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VOICE-GUIDED WHEEL CHAIR CONTROL FOR INDIVIDUALS WITH IMPAIRMENTS

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Abstract: One cutting-edge assistive technology designed specifically for people with physical limitations is the voice guided wheelchair. It works by processing voice commands sent by a mobile device with Bluetooth capability, which is handled by an Arduino BT Voice Operate module. This module converts the spoken commands into strings that can be used to move the wheelchair. It then relays this information to a Bluetooth Module SR-04 that is connected to an Arduino board. User-friendly commands like "Proceed," "Reverse," "Turn Left," "Turn Right," and "Halt" enable wheelchair users to move in a variety of directions with ease. With the use of this voice interface, wheelchair users with physical limitations can now be more independent and accessible than ever before. In addition, the wheelchair has an ultrasonic sensor to identify possible obstructions in front of it, allowing for safe travel and collision avoidance. The system enhances users' mobility independence and spatial awareness by incorporating this feature. The "Voice-guided Wheelchair" is essentially a revolutionary solution that empowers people with physical limitations by offering a low-cost, efficient, and user-focused mobility device that promotes autonomy and improves their quality of life.

Keywords: Voice Activation, Bluetooth, Direction, Movements.

I. INTRODUCTION

For those of us who are severely paralyzed, have had an accident, or are elderly and unable to use their legs, a wheelchair is a useful tool. In their daily lives, many people with disabilities depend on others, particularly when they are relocating. Wheelchair users need continuous help from another person in order to move their wheelchair. Their lives are made more difficult because their wheelchairs are not equipped with an intuitive control system that allows them to move independently. When an individual with a disability uses an electronic wheelchair instead of a mechanical wheelchair on their own, they become much more autonomous because operating a mechanical wheelchair on their own takes a lot of work and help from others [1].

A motorized wheelchair may be operated by verbal instructionsfor patients who are hand-free, which makes for an intriguingand encouraging result [8].

However, because they are expensive and difficult to use, smart wheelchair solutions arestill not always widely available. The recommended technique, which is detailed in this paper, will provide a low-cost, easy, and consumer approach for the voice-controlled platform. It is user-friendly, fully adjustable according to theuser's language, and will help in strengthening the user's independent movement. One current area of study that has many untapped potential applications is using a smartphone as the "brain" of a robot [2].

Another relatively new and highly successful technology is Bluetooth, which hastransformed conventional cable and changed the wayindividuals use digital devices at home and at work by converting them from wired to wireless. [3].

Voice controlledwheelchair can be implemented with the help of Android application that will convert the voice command given by thewheelchair user in to its equivalent text message. When thereis any undesired inconvenience, the system recognizes and sends short message to the care taker of user. This study is centered on the design and implementation of wireless remote control systems for voice-controlled wheelchairs using mobile phones and Bluetooth technology.

The project also uses ultrasonic sensors to halt the wheelchair until further instruction and to identify obstructions within a 4-meterrange. The control of a smart wheelchair utilizing an Androidapplication called SOPO base and an Arduino Uno microcontroller is demonstrated in this study.

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II. LITERATURE SURVEY

A computer tool called object detection determines the exact position and size of human objects in random (digital) images shown in [5]. It prioritizes facial features and ignores everything else in the digital image, such as trees, buildings, and bodies. This is probably a "concrete" example of feature class detection. The goal is to find and resize all objects of a certain class in the image. Object tracking can be considered a more "generic" type of object detection. The purpose of the object position (usually one) is to find the position and size of a known set of elements [6]. There are basically two different ways to identify facial features in a given image.

For example, Feature-based techniques aim to extract features from images and compare them with known properties of objects. Image-based methods, on the other hand, aim to match training and test images as accurately as possible.

Jianwu Dang and Wenbo Lan, 2018 Some pedestrian data is lost after traversing deep networks, resulting in steep descents and inaccurate pedestrian detection. In this work, First, he added three transition layers to his original Feature Enhancement Algorithm (FEA) network [7]. The original level and the rearranged level form a path level. Its function is to connect high and low resolution pedestrians, shallow and deep pedestrians. The route layer function transfers the pedestrian feature data from the specified layer to the current layer, uses the sort layer to map the features, and the next layer's features his map matches the new class D cruise function will do so. Rearrange the map. His three layers of sidewalks involved [8] in this technique efficiently transmit small and shallow pedestrian feature information from one of his networks to a deeper network, allowing the deep network to learn pedestrian feature information. more efficient farming. Furthermore, to improve the network's ability to extract information from flat pedestrian zones, this paper reduced the number of layers connecting the corridors from layer 16 to layer 12 in the original YOLO method. This improvement has been applied to the INRIA Pedestrian Area Toll Record. Test results show that the technology can significantly improve pedestrian detection accuracy while reducing false positive and non-match rates. The recognition speed reaches 25fps.

Joseph Redmon first introduced the model in his article "You See Only, Real-Time, Uniform Object Detection". This algorithmic [9] approach labels for each bounding box directly from the image input. Using the rate-optimized version of the model, we were able to achieve velocities up to 155 fps and up to 5 fps, but at the expense of prediction accuracy, mainly due to increased position error. Since the center of the bounding box is inside the bounding box, each cell plays a role in height, and a quality index called the confidence score [10]. Additionally, class prediction is performed cell-by-cell. An example is provided for clarity. For example, we can use a 7x7 grid to divide the image into cells, the bounding box and class probability and confidence maps. YOLO is not without its drawbacks. This algorithm has some limitations on the number of meshes it can handle, in addition to other issues discussed later.

III. EXISTING METHOD

Initially, the joystick is set to the exact middle position. The motor will stop as long as the joystick is held in the middle position. The potentiometer moves when the joystickis moved. Encoded analog voltage value and send them to theArduino board via the analog data pin. These analogue valuesare sent to an ADC (analogue to digital converter) by the Arduino. The analogue value is converted to a digital signal by the ADC. The digital signal is routed through the digital data output pin to the motor driving IC (L293D). L293D includes two H-bridge driver circuits. Two DC motors can be driven simultaneously in forward or reverse, and in either direction [11]. Differently abled persons, especially those withsevere disabilities who are unable to move like regular people, will be able to move independently using wheelchairsthat has voice recognition [5].

A wheelchair that uses an android application with direction arrows, and with a simpletouch, the smart phone is connected to the wheelchair via Bluetooth, and the wheelchair is operated based on the user'sinput[12].A speech-controlled cloud-based wheelchair platform prototype was demonstrated in 2019 by AndrejKraba and colleagues [10]. The platform is controlled by cloud-based speech Web Kit that is readily available andinexpensive. In addition to voice control, a GUI is built, which functions in both web browsers and mobile devices while streaming live video. Sobia, M. Carmel, and colleaguessuggested a hands-free wheelchair command interface [13]. It has three main components. They are command generation, face detection, and facial expression recognition. The program can recognize faces using digital image processing,identify facial expressions using principal component analysis, and generate command signals for a wheelchair interface. By listening to speech orders and the patient's basic facial movement, kalbi et all demonstrated controlling the wheelchair's mobility in several directions [13]. Ultrasonic and infrared sensors were used to automate obstacle identification and avoidance, allowing the patient to temporarily stop the wheelchair in the event that an obstruction unexpectedly blocks its path. In the wheelchair, algorithms for wall tracking and target tracking had also beencreated. Each of the above articles has its flaws and shortcomings.

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IV. WORKING

The Fig. 1 flow diagram represents the overall design methodology of our project "Controlling of Wheelchair Using Voice Recognition" The data flow starts from the android application towards the microcontroller unit through the wireless Bluetooth module. Thus acquired data from the user is further processed by the microcontroller unit and the decision is made to move the robot in desired direction with the help of geared DC motors. Another set of data from the temperature sensor is also fed to the microcontroller unit in order to process the wheel chair user body temperature. Whenever the temperature of the wheelchair user crosses the desired temperature, the alert is provided by the piezoelectric buzzer and also SMS alert is provided by the SIMCOM GSM modem to the care taker.

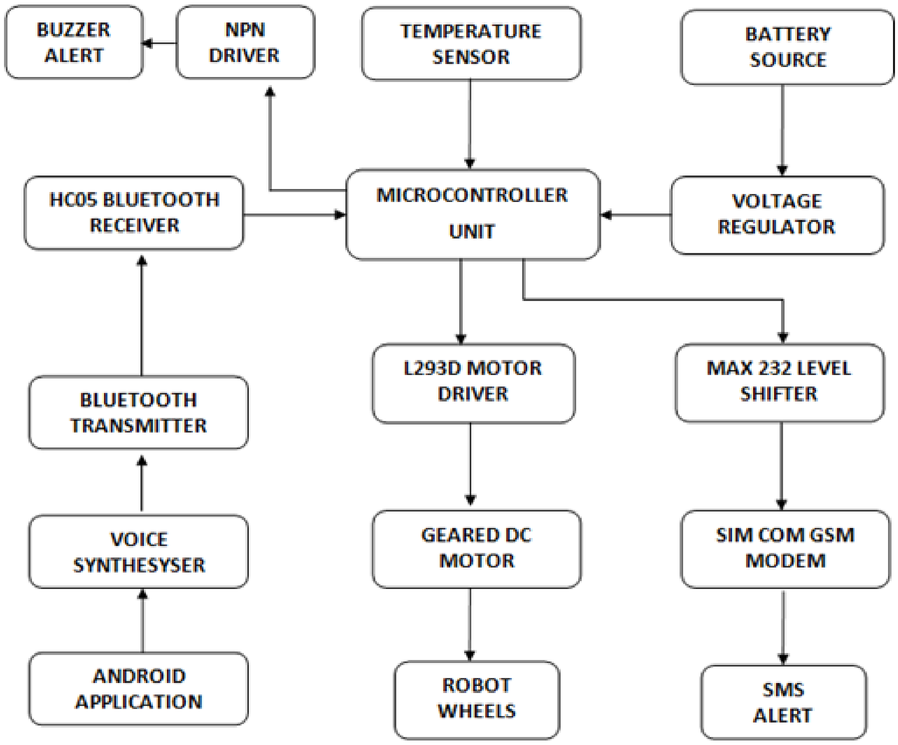

Fig. 1: System Architecture

V. APPLICATION DESCRIPTION

In the proposed system of methodology, thedisabled person will speak the voice command in the androidapplication [4]. The android application chosen here has in built Google voice to Text conversion engine. This willconvert the voice signal into the text signal and transmits thesignal to the Bluetooth receiver present in the wheel chair. The voice command is picked up by the Bluetooth receiver, which then delivers it as a text string to the microcontroller unit. The microcontroller unit categories the vocal orders it has received and decides whether to propel the wheelchair in the intended direction. When the microcontroller unit receives the FORWARD command, it automatically decodes the messageand rotates the left and right wheels in a clockwise direction,moving the wheel chair robot model forward. Likewise, whenthe microcontroller unit receives the REVERSE command, both wheels automatically rotate in the opposite direction, moving the robot backward. As soon as the microcontroller unit receives the LEFT instruction, the left wheel rotates anticlockwise and the right wheel rotates clockwise, causing the robot to move to the left. Similar to this, when the microcontroller unit receives the RIGHT instruction, the wheelchair is moved clockwise by rotating the left wheel in a clockwise manner and the right wheel in an anticlockwise way. Finally, when the STOP command is received by themicrocontroller unit, both the left and right motors are haltedand break pulse is applied by the l293D module so that the wheelchair will not move forward or backward even in slippery direction.

Additionally, the patient in the wheel chairtemperature is continuously monitored by the microcontrollerunit and once the patient temperature is found to be critical (exceeds threshold value), the piezoelectric buzzer alert is enabled to take care of the person immediately when his/her condition goes critical. Also, the SMS alert is also sent to thecare taker regarding the health condition in order to take careof the person immediately [7].

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VI. RESULTS AND DISCUSSION

The Fig.2 represents the physical model of our project "CONTROLLING OF WHEELCHAIR USING VOICE RECOGNITION". In this model we have used 0.8mm MS sheet which is further cut and welded to form thewheel chair body. Finally, the wheel chair model is coated with enamel paint to prevent rust formation and short circuitof the electronics components.

Fig 2. Wheel chair Hardware Implementation

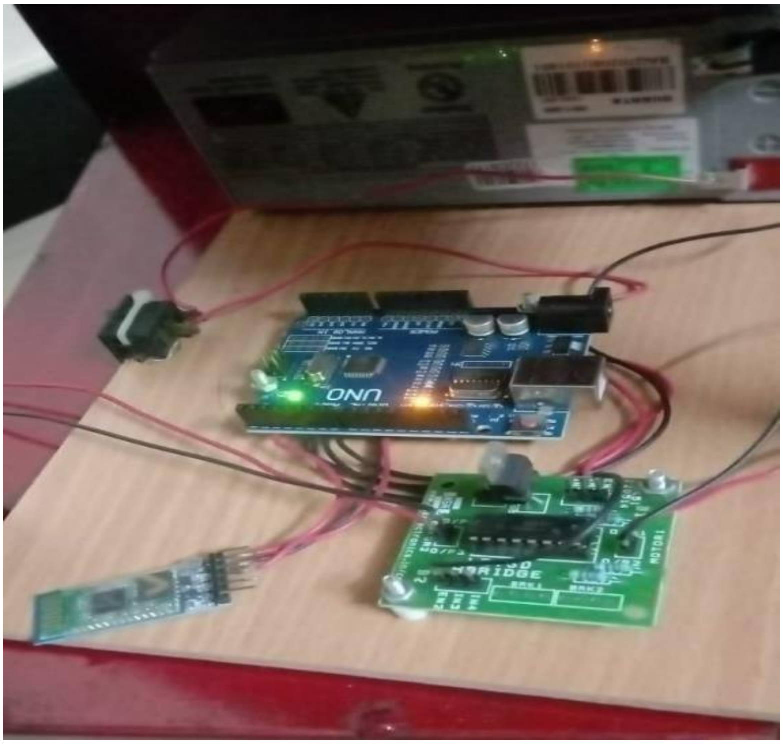

Fig 3. Electronics Assembly

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The Fig. 3 represents the overall electronics assembly of our project in which ARDUINO UNO microcontroller board is connected with HC05 Bluetoothmodule and L293D motor driver module which drives the wheel chair motors further based on the commands receivedby the Bluetooth module.

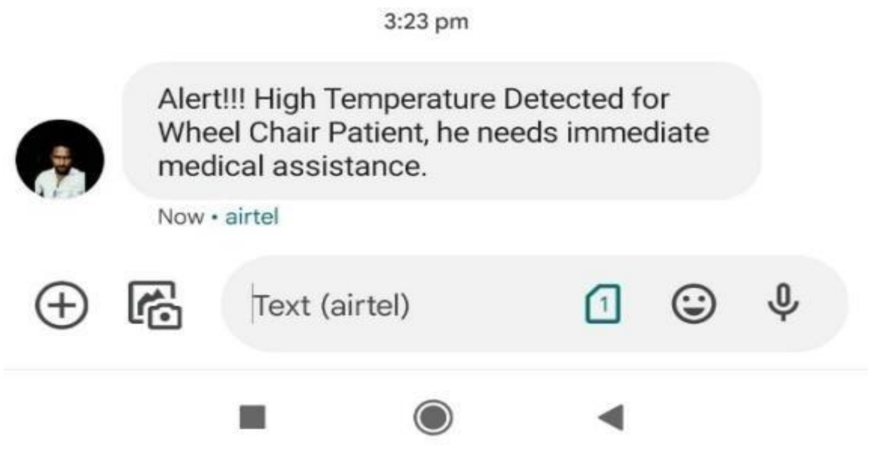

Fig 4. SMS Alert for Critical Health

The Fig. 4 represent SMS Alert notificationsent to the care taker when the wheel chair user is in critical health condition. Table I shows the voice command and its corresponding wheel rotation.

TABLE I VOICE COMMAND AND WHEEL MOVEMENT

S.NO	**VOICE COMMAND**	**LEFT WHEEL MOVEMENT**	**RIGHT WHEEL MOVEMENT**
1	FORWARD	CLOCKWISE	CLOCKWISE
2	REVERSE	ANTI CLOCKWISE	ANTI CLOCKWISE
3	LEFT	ANTI CLOCKWISE	CLOCKWISE
4	RIGHT	CLOCKWISE	ANTI CLOCKWISE
5	STOP	HAULT	HAULT

VII. CONCLUSION

With the aid of a Bluetooth module, this project elaborates on the design and building of a smart electronic wheelchair. The circuit operates correctly to move in response to user commands. After been designed, tested, and approved, the circuit allows those who are physically unable to operate their wheel with an Android app on theircellphone.

Likewise, the primary benefit of the wheelchairuser's health monitoring is that it allows the person providing care to know when to help the disabled person byreceiving SMS notifications about their health state.

The suggested approach helps elderly persons and others with disabilities become more independent.

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REFERENCES

[1]. M. AL-Rousana,, K. Assalehb A Wavelet- And Neural Network-"Based Voice System For A Smart Wheelchair Control", Journal of the Franklin Institute, February 2011.

[2]. M. Maze, FJ. Rodrfguez, J.L. Iazaro, J. Urefla, J.C. Garda, E. Santiso And P.A. Revenga – "Electronic Control Of A Wheelchair Guided By Voice Commands", Control Engineering Practice, May 1995, Page 665-674, Volume 3.

[3]. Deepak Kumar Lodhi1 , Prakshi Vats1 , Addala Varun1 , Prashant Solanki1 , Ritakshi Gupta1 , Manoj Kumar Pandey2 , Rajat Butola2-"Smart Electronic Wheelchair Using Arduino And Bluetooth Module", International Journal of Computer Science and Mobile Computing, May 2016,Page 433-438, Volume 3.

[4]. Engr Fahad –"Voice Controlled Wheelchair using Arduino and Voice recognition Module", August 7,2020.

[5]. Deborah R. Shapiro Department of Kinesiology and Health-"A preliminary look at a collegiate intramural wheelchair basketball season on beliefs, attitudes and behaviors of participants without disabilities", Journal of Hospitality, Leisure, Sport & Tourism Education, June 2020, Volume 26.

[6]. Priyanka Mishra, Sanatan Shrivastava-"IoT based automated Wheel Chair for Physically Challenged Author links open overlay panel", October 20,2021.

[7]. Sudipta Chatterjee, Sahadev Roy-"A low-cost assistive wheelchair for handicapped & elderly people", Ain Shams Engineering Journal, December 2021, Page 3835-3841, Volume 12.

[8]. A preliminary look at a collegiate intramural wheelchair basketball season on beliefs, attitudes and behaviors of participants without disabilities Deborah R. Shapiro.

[9]. LingChe, SenWang, HuoshengHu, DongbingGu, IanDukes- "Voice-directed autonomous navigation of a smart-wheelchair", Smart Wheel Chairs and Brain-Computer Interfaces, January 2008, Page 405-424.

[10]. PanelAndrej Koložvari , Radovan Stojanović , Anton Zupan , Eugene Semenkin , Vladimir Stano vov , Davorin Kofjač , Andrej Škraba –"Speech- recognition cloud harvesting for improving the navigation of cyber-physical wheelchairs for disabled persons", Microprocessors and Microsystems, September 2019, Pages 179-187, Volume 69.

[11]. Joystick controlled wheelchair Trinayan Saharia1, Jyotika Bauri2, Mrs. Chayanika Bhagabati3Volume: 04 Issue: 07 | July -2017 International Research Journal of Engineering and Technology (IRJET)

[12]. Smart Wheelchair Prototype Based Android As A Tool For People With Disabilities January 2020 Conference: Proceedings of the First National Seminar Universitas Sari Mulia, NS- UNISM 2019, 23rd November 2019, Banjarmasin, South Kalimantan, Indonesia

Facial expression recognition using PCA based interface for wheelchair M.Carmel Sobia; V. Brindha; A. Abudhahir September 2014 International Conference on Electronics and Communication Systems (ICECS).