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An Automated Smart Wheelchair with Multiple Control Strategies

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ABSTRACT:
Recently physically handicapped persons and old persons using transportability assistive devices such as wheelchair are increasing.Many handicapped people especially with motor disabilities are unable to operate a power wheelchair firmly without causing harm to others.This paper presents about modelling and development of Automated smart wheelchair with different control techniques.A prototype model of smart wheelchair system has been developed based on traditional wheelchair available in market.This incorporates Electronic system configuration,A Sensor system for obstacle detection, A Mechanical model, A Voice recognition system and a Joystick control. Experiments have been conducted on the developed automated smart wheelchair for testing its proper functionality.

KEY WORDS: Smart Wheelchair,Motor Disability,Obstacle detection,Voice recognition system

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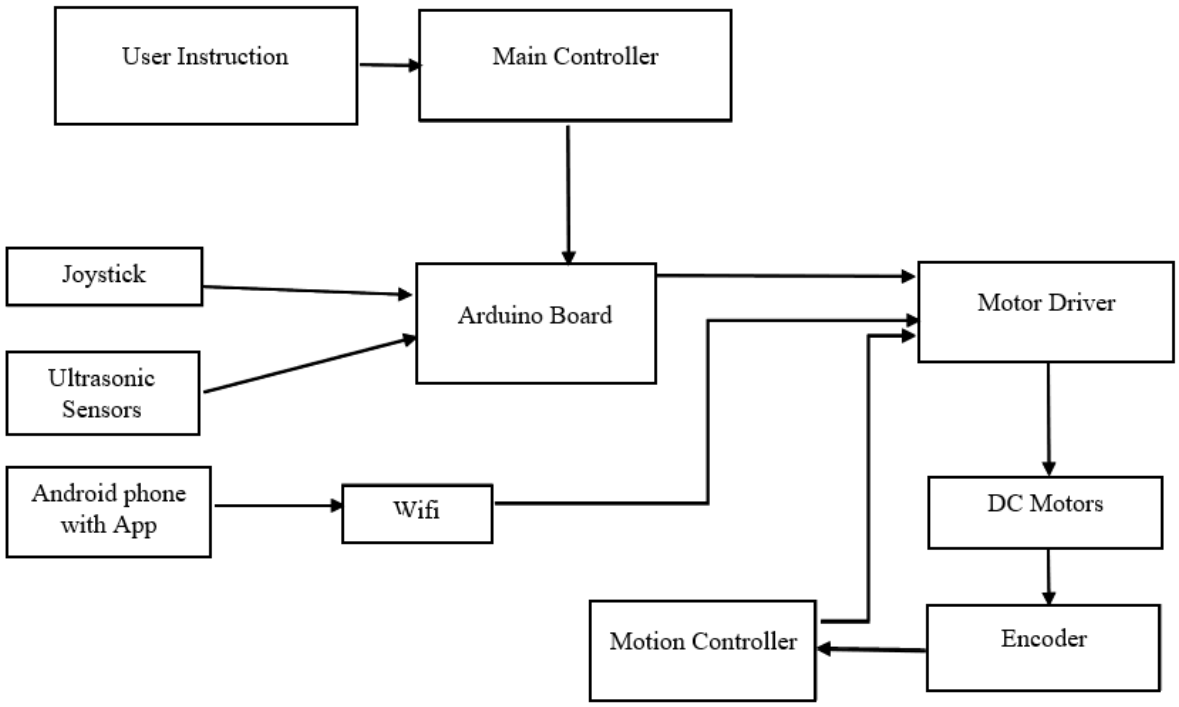
I. INTRODUCTION

People with motor disabilities are unable to perform regular tasks. The physically handicapped people need assistance from chaperone for their daily activities. For such kind of people if there is an access to a means of independent mobility it can increase the productivity in various fields, for example vocational and educational field.Many technologies and several applications are available in the market which help handicapped people to perform their tasks. Powered wheelchairs can be designed using intelligent system and robotics. This project is mainly focused to develop a smart wheelchair that incorporates multiple control strategies such as voice control of wheelchair, Joystick control, Obstacle detection system etc.In order to easeinfirm people with safe riding an ultrasonic sensor is used to record the obstacles present on the way. Based on the movement of joystick the motors will drive wheelchair in any four directions and speed on each direction increases as far the one presses joystick controller. The presence of obstacle on the way is detected by ultrasonic sensor and the motion in all three directions except backward direction ceases, and system if on motion comes to rest. This automated system is based on simple electronic control and mechanical arrangement that is controlled by programmable interface controller.

II. PROPOSED SYSTEM

Till date certain prototype models of smart wheelchair have been developed. The proposed system consists a Voice Command interfacing system. This makes the system fully independent as the user do not require any other persons help for their movement.

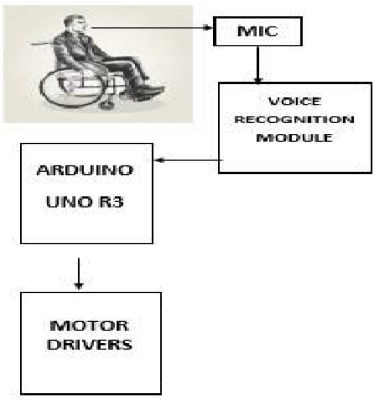


Proposed System Block Diagram

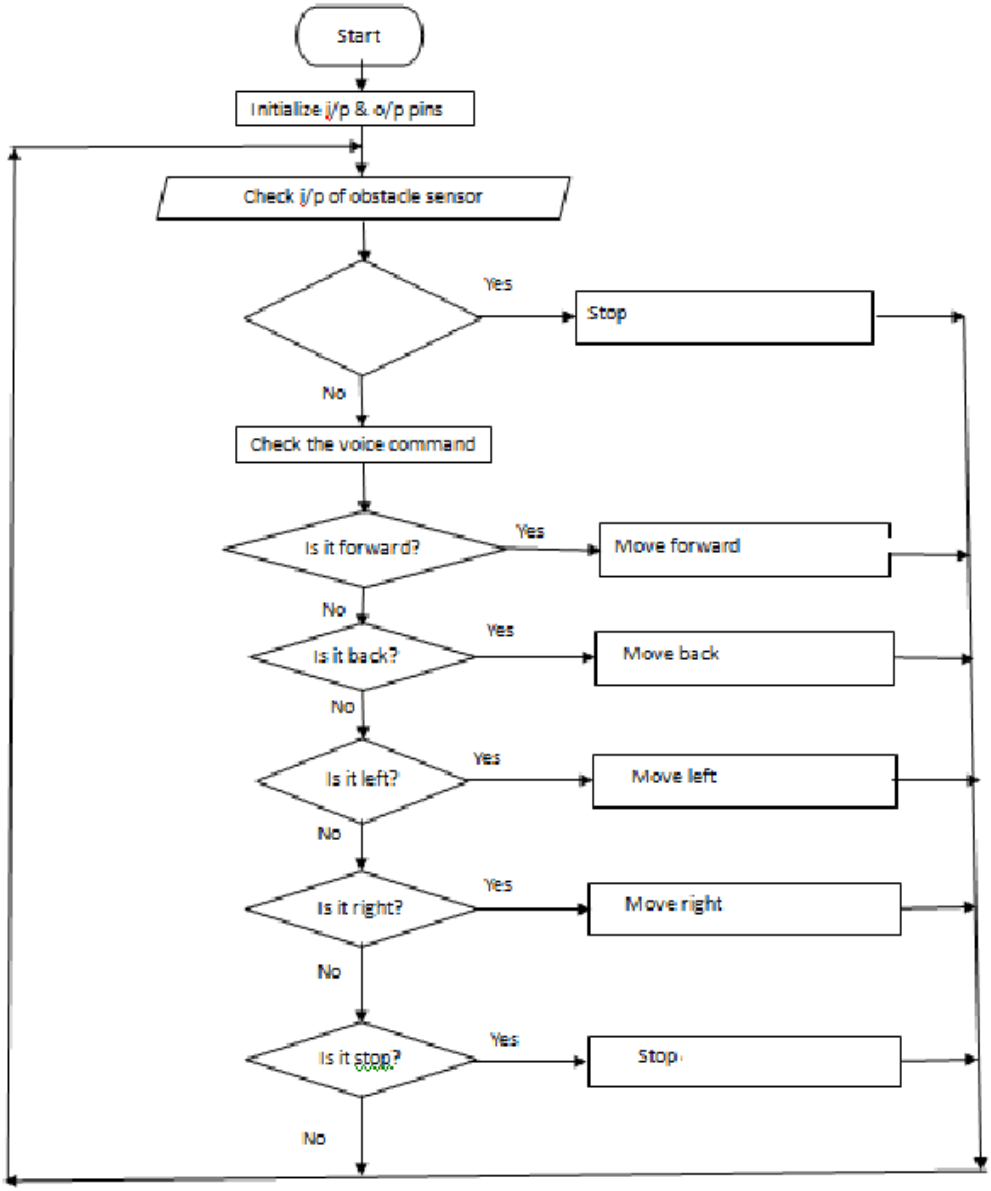
III. WORKING

There are basically five commands, that can be given by the user, accordingly the wheelchair will move. In the first step the voice commands of the user is recognized. Once it is recognized, the commands are converted into its equivalent instructions which drive the system. Voice recognition module and motor driving module are the major modules in the system. The voice recognition is done through voice recognition module. The output of this module is directed to Arduino which uses a motor driver IC to drive the motors.

The voice-controlled wheelchair works using unilateral mic, voice recognition module, Arduino and motors. The input to the system is the unilateral mic. It's capable to take user's voice commands and not bother about other noises. The output is in the form of voice signals and is transferred to the voice recognition module which acts as an interface between mic and Arduino. The Arduino then receive the output from voice recognition module thus converting it into binary code. Thus, the generated voice command is converted into machine understandable form and directed to Arduino. It is connected with motors to drive the wheelchair anywhere. Motors are responsible for the movement of wheelchair. Hence, motors receives input from the Arduino and depending upon the instruction type, motors moves accordingly. This system uses two motors connected with motor driver. There are five different instructions that can be given to the motors, they are forward, backward, left, right and stop. The movement of wheelchair depends only upon these five commands.The wheelchair responds to the voice command from its user to perform any movement's functions. The basic movement functions include forward direction, left and right turns and stop. In order to recognize the spoken words, the voice recognition processor must be trained with the word spoken out by the user who is going to operate the wheelchair.


MIC
VOICE RECOGNITION MODULE
ARDUINO UNO R3
MOTOR DRIVERS

Flowchart


Start
Initialize i/p & o/p pins
Check i/p of obstacle sensor
Yes
Stop
No
Check the voice command
Is it forward?
Yes
Move forward
No
Is it back?
Yes
Move back
No
Is it left?
Yes
Move left
No
Is it right?
Yes
Move right
No
Is it stop?
Yes
Stop
No

The proposed system consists a Joystick control.The user can implement the command through joystick and then the command is sent to the Arduino. It will execute the command. After executing, the controller sends the command in the form of digital signal to the motor driving ICand the motor driving IC control the movement of the dc motors. Thus, the dc motor rotates according to the command of the joystick.

Joystick Control Unit

Generally smart wheelchairs have used wide range of sensors such as IR sensors,sonars,bumbersetc to find the hurdles in its path.This paper focuses on modelling a wheelchairs that provides collision free movement at minimum cost with reduced modifications in currently available wheelchairs. Obstacle Detection system is an added advantage of this proposed model. Four Ultrasonic Sensors are the important component of obstacle detection system. Sensors where placed to cover maximum possible area around. These sensors where placed on four sides. The system works according to different input methods, which holds the wheelchair.In addition most of the inputs and outputs of the Arduino were used. The structure of the system allows continuous communication with all sensor monitoring the presence of obstacles, to send the informationreceived by sensors to the Arduino.If the sensor sensed an obstacle the microcontroller disables commands and directions thatlead to the obstacle and kept only enabled commands inwhich the sensors have not detected anything.

Motor Driver is an interface between the DC motor and the Arduino. The commands areprocessed furthertowards driver and executed by DC motor to rotate the wheels in specific direction orto stop.

IV. CONCLUSION

By incorporating Voice control, Obstacle detection system, Joystick Control we have designed a Smart wheelchair which help the physically handicapped people more independent.This wheelchair has some added advantages such as

- Easy to drive with negligible efforts.
- Less Complexity and Hardware to mount.
- Can be mounted on the existing wheelchair.
- Wireless control helps to monitor the wheelchair.
- Reduces manpower and dependency on other human drive.
- Wheelchair is compact and economical.
- Provides easy movement for physically challenged people.
- Low power consuming and easy to operate the wheelchair.

Future Scope Of The Project

This project can further improved by a gesture control for its movement also we can use Solar Panels and Super Capacitors as battery backup for its continuous functioning.

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