B. OBJECTIVE

The goal of this project is to develop a smart wheelchair that can be intuitively controlled using an Android smartphone, enhancing mobility through seamless wireless interaction. The control of the designed prototyped wheelchair is facilitated wirelessly using the Android phone in a way that the Bluetooth facility available in it is utilized. This project enables users to control a wheelchair remotely using an Android smartphone, offering a convenient and intuitive way to navigate.

III.SYSTEM DESIGN

The hardware, which forms the physical structure, and the software, which controls its operation. The hardware configuration consists of an embedded system using an Arduino Uno board, a Bluetooth Module, a Motor Driver, and an Android phone. The user communicates with the system through voice commands sent over the Bluetooth Module from the Android phone. The user gives instructions to the "Voice Control for Wheel Chair (MIT Application)" application running in the Android phone, who in turn sends them over Bluetooth to the Bluetooth Module SR-04. The instruction is translated into a string array and sent to the Arduino Uno connected. Once the message is received, the Bluetooth Module retrieves and performs the command with the connected microcontroller, controlling the motors appropriately using the Motor Driver. The system translates commands to modify the movement of the wheelchair by way of the Android app. Also, an ultrasonic sensor is continuously on to sense any obstacles on the way and inform the Arduino to stop the wheelchair until another command. When moves in Forward Direction if finds any obstacle then automatically stops.

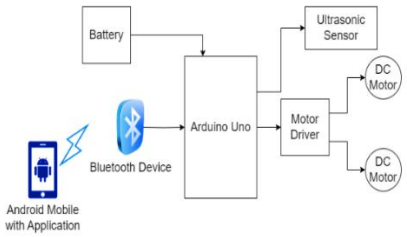

Fig: - Block Diagram

IV METHODOLOGY

The system can be represented using algorithms and algorithms are designed using flowcharts.

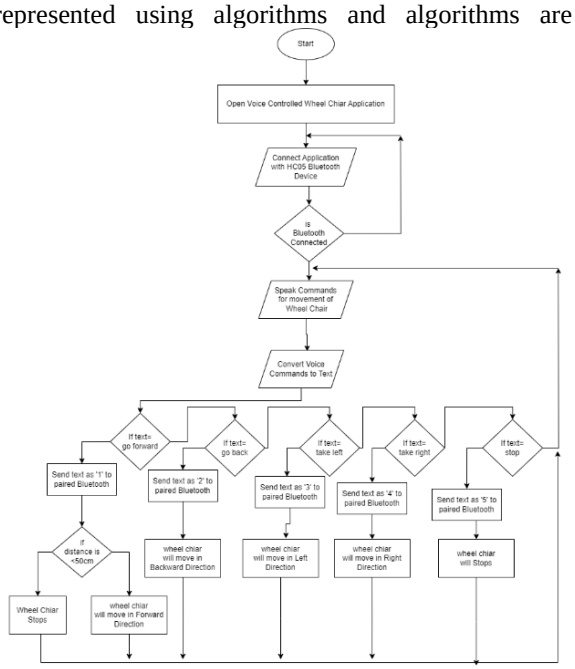

Fig:- Flow Chart.

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Step 1. The process begins.
Step 2. User provides voice command: The user initiates the System by providing a voice command.
Step 3. Voice Recognition: The system verifies if it can identify the voice command.
Step 4. Recognize voice command: If it is possible to recognize the voice command, proceed; otherwise, require the user to repeat the command.
Step 5. Command validation: Check whether the received command is recognized and valid.
Step 6. Process sensor data: If the command is valid, process sensor data to obtain information.
Step 7. Obstacle detected: Verify if there are any obstacles detected.
Step 8. Stop motors: If there is an obstacle detected, stop the motors for safety reasons.
Step 9. Control motors based on command: If there are no obstacles detected, control the motors according to the identified command.
Step 10. Ignore invalid command: If the identified command is invalid, ignore it.
Step 11. End of the process.

V.IMPLEMENTATION

The project suggests a voice-operated intelligent wheelchair that moves using voice commands through an Android mobile app. The commands are sent through Bluetooth and decoded by an Arduino Uno microcontroller, which drives the movement of the wheelchair. Obstacle detection is also provided by an ultrasonic sensor to ensure safety.
System Architecture:
•Input Device: Android smartphone with voice recognition software (developed using MIT App Inventor).
•Communication Module: Bluetooth module HC-05.
•Controller: Arduino Uno (ATmega328P microcontroller).
•Actuators: DC motors with motor driver (L298N or relay-based).
•Safety Component: Ultrasonic sensor (HC-SR04) for obstacle detection.
•Power Supply: 12V lead-acid battery.
Working Mechanism:
1.Voice Command Input: User gives voice commands such as "forward", "left", "stop" into the Android app.
2.Bluetooth Transmission: The commands are transmitted through Bluetooth to the Arduino board.
3.Command Processing: Arduino interprets the command and switches on the motor drivers.
4.Movement Control: Depending on the command, the motors propel the wheelchair accordingly.
5.Obstacle Detection: If an obstacle is encountered, the system stops the wheelchair automatically.
Software Tools:
•Arduino IDE – to program the microcontroller.
•MIT App Inventor – to create the mobile application.
Testing:
•Unit, integration, system, and acceptance testing were conducted.
•White-box and black-box testing methodologies were implemented.
•System was tested for robustness, recognition accuracy of commands, and responsiveness of motors.

VI.SYSTEM REQUIREMENTS

Designing a voice-controlled wheelchair with Arduino and a Bluetooth module requires a number of crucial steps. First, you have to prepare the hardware by interfacing a Bluetooth module (such as HC-05) and motor driver modules with the Arduino to control the motors of the wheelchair. Next, you create an Android application with speech recognition functionality to translate voice commands into text. This application interacts with the Arduino through Bluetooth, providing particular commands for wheelchair movement according to the identified speech. The Arduino program interprets these commands, controlling the wheelchair accordingly. Safety aspects like sensor-based obstacle detection and fail safe mechanisms need to be implemented. Proper testing, movement calibration, and extensive documentation are important to develop a user-friendly and safe voice controlled wheelchair system. The project involves the following major steps:
1. Hardware Setup: Build wheelchair parts, such as motors, wheels, Arduino, Ultrasonic Sensor and Bluetooth module.
2. Voice Recognition System: Integrate a voice recognition algorithm with the Arduino.
3. Bluetooth Communication: Connect a smartphone Arduino using the HC-05 module.
4. Motor Control: Create motor control algorithms to implement wheelchair movements from voice instructions.
5. Testing and Optimization: Test extensively with the user to finalize the system to achieve reliability and safety.
There are two big types of system requirements, hardware and software requirements.

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VII.CONCLUSION

The Bluetooth-based voice-controlled wheelchair project is a major leap in improving mobility and independence for people with restricted physical capabilities. Through the smooth integration of voice commands via Bluetooth communication, the wheelchair provides an easy-to-use and intuitive system for movement control. This technology not only encourages accessibility but also instills a feeling of empowerment and independence among users, allowing them to move around easily. The use of Bluetooth technology provides a stable and wireless linkage between the wheelchair and the voice control system, and it allows for ease of operation with flexibility and convenience. The project not only offers the practical solution to the everyday issues of conventional wheelchair control but also adopts a twenty-first-century and inclusive vision of assistive technology.

VIII.FUTURE ENHANCEMENTS

• Alternate power source

Solar panel roof can be an alternate power source and it can also serve as a rain and sun protection layer.

• Artificial intelligence and image processing.

Artificial intelligence (AI) is a technology and computer science field that investigates and creates intelligent machines and computer software. Leading AI researchers and textbooks characterize the field as "the study and design of intelligent agents", an intelligent agent being a system that senses its environment and acts to maximize its success rate.

• GPS navigation.

Tracking and Navigation the real position of wheel chair.

• Mind control:

Controlling the wheelchair motion by electric signal from brain. Since our brain has thousands of neuron, there is some potential difference among each neuron. When we imagine something neuron sends 0 to 50 HZ electric signal. By interpreting the signal through modulation/demodulation, we can drive the chair.

REFERENCES

[1] Raiyan, Z., Nawaz, M. S., Adnan, A. K. M. A., & Imam, M. H. (2017). Design of an arduino based voice-controlled automated wheelchair. 2017 IEEE Region 10 Humanitarian Technology Conference (R10-HTC). doi:10.1109/r10-htc.2017.8288954.

[2] Dutta, P. P., Kumar, A., Singh, A., Saha, K., Hazarika, B., Narzary, A., & Sharma, T. (2020). Design and Development of Voice Controllable Wheelchair. 2020 8th International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions)(ICRITO). doi:10.1109/icrito48877.2020.9197765 VIII

[3] Ghule,P.B.,Bhalerao, M.G.,Chile, R. H.,&Asutkar, V. G.(2016). Wheelchair control using speech recognition. 2016 Ninth International Conference on Contemporary Computing(IC)doi:10.1109/ic3.2016.7880214

[4] Md Abdullah Al Rakib, Salah Uddin, Md. Moklesur Rahman, Shantanu Chakraborty, Md. Ashiqur Rahman, and FysolIbna Abbas. Smart Wheelchair with Voice Control for Physically Challenged People. 2021 Decenber International Conference on Contemporary Computing DOI: http://dx.doi.org/10.24018/ejers.2021.6.7.2627

[5] Ms. Cynthia Joseph, Assistant Professor, Department of ECE, Coimbatore Institute of Technology, Coimbatore142)Aswin S, (3)Sanjeev Prasad J UG Scholars, Department of ECE, Coimbatore Institute of Technology, Coimbatore-14 titled" Voice and Gesture Controlled Wheelchair "Proceedings of the Third International Conference on Computing Methodologies and Communication(ICCMC2019).DOI:10.1109/ICCMC.2019. 8819662.

[6] International Journal of Research Publication and Reviews Journal homepage: www.ijrpr.com ISSN 2582- 7421

[7] Speech Based Wheelchair Control Using Voice Recognition Kit Issn : 2320-2882

