Wheel Chair with Smart Navigation System and Safety Features

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Abstract

In this Paper We provide a wheel chair that operates automatically with a minimal human interaction or based on voice commands and is also capable of communicating messages to the distant relatives or ambulance in case of Emergency. This system can be used by Physically challenged or the old age People both indoor and outdoor. The proposed system comprises of a wheelchair, Voice Recognition Module, Automatic navigation module (using RF sensors) and Emergency situation communicating module (using GSM and GPS).

It's common that the elders and the physically challenged people find it hard to move the wheel chair without anybody's support, By making use of the proposed system, elderly and the physically challenged can go to different rooms in the house like kitchen, living room, dining room etc by just speaking a word which is predefined to that particular room. According to the received voice, the destination is automatically understood and the wheelchair moves according to the route which is predefined or also operates with the turn by turn commands and capable of avoiding the obstacles. with the use of this system the physically challenged can live the life like normal people with their daily locomotion to go to office, to attend the social functions etc.

Key Words – ***wheel chair, voice recognisation system ,GSM, GPS, obstacle avoidance , IR Sensor***

1.INTRODUCTION

We see lot of people around us who are incapable of moving on their own, this category of people include the old age, physically challenged or disabled by any other medical conditions, these people always need some kind of assistance for their movement. the wheelchair for physically disabled people is proposed in this paper. A Dependent-user recognition voice system, infrared sensor systems and GPS-GSM assembly for emergency situations has been integrated in this wheelchair. In this way we have obtained a wheelchair which can be driven by using voice commands and with the possibility of avoiding obstacles and downstairs or hole detection.

II. Literature survey

The official estimates of disabled persons in India, obtained through the latest Population Census and National Sample Survey Organisation's comprehensive surveys on disability, put the figure as about 21 million (roughly around 2 percent of the population) at the beginning of the new millennium. However, estimates vary across sources and a new World Bank Report1 on disabled persons in India, has observed that „there is growing evidence that people with disabilities comprise between 5 and 8 per cent of the Indian population (around 55 – 90 million individuals). One common concern is these disabled persons are nowhere contributing in the development process of the country, Rather than this even they are not happy staying alone at home, Government has introduced certain policies to improve the disability of the people, but this alone is not going to help. Here is the clear idea on the dimension of disability in India

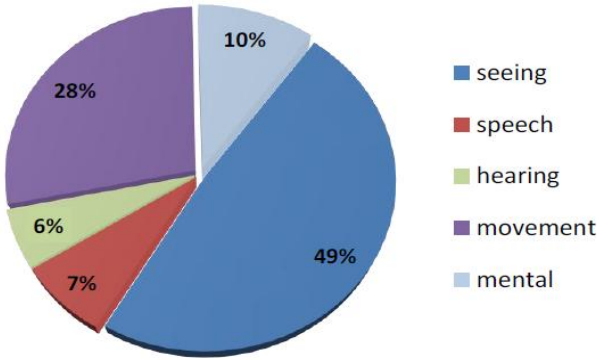

Fig 2.1. Percentage of distribution of disability

In this paper we propose an attempt to help these disabled people by bringing them into the society.

III. PROBLEM STATEMENT

The elderly and the physically challenged people find it tough for locomotion without the help of external aid. Studies have shown that until quite recently disabled people were socially isolated. Whether their condition was physical, emotional or mental, all met the same attitudes. They were kept off from social gatherings because they needed special attention or people to take care of them. These miserable conditions made us think of bringing out a system which include personal security features and can be used by these misfortunate people so that they can navigate easily and without external aids.

IV. MOTIVATION

There are millions of people around us who have physical disabilities, most have serious problems related to movement. We can change the way they are leading their lives with the use of technology that we have, The present high level of technology in the electronic and Robotic systems permits some of the mobility problems suffered by certain people to be resolved. Electronics solves the problems very acceptably for the users. This is because the electronics use dis-eminently suitable for coping with the needs presented.

IV. PROPOSED SYSTEM

To overcome the problems faced by the physically challenged and the old age people we introduce a smart navigation system explained below.

This system can take the person of interest to different rooms in the house like kitchen, living room, dining room etc by just speaking a word which is predefined to that particular room. According to the received voice, the destination is automatically understood and the wheelchair moves according to the route which is predefined or also operates with the turn by turn commands and capable of avoiding the obstacles. with the use of this system the physically challenged can live the life like normal people with their daily locomotion to go to office, to attend the social functions etc.

V. BLOCK DIAGRAM OF THE SYSTEM

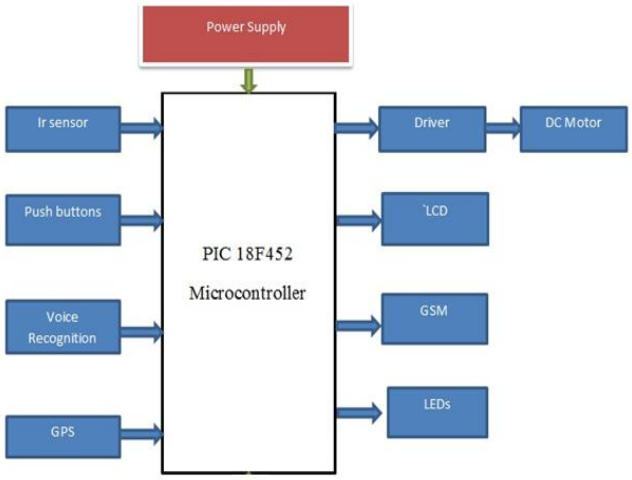

Fig 5.1. Block diagram

. 5.1 Hardware Requirements:

- IR SENSORS: Lane detection when it is in auto mode
- Voice recognition : Takes the input from users for the directions (Manual mode)
- PUSH BUTTONS: These are used to set destinations in the auto mode
- DRIVERS: Used to control the motor
- LCD: Easy and simple visual interface
- PPS and GSM: This is used to send the coordinates to the user through SMS
- LEDs: Indication, lower, mode, etc.

5.2 Software Requirements:

- mikroC compiler/IDE
- Proteus: Design software

VI. SYSTEM OPERATION DETAILS

The System supports two modes of operations, They are

1. Manual Mode of Operation
2. Automatic Mode of Operation

Schematic Diagram of the system

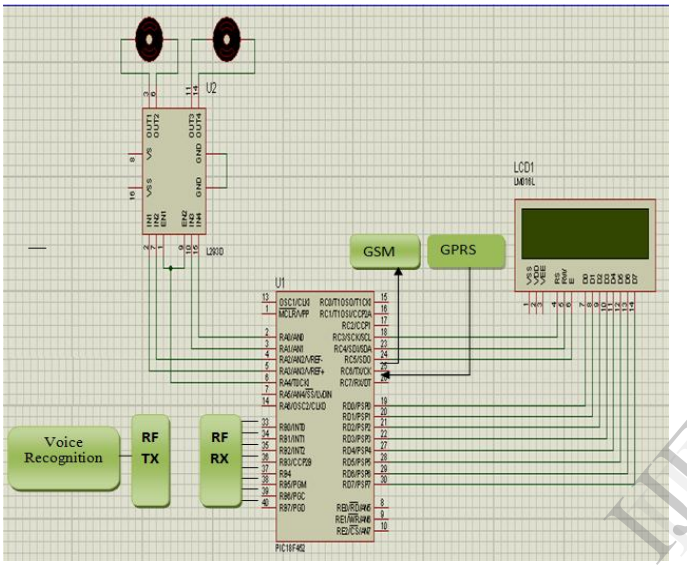

Fig 6.1. Schematic diagram

6.1 MANUAL MODE OF OPERATION

It is manual mode the pre-recorded data guides the action to be taken by the controller. The person of interest considered in this mode of Operation is the one who can at least speak, i.e He may be either a Old age person or a physically Handicap person.

6.1.1 HM2007

The voice of the disabled person is recognized by the Voice recognition device, the voice recognition device used here is HM2007. This device is can be trained to receive the voice commands of Particular user, this received voice commands are sent to the controller in the form of 8-bit data. In this mode the commands that the user can give to our system are e.g.

- Go Straight
- Take Right
- Take Left
- Take Reverse
- Halt
- Help

These commands are passed to the PIC microcontroller through the RF medium.

6.1.2 RF Module

The RF module, as the name suggests, operates at Radio Frequency. The corresponding frequency range varies between 30 kHz & 300 GHz. In this RF system, the digital data is represented as variations in the amplitude of carrier wave.

The given command is processed in the HM2007, This processed command is then transmitted to the PIC microcontroller through the RF medium as a 8 bit digital data.

6.1.3. PIC-18F452 Microcontroller

This is a powerful, yet easy-to-program CMOS FLASH-based 8-bit microcontroller which is available in a 40 pin package and is upwards compatible with the PIC16C5X, PIC12CXXX, PIC16CXX and PIC17CXX devices and thus providing a seamless migration path of software code to higher levels of hardware integration.
This Microcontroller receives the data from HM2007 voice module and processes with the help of the software program and gives the commands to DC motors to control the motors in turn the movement of the wheel chair system.

6.1.4. DC motors

A DC Motor in simple words is a device that converts direct current(electrical energy) into mechanical energy, We have provided two motors through which the wheel chair movement is

driven. These motors are driven with 12 volts provided by the drivers.

6.1.5. LCD Display

A 16×2 Character LCD is a very basic LCD module which is commonly used in electronics projects and products. It contains 2 rows that can display 16 characters. Each character is displayed using 5×8 or 5×10 dot matrix. It can be easily interfaced with a microcontroller.
We used this LCD Display to indicate the current state of wheel chair system, e.g. Forward, Reverse, Right, Left Movement etc. also it is used to indicate the mode of operation i.e. Auto mode or the Manual mode of operation.

6.1.6 GSM (SIM-900) and GPS modules

(Emergency)

These modules are used to in the system to help the user in case of emergency, Where in We communicate the emergency situation to the relatives of the user of the system or the Ambulance etc. This is achieved by sending the location parameters to as an SMS. Here When the user gives the command as Emergency, We immediately capture the GPS parameters such as Longitude and Latitude and send them as an SMS using SIM-900 to the above any pre mentioned contacts numbers, these numbers are pre-programmed into the software.

6.2 MANUAL MODE OF OPERATION

This mode of operation is developed for the individuals of interest to use the system indoors, specially into the house, Hospitals etc.
Here in this case a keyboard can be provided to the user, using which he can just press a key to go to the desired destination, the destination in this case can be a bedrooms, hall etc.

6.2.1. IR sensors

We have achieved the Manual mode of operation with the help of the two IR sensors, one IR sensor keeps checking whether the destination is reached or not And the second IR sensor is used in the Obstacle avoidance.

VII. RESULTS

The hardware setup of the proposed system is shown below, Figure 7.1 shows the Voice module that the user uses to give the voice commands'.

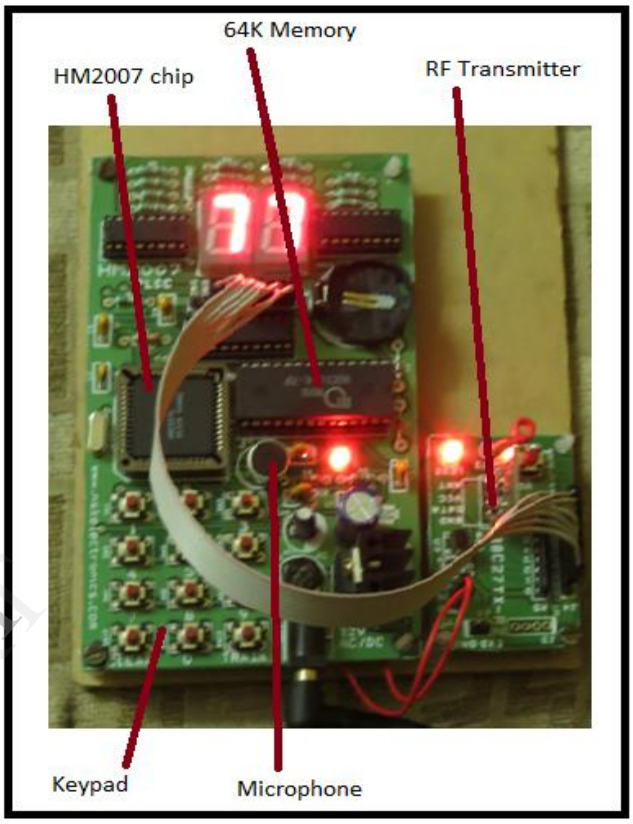

Fig 7.1. Voice Module

Figure 7.2. shows the prototype of the proposed system.

Real time testing is carried out with the prototype of the proposed system, We could train the voice module for a individual users voice commands. Recorded commands were spoken in voice mode say "Move straight", the voice module detected these commands and the 8-bit output from the voice module is transmitted to the wheel chair system from the RF transmitter.
RF Receiver received the 8-bit data, this data was processed in the PIC microcontroller and the appropriate action was taken, e.g. system could move based on the voice commands.
We also tested the system in the Automatic mode, where in the system could go to the preset destination, Obstacle avoidance was also tested.

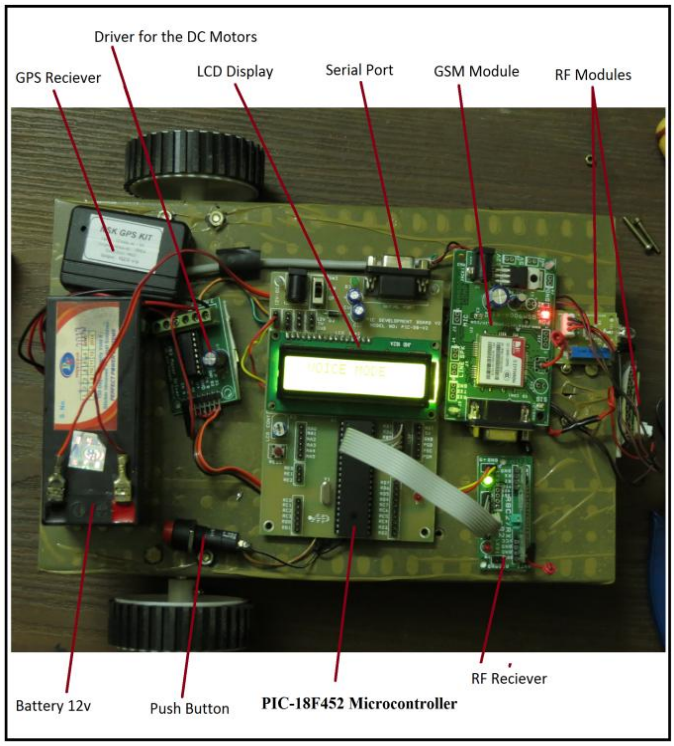

Fig 7.2. Prototype of system

VIII. CONCLUSION

We have developed a prototype of the "smart wheelchair navigation system" which is capable of operating indoors as well as outdoors. The system operates on a battery and driven by the voice recognition system in the manual mode and by IR assembly with the software in the Automatic mode. And the GPS and GSM help in communicating the emergency situation to the distant relatives, Ambulance etc. We are trying to developed a device which could make a handicap one independent and can provide extreme ease in his life. For a person no need to rely on other for his day to day work by using this project. There are several barriers that must be overcome before smart wheelchairs can become widely used. A significant technical issue is the cost versus accuracy. project involves the electronic circuits, the hardware designing & software knowledge. Automated wheelchair can be used to help handicapped people, especially those who are not able to move.

IX. FUTURE ENHANCEMENTS

The wheel chair navigation system can be enhanced to a Standing wheelchair, standing wheel chair is the one that supports the user in a nearly standing position. They can be used as both a wheelchair and a standing frame, allowing the user to sit or stand in the wheelchair as they wish. They can go from sitting to standing with a hydraulic pump or electric-powered assist. With this enhancement user can extend his access level, can get relief by changing the sitting positions which improves the quality of life.

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