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"Design and Development of Smart Wheelchair"

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Abstract
Now a days society want the people to be independent, irrespective of their natural challenges, mentally or physically. This project describes the design of a smart, obstacle detection and voice-controlled wheelchair using embedded system. A voice-controlled wheelchair can provide simple access for physical disabled person who cannot control their movements especially hands. This design supports obstacle detection & voice activation system for physically disabled persons with manual operation. Arduino microcontroller and speaker dependent voice recognition processor have been used to support the navigation of the wheelchair. The direction and velocity of the chair are controlled by pre-determine voice commands. As per the direction specified in the commands, the Arduino will drive the motors. The speech recognition is carried out by voice recognition module, connected with Arduino. Arduino get the coded digital signals from voice-controlled module which being properly recognizes voice commands in order to control the function of the chair accordingly. The wheelchair does not react to a false speech command. Ultrasonic sensors are commonly used for distance measurement. These economical sensors fundamentally address majority of problems related to the obstacle detection and obstacle avoidance. The overall mechanical assembly is driven by two DC motors. This voice-controlled wheelchair helps them to drive the wheelchair without anyone's help. The system has been designed and implemented in an economical way so that if our project is commercialized the needy users in developing countries will benefit from it.

Keywords: *Voice Recognition, Obstacle detection, physically disabled.*

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I. INTRODUCTION

Peoples who need to move around with the help of some artificial means due to an illness or an accident. Recently, the aged person and the physically disabled person who use a wheelchair are increasing. Hand operated and joystick operated wheelchairs are available in a market.

We are trying to construct a voice controlled with obstacle detector wheelchair; the system will recognize and follows voice instruction such as "Start, stop etc." and also detect nearest object. Therefore, The Smart Wheelchair is develop to overcome the problems faced by such people and let them to operate the wheelchair.

The wheelchair will be operated using the voice commands through the given input. The Arduino will take care about all the directions the user wants. The voice recognition will be done by voice recognition module.

The output from this module is then received by the Arduino. Programs already written in Arduino help the Arduino to convert this voice command into quite an output and the wheelchair will move accordingly.

Problem Statement

- Physically disabled people face Problem in moving with a manual wheelchair.
- A lot of energy wasted by the patient in operating manual wheelchair
- Help blind disabled people to move easily from one place to another.

Objectives

- To Provide the facilities for disabled people and elderly people who cannot move properly.
- To reduce a burden of the people who push the wheelchair.
- To develop a wheelchair which can detect object and controlled by voice

II. Methodology

Design of Wheelchair: -

In our attempt to design a smart wheelchair we have adopted a careful approach; the overall design work has been divided as follows: -

- System design
- Mechanical design
- Electronic design

System design is mainly concerned with the positioning of various physical constraints and ergonomics, space requirements, arrangement of various components on the main frame of the wheelchair such as sensors, batteries, motors, etc.

In Mechanical design the components are divided in two parts: -

- Parts design
- Parts to be purchased.

In Parts designing we are design the frame of the wheelchair.

Methodology can properly refer to the theoretical analysis of the methods suitable to a field of study or to the body of methods and principles particular to a branch of knowledge. There are many methods use in this project such as internet references, interviewing lecturers and technicians and the most important is group discussion.

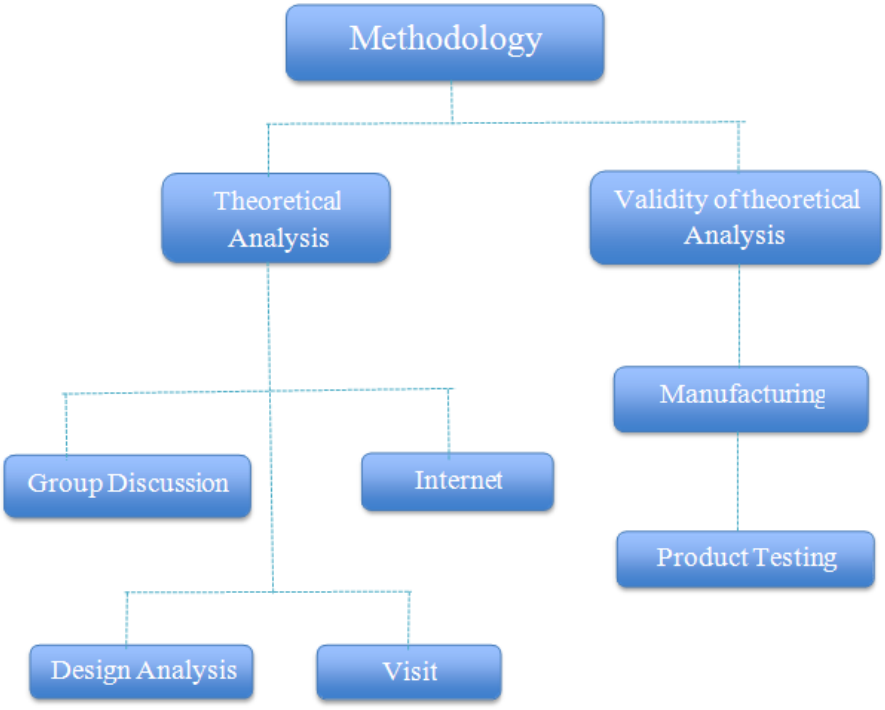

Figure. Flowchart of methodology

III. Methodology of working process

Complete the research or study of smart wheelchair.

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Search or collect information of part like sensor, motor, battery etc.

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Finalize the basic plan or model of wheelchair.

↓

Buy the required parts.

↓

Manufacture actual smart wheelchair.

↓

Testing of wheelchair.

Figure. Flow Chart for Working Process

Parts included in Smart Wheelchair: -

1. Ultrasonic Sensor
2. Lead Acid Battery
3. Arduino Uno R3
4. Motor Driver
5. DC Motor
6. Voice Recognition Module
7. Bluetooth Module
8. Microphone
9. Wheels
10. Power Supply

1. Ultrasonic Sensor

Sensors are used to detect the barrier from specific distance and alert the user about it. They are highly effective and efficient. An ultrasonic sensor is an electronic device that compute the distance of a target object by ejecting ultrasonic waves and converts the reflecting sound into an electrical signal.

2. Motor Driver

Motor drive, or simply known as drive, describes equipment used to control the speed of machinery. It is an interface between the DC motor and the microcontroller Atmega328. The commands are processed further to Atmega 328 towards driver and accomplish by DC motor to rotate the wheels in particular direction or to stop.

3. Lead Acid Battery

The lead–acid battery was invented in 1859 by French physicist Gaston Planet and is the oldest type of rechargeable battery. Lead acid batteries are very common in our day-to-day life. It is most commonly used battery in electronics. It has many advantages like low cost, frequently available and is also explosion free thus is the most frequently used battery**.**

4. Arduino Uno R3

The Arduino Uno R3 is a microcontroller board based on a removable, dual- inline-package (DIP) ATmega328 AVR micro-controller. The Arduino Uno R3 acts as an intermediary agent between the voice recognition module and the motors to drive the wheelchair. It is a microcontroller board based on the ATmega328P. It has 14 digital

input/output pins, 6 analog inputs, a 16 MHz
quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It holds everything needed to support the microcontroller. It collects the input given to the voice recognition module and converts into the format accepted by the motors and thus the motors work according to the command given. The Arduino needs to be allied to the motors as well as the voice control module.

5. Voice Recognition Module

The voice recognition module i.e., v3.1 is used to recognize the voice commands given by the user and it can be instructed by the user. It's a 48-pin single chip CMOS voice recognition LSI circuit with on-chip analog front end. In this system, the voice recognition module is instructed, and it takes the input from mic available in the system. The wheelchair uses the voice recognition module interfaced with the Arduino Uno R3 to convert the voice commands into motor understandable instructions to move the wheelchair as commanded by the user.

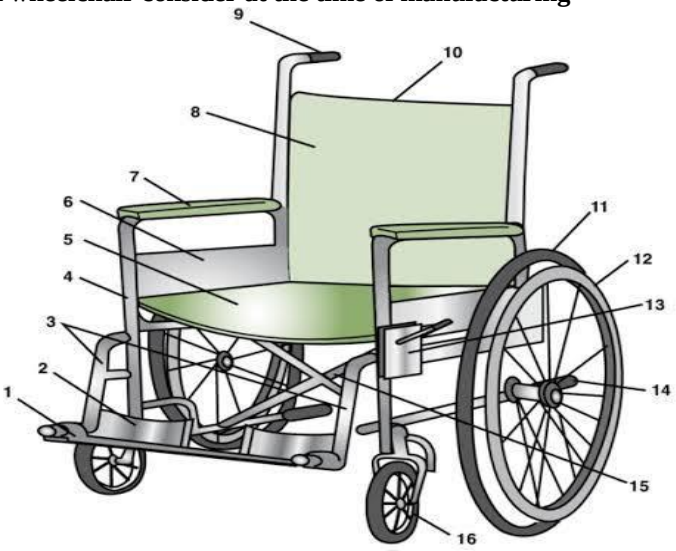
6. Microphone

Microphone is a device – a transducer - that convert sound into an electrical signal. A standard microphone is the key when utilizing automatic speech recognition (ASR). The mike should have the ability to not pick up the ambient noise that may give the ASR programs hard time. The mike used in our work is shown in fig. This mike is plugged in directly to the speech board. This voice- controlled wheelchair uses unilateral mic. The individual mic is capable of ignoring noises apart from the actual voice commands. The mic collects the voice commands
by user and send it to the voice recognition module.

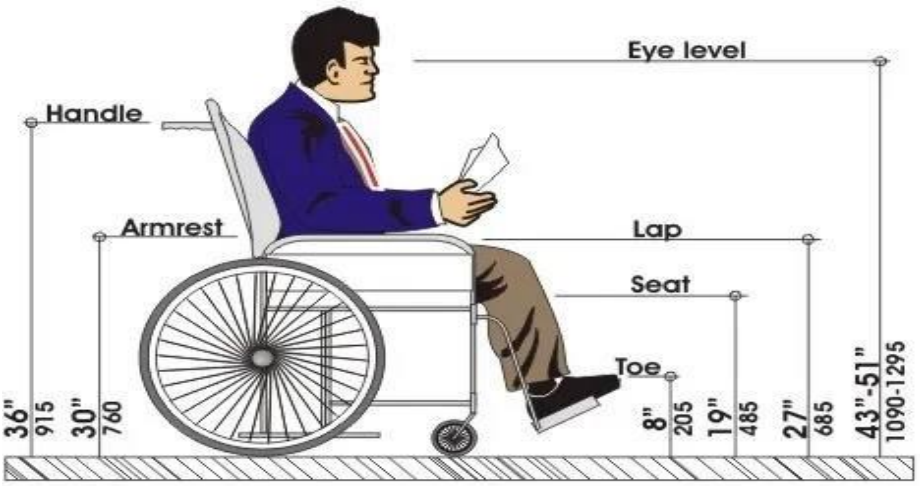
IV. Estimated Cost

Sr. No.	Part Name	Cost Range
1	Ultrasonic sensor	100-300
2	Lead Acid Battery	500-1000
3	Arduino Uno R3	1000-3000
4	Motor Driver	100-400
5	DC Motor	50-1000
6	Voice Recognition Module	2000-3000
7	Bluetooth Module	200-500
8	Microphone	100-1000
9	Wheel	1000-2000
10	Power Supply	500-2000

Parts of wheelchair consider at the time of manufacturing



Wheelchair Dimensions



Future Scope

- To adjust the resting position when needed.
- To convert the wheelchair from sitting position to sleeping position in particular angle.
- A map and GPS system can be added to Arduino and by naming the places, wheelchair can go automatically to required place without commands of direction.

V. Conclusion

The moto of our project was to design a voice controlled and obstacle detector wheelchair for disabled people normally depends on others in their daily life especially in moving from one place to another. So, we can conclude that physically disabled and elderly people can move without any trouble when use our smart wheelchair. They no need to be depend to other's help anymore to move from one to another place. They are also no need to have any extra skills to operate this smart wheelchair because it can be operated just by voice instructions. This Wheelchair also lower the energy by people to operate the chair.

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