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IOT BASED VOICE-CONTROLLED WHEELCHAIR

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ABSTRACT

Physically challenged people who are suffering through different physical disabilities face many challenging problems in their day-to-day life for commuting from one place to another and even sometimes move from one place to another dependent on others. There may have been many significant efforts over the past few years to develop advanced wheel chairs that could enable the person for its ease of operation without any ambiguity. The main aim of this project is to develop an IoT voice-controlled wheel chair to make the life easier of physically challenged persons. This voice-controlled wheel chair comes with enhanced features like electric powered, voice control, obstacle avoidance etc. Few patients such as quadriplegic, stroke, cerebral palsy and multiple sclerosis are dependent on other people to move from one place to another and due to this they don't have the freedom of mobility. This one worked according to the user's simple voice commands. Depending upon the direction specified in the commands, the processor will drive the motors. The system has three modes of input control to the wheelchair that are Voice recognition, Accelero control and Button control (Via Mobile Application using Bluetooth Module). There will be an option provided on the application to select the input mode. The current system uses Ultrasonic sensors to detect any objects which come near the wheelchair from front or left or right while moving.

Key words: Internet of Things, Voice controlled wheel chair,

I. INTRODUCTION

The advancement in IOT & Embedded Systems technology has changed the operational activities of most organizations and common people in recent times. We need to use that for our benefits and improve our life in all aspects. A report on disability by World Health Organization (WHO) states that around 15 percent of the world population are living with some kind of disability. Out of which about 2-4 percent had difficulties in functioning. The United Nation Development Program (UNDP) estimated that around 80 percent of the disabled people live in developing countries.

In India, the census 2011 which collected data for 8 disabilities, states that 20.5 percent of the disabilities lies in the movement. The restriction in movement due to disability leads to low self-esteem, stress, isolation, fear of abandoning, etc. Arthritis, Muscular Dystrophy, Spina bifida, Spinal cord injury, Acquired brain injury, Epilepsy patients and Multiple sclerosis patients suffer from severe disabilities by which they cannot move.

1.1 Problem Definition

All the people in this world have the right to live an independent and happy life. The people with disabilities leading to restriction in movement and being dependent on others should be provided with such facilities with the help of modern-day technology so that they can become self-reliable, safe and independent.

1.2 Objective

The main objective of the proposed wheel chair is providing the\ multi-control operated wheel chair at a very low cost.The project aims to develop a smart and safe wheelchair system to help people with overcoming such defects with multiple control for navigation in familiar environments.

1.3 Significance

An appropriate smart wheelchair provides the user the freedom to move around, allowing the user to access day to day physical activity as they push around conducting activities. It also provides the greatest possible opportunity for independence and to do the things they want to do, allowing individuals to move within their home more easily, provides increased comfort and a more active lifestyle.

The disabled people can become more self-reliant and independent by using the IOT based voice-controlled wheelchair without having the need to depend on someone else for their movement. The person with disability can easily control and use the wheelchair with the ease of access and the numerous utilities provided along the wheelchair with the help of IOT.

1.4 Methodology

Since the current system has various safety issues the proposed system has been developed keeping in mind those safety issues. The proposed system has three modes of input control to the wheelchair that are Voice recognition, Button

control and Accelero control (Via Mobile Application using Bluetooth module).There will be an option provided to the user on the wheelchair to select the input mode. The current system uses Ultrasonic sensors to detect any objects which come near the wheelchair from front or left or right while moving.

The voice recognition step is the key factor of this project that is used to set up the pertinent voice command and output. It contains three steps, which are 1) voice customization,2)voice capture and 3)voice recognition. Voice customization is the process of matching the desired voice recorded to the desired output signal. Voice capture in this step that records the correct person's voice command and saves the voice based on the customization framework

The voice recognition phase is the final phase where when voice command has been recognized, this module will send a specific signal to the microcontroller for the necessary operation. The voice recognition is intended to be implemented with the help of a voice app on the user's mobile. The app would give instructions to the hardware circuit by using the Bluetooth module, after receiving the instructions, the IOT hardware circuit will carry out the desired movement of the wheelchair.

1.5 Outline of the Project

Disabled people will become self-reliant and independent. A wheelchair can be controlled through various inputs. It will be easy and safe for disabled people to move from one place to another. Whenever a disabled person travels it is easy for their friends and relatives to locate him.

1.6 Scope of the Project

This project was issued for patients who suffer from severe disabilities by which they cannot move. We can use this system/device to control the wheelchair by various input methods. It is an issue full of disabled people becoming self-reliable, safe and independent.

II. LITERATURE SURVEY

This section reviews the existing recent literature work and provides insights in understanding the challenges and tries to find the gaps in existing approaches. Voice recognition, as mentioned, is not something new is the ability of a machine or program to receive and interpret dictation or to understand and carry out spoken commands. Voice recognition has gained prominence and use with the rise of AI and intelligent assistants, such as Amazon's Alexa, Apple's Siri and Microsoft's Cortana. Voice-activated devices have helped fuel IoT adoption. The long-term ramifications for application development could be considerable. While the average person speaks about 15,000 words a day, increasingly they're speaking those words to machines. Internet of Things (IoT) voice control is also pushing automobiles to the forefront of IoT adoption. Cars are now integrated with mobile apps to enable voice-activated commands while driving. Gartner puts adoption at 20% by the end of the year 2020.

2.1 Terminologies

Terminology is a general word for the group of specialized words or meanings relating to a particular field, and also the study of such terms and their use. Terms are words and compound word or multi-word expressions that in specific contexts are given specific meanings—these may deviate from the meanings the same words have in other contexts and in everyday language.

2.1.1 Line Follower Section

Line follower section is used to reach the specific section of the hospital. This whole section also follows the same control procedure i.e. the use of BT Voice Control application which is installed in an android mobile .The patient has to speak the name the particular section which are K, M and V Line follower section consists of four pair of IR sensors and one pair ultrasonic sensor. IR sensors are the main triggers of the whole line following the action mechanism. IR sensor is basically a transceiver. It consists of one IR LED as transmitter and one Photodiode as receiver. The transmitter section of the IR sensor emits infrared light which will be received by the receiver diode and according to the intensity or pulse width of receiving light the decision of the movement has been taken by the wheelchair. There are two types of strips in the line following the path which are black stripe and white strip. There is no reflection from Black strip, low or ('0') logic will reach the microcontroller and when there is white or reflective surface there is high reflection and a high or ('1') reaches to the microcontroller. Fig 2.1 is depicting line follower path with respective position of IR sensors.

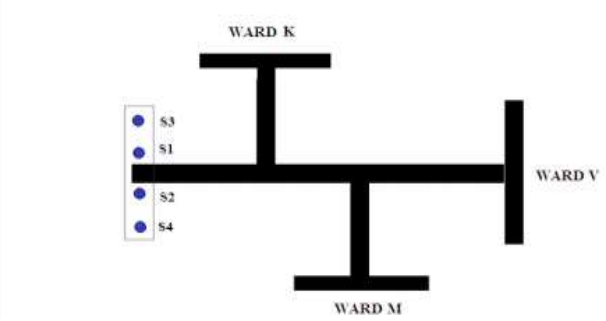

Fig 2.1.1 Line follower path with respective position of IR sensors

When the wheelchair is following black line, the sensor will send the signal to the microcontroller and the microcontroller executes these inputs and sends output to PWM pins in which the motor driver is connected.

2.1.2 Obstacle Detection

To avoid collisions and obstacles, the ultrasonic sensor is used. Here we have used HC-SR04 Ultrasonic sensor. Whenever the wheel chair is going on the desired path the ultrasonic sensor transmits the ultrasonic waves without interruption. When an obstacle comes into the path, the sensor's wave is reflected by the object and the discontinuity in the reception of ultrasonic wave information is passed to the microcontroller. If any obstacle is less than 100 cm, the wheelchair will stop and will not move till the obstacle is passed or goes away greater than 100 cm from the wheelchair.

2.2 Related Works

The Researchers are showing a keen interest in the research area of smart controlling the wheel chair. The wheelchair is especially for those persons who are unable to move their body parts other than head and the movements are sensed using an in-mouth position sensor. Smart wheelchairs are also under research. These wheelchairs sense obstacles in the path of the user. Sensors are to sense the objects. These wheelchairs mainly contain "voice recognition circuits" and "sensors".

Many systems have more separate options to perform tasks which are identified to be difficult for a disabled person. In order to make the operation of the wheel chair for disabled persons much simpler and easier, we simplified and developed the control system with the help of a voice command system. This voice command system helps in moving the wheel chair with short voice control commands. The number of physically disabled people in society has greatly irritated in the past decade as a result of increasing war and aging population. Improving the quality of life for disabled people has been a major concern.

The largest problem faced by all handicapped, paralyzed and disabled is immobility and the need of an artificial means of transport. The common and largely used solution in this regard is a wheelchair, but a wheelchair is associated with a number of disadvantages. The user needs more effort needed for dragging and pushing the wheels, lack of security and stability prevents a physically disabled person from operating a wheelchair on his own and makes him depend on another person's help. Today's all people are busy lifestyles, this can be very in-affordable.

In the existing traditional wheelchair where the person has to push the wheelchair, though it has advantages like independence to move, exercise and transportability in a cost effective way but it has the disadvantages like lack of efficient assistance on inclines and irregular terrains, fatigue and repetitive stress injuries. Disadvantages are control by present power wheelchairs. The power wheelchairs with the joysticks placed near the arm rest helps in assisting without much effort. But most of the patients have injuries to their limbs, where they can't move the joysticks. So, in the proposed systems, instead of moving the wheel chair with a joystick, the wheel chair is moved with the help of voice commands. Mounting of sensors, line detectors and obstacle detectors made the system avoid collisions or accidents. This gives the patient independence to move freely without any other help, also helps the family to rest assured with a safe, collision avoidance system.

2.3 Tools

Here are given the tools and technologies which have been used to make this implementation of this project.

2.3.1 MIT App Inventor (Mobile Application)

MIT App Inventor is "a web application integrated development environment originally provided by Google ", and now maintained by the "Massachusetts Institute of Technology" (MIT). It allows newcomers to computer programming to create software application for two operating systems: "Android", and "iOS", which, as of 8 July 2019, is in final beta testing. It is free and open-source software released under dual licensing: a Creative Commons Attribution Share Alike 3.0 Unported license, and an Apache License 2.0 for the source code.

2.3.2 Arduino Software IDE

The Arduino (IDE) is a cross-platform application for all types of Operating systems like MAC,Linux etc., use C and C++ languages. It is used to write and upload programs to Arduino compatible boards, but also, with the help of third-party cores, other vendor development boards.

Hardware Components For Small Prototype

The following the components which were used to build the small prototype of the proposed system:

- Car robot chassis (2/3 wheeler):
- Screws (small/ large & normal with nut):
- DC motors: A
- DCjack:.
- Battery snappers:
- Motor driver(L293D) circuit board:
- Arduino Uno:
- 9V batteries:
- Jumper Wires (male to female, female to female, etc.):
- Bluetooth HC-05:.
- Ultrasonic HC-SR04:

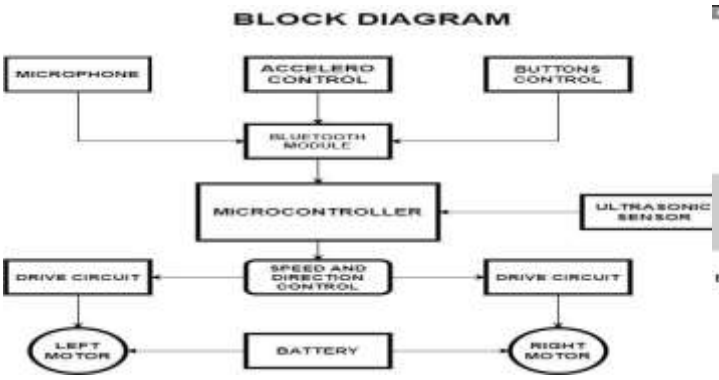

Fig 3.1: Block diagram for IOT based voice-controlled wheelchair

This block diagram explains the basic structure of the system and how the system works and the components of the system are connected to each other.

III. RESULTS

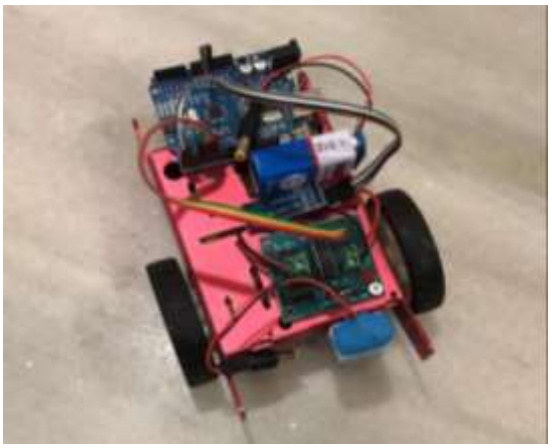

Fig 4.1 Prototype of proposed system

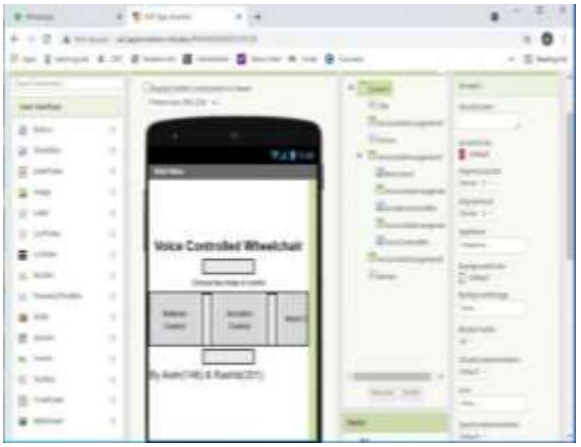

Fig 4.2 Structural Design of Mobile Application

Fig 4.3 Home Screen of Application

Fig 4.4 Button Control Panel

Fig 4.5 Voice Command Panel

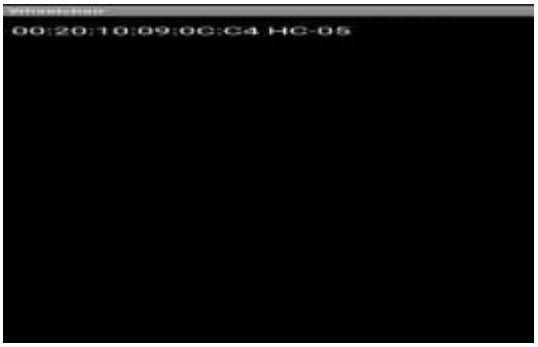

Fig 4.6 Device Bluetooth Connection

IV. CONCLUSION AND FUTURE WORK

Our proposed smart wheelchair provides a safe and reliable system with the presence of a line follower and obstacle detector. It provides an easily accessible and a variety of functionalities. The multiple command option allows users to use the system based on their comfort. The wheelchair system which includes ultrasonic sensors detects the obstacles in between the track along with an intelligence of taking proper care to avoid the accident. Thus, the disabled persons can be self-reliable, safe and independent with the help of this easily controllable wheelchair.

- Multiple Language Voice Commands
- Tracking the Wheelchair
- Wheel Alignment Based on the Floor Surface
- Biometric Authentication
- Using various sensors & Technology we can make more user friendly and safer wheelchairs.

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