Design of Wheel Chair for Physically Challenged People Using Arduino

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Abstract - **Mobility of the Physically Challenged people or crippled people is a great concern of the society. This work focuses on designing a mobility aid for the physically challenged people to travel from one place to another. The DC geared motors are used for the movement of the wheels for the purpose of lower speed movement of chair which will be convenient for the physically challenged. As the wheelchair has been named as electric / powered wheelchair, this paper utilizes the power from the lead acid batteries which are rechargeable, harmless, and weightless compared to others available. The wheelchair will be equipped with MEMS and buttons that allow the user to control its movements through simple gestures or movements. The use of MEMS will provide a more intuitive and accessible way of controlling the wheelchair, compared to traditional joystick-based systems. The proposed wheelchair system has the idea to run both in indoor and outdoor environments.**

Keywords: Electric wheelchair, Joystick controller, MEMS, Arduino, DC motors, Rechargeable batteries.

I. INTRODUCTION

Physically challenged people face many challenging problems in day to day life for moving from one place to another place and many times they might have to depend on others for mobility. So designing mobility assistance devices makes them independent and greatly improves their self confidence. To drive wheelchair in our environment is a challenge for people using their arm or hands. The wheelchair is developed to overcome such problems. The automated wheelchair is an easy transportation for the physically disabled persons. The work represents a hand gesture-controlled wheelchair using gesture control technique. Wheelchairs are used by the senior aging group and people facing some kind of disability and injuries. The main aspect is to make senior aging group and physically disabled person independent. The user can control the wheelchair using his/her hand gesture. In this wheelchair the automation is not isolated as the luxurious thing. It is to be beneficial for all common people. So, how to reduce the physical strength used by old age people & handicapped people to operate the wheelchair is paramount aim. As many such people has their own wheelchair but they can't afford automation in it. In current scenario the automatic wheelchairs are available in market, but it is costlier than the wheelchair that we have designed.

2. LITERATURE SURVEY

Many works have been reported earlier for optimum design of automated wheelchair. Joshi et al. [1] designed voice-controlled smart Wheelchair that comes with enhanced features, like electric powered, voice control, line follower with the obstacle avoidance etc. Swapna et al. [2] focused on designing a mobility aid for the physically challenged people to travel from one place to another. This work also concentrates on integration of GPS and GSM system for localization task and also a mobile application with the help of MIT application developer has been developed for the convenience of the care taker in order to know the position of the person in wheelchair through Google maps.

Pathan et al. [3] developed a real time operating wheelchair consisting of mode changing option between joystick control mode and head gesture control mode as per as the user's requirement.

The "Tongue Dive System" is a tongue operated Assistive Technology (AT) developed for people with severe disability to control their environment. Tongue Drive consists of an array of Hall Effect magnetic sensors mounted on a mouthpiece to measure the magnetic field generated by a small permanent magnet secured on the tongue. The tongue is considered an excellent appendage in severely disabled people for operating an Assistive device. Jain et al. [4] presented an efficient, low cost solution to all the issues encountered in previous AT's. Detailed analysis of various design processes has also been discussed. Nasif et al. [5] developed a hands-free wheel chair for physically disabled persons. The proposed device works based on the Head Gesture Recognition technique using Acceleration sensor. Pulleti et al. [6] proposed a wheelchair-manipulated gadget to help disabled human beings to turn out to be unbiased. The device uses a voice recognition unit which will take human voice as command and control the wheelchair movement based on the command.

Udaya et al. [7] developed a device where manual wheelchair operation is substituted by automatic wheelchair control, which is operated by eyeball movement, allowing patients to feel freer and with less or no trouble in their movements. To determine position of eye pupil, a continuous image is acquired with assistance of a camera, which will then be subjected to numerous image processing techniques. The Gesture Functions are incorporated as well, allowing the user to use gestures for basic specifications/commands, allowing this wheelchair to be used for a variety of applications.

Objective

The Hand Gesture Controlled Wheelchair is designed to provide a solution to the mobility challenges faced by individuals with disabilities. The traditional manual wheelchair requires significant upper body strength and mobility, making it difficult for some individuals to use.

This work aims to address this issue by allowing users to control their wheelchairs using hand gestures, which is a more intuitive and natural way of controlling the movement of the wheelchair. The system consists of MEMS and buttons to detect the user's hand gestures and translate them into commands to control the wheelchair's movement. The Arduino board is used to process the sensor data and drive the motors through an L293D motor driver. The LCD display is used to provide feedback to the user on the current status of the wheelchair and the battery level.

This project is designed to be affordable, portable, and easy to use, making it an ideal solution for individuals with mobility impairments. The Hand Gesture Controlled Wheelchair project has the potential to significantly improve the quality of life for individuals with disabilities, providing them with greater independence and mobility.

III.METHODOLOGY

The block diagram of the modules used for designing gesture controlled Wheel Chair is as shown below in fig. 1:
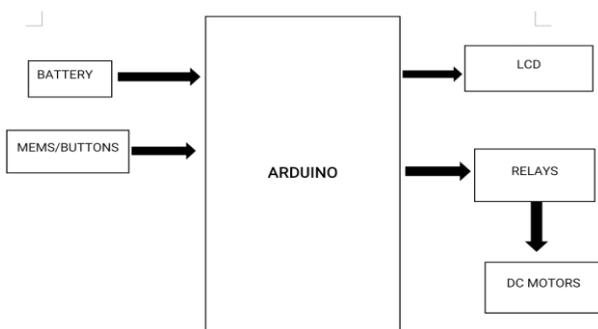

Figure 1: Block Diagram of Gesture controlled Wheel Chair

Some of the hardware and software tools used in this project are:

Hardware Required

- Arduino uno
- MEMS (MMA7660FC)
- L293D IC
- Battery
- DC Motors
- Lcd display

Software Required

- Arduino IDE
- Proteus

Working

In this work, a wheel chair using Arduino [4] was operated in two modes. They are:

1) MEMS mode
2) Button mode

After all connections made as per the interfacing diagram that were discussed earlier, the power should be supplied to the prototype. Next one of the two modes is to be selected so that the wheel chair can be operated. This mode can be selected through the mode selection board which is readily available in the kit.
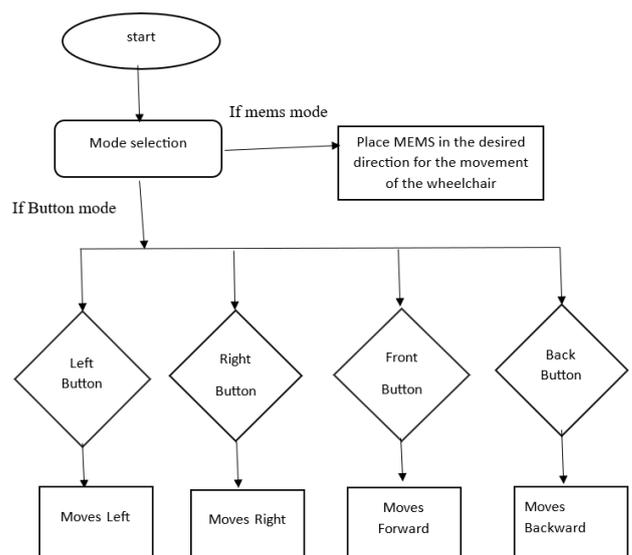

Figure 2: Flowchart for working of Wheel Chair

After selecting the mode of operation, if the MEMS mode is selected then the position of the MEMS is to be adjusted in such a way that it must be placed in the desired direction. If the desired direction is right then it is required to

tilt the position of MEMS towards right, similarly to the remaining directions.

If the selected mode is 'Buttons' mode, the wheel chair can be operated through buttons. An individual button for each direction of the wheel chair is provided. For four directions i.e. left, right, front, back; four keys are provided. If the desired direction is left then the left key should be pressed continuously. Similarly if the wheel chair is to be moved in front direction, then the front button is to be pressed continuously. In this way the wheel chair can be moved in desired direction either through buttons or through MEMS.
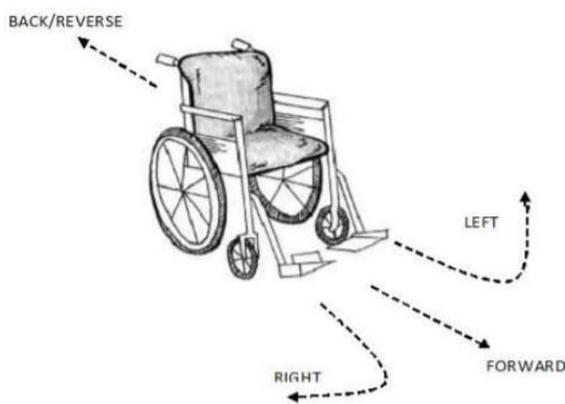

Figure 3: Wheel chair movement paths

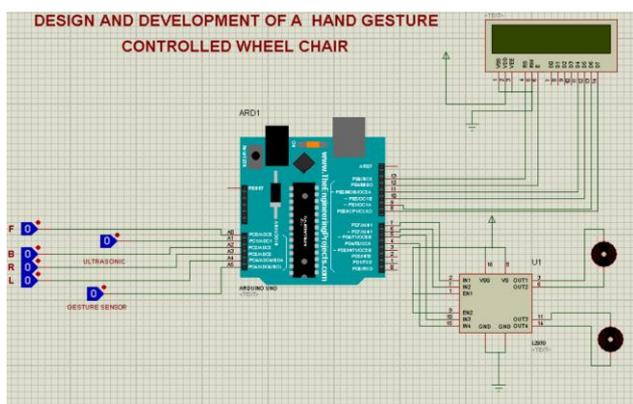The wheel chair movement paths are depicted in fig.3.

Figure 4: Interfacing Diagram

The above image fig 4 shows the interfacing diagram of Wheel chair design. Here various components of the wheel chair like LCD display, motor driver, DC motors, Gesture sensor, Buttons, etc., are connected to the Arduino Uno micro-controller.

IV. RESULTS AND DISCUSSION

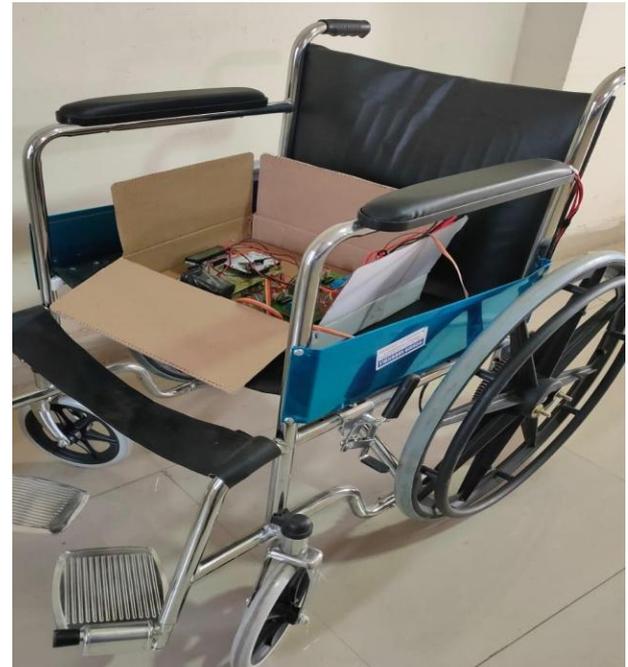The gesture based wheel chair for handicapped people prototype is shown in Fig. 5.

Figure 5: Wheel chair Prototype

The wheel chair was tested in two modes and it could successfully move in all directions in either mode.

V. CONCLUSION

The hand gesture-controlled wheelchair is a valuable tool for people with disabilities, allowing them to navigate through their environment more easily and with greater independence. The design and development of the wheelchair involved the use of several components, including the Arduino microcontroller, MEMS, Buttons, LCD display, motor driver, and motor. Testing was conducted to ensure that the wheelchair was able to detect obstacles, respond to hand gestures, and navigate smoothly. The prototype demonstrates the potential of using hand gestures as a control mechanism for assistive devices.

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