

IOT based smart motorized wheelchair with health monitoring features

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ABSTRACT

we know that the needs of many people with disabilities can be overcome with power wheelchair, but some portion of this community is finding it difficult to operate power wheelchair. Though we have evolved in the field of health care and technology, but we are still not good enough to solve difficulties of this sector of population. This project is related to an android device controlled wheel chair along with an alternative use of manual joystick. The main objective of this project is to facilitate and increase the movement of people who are handicapped and the ones who are not able to move freely. Therefore, we are coming up with a design of wheelchair which will be an asset for medical department and to make it more advance in existing technology, we have equipped our prototype with android device for control along with sensory network which will eventually decrease chances of miss-happening and allows the victim to live a freer life.

Key Words: Smart Wheelchair, Android Device, Remote Access, Physically Disabled, Sensory Network, Arduino, Wireless sensory network, IOT

I.INTRODUCTION

In a very simple language, a wheelchair is a machine with wheels enabling easy movement, which empower a physically disabled person to move around with less dependency on others. People have disabilities with their hands, feet, lower extremities which puts a limit to perform regular task in their daily life. Still these wheelchairs have not satisfied the needs of the disabled people. It is therefore crucial that problems are understood in detailed and accordingly sensors should be equipped, hence this paper is a result of the needs and includes development of a multifunctional chair.

II. OBJECTIVE

The main agenda of this project is to enable a disabled person to move with less difficulty. Due to exponential growth of technology with time, it is the need of the hour to provide easily operated machines. The various modes of control will allow moving the chair with less human intervention.

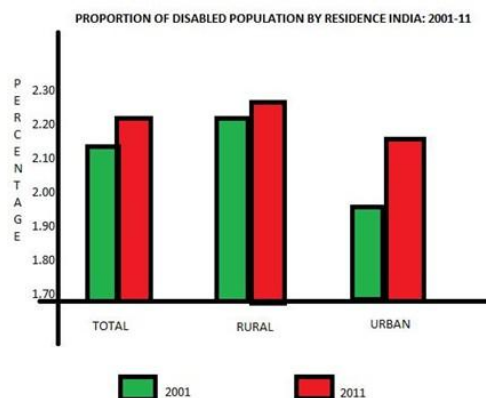
III. METHODOLOGY

The prototype of the wheelchair mainly consists of two parts mainly: hardware and soft ware. The hardware architecture consists of an embedded system that is based on Arduino Uno board, Bluetooth module, motors, motor drivers, a manual joystick and an android device .This Bluetooth module provides the communication media between user and system through the android device by means of voice commands. The user gives desired command to the Bluetooth module. Through a software application installed in the device the Bluetooth is connected to the Bluetooth module. Once the Bluetooth module receives message, the command sent will be received and executed by the microcontroller. Depending upon the commands fed to the motor drivers, the motors will function according to it. Meanwhile, the ultrasonic sensors works while the circuit is on and makes sure that the path has no obstacles. If any obstacle occurs it notifies the Arduino and stops the wheelchair till further command is given by the user. The health monitoring sensors gives the time to time health data of the patient. The health monitoring sensors includes temperature sensors, pulse rate sensors, blood pressure sensors which are present in contact with the patient's body. The health data of the patient is recorded, monitored and also displayed on the LCD. The data is transmitted from the patient to others through an IOT application. For example, if the patient's body temperature is less than or greater than the normal range of temperature then immediately an alert message is sent to their respective caretaker and consultant doctor.

IV.LITERATURE SURVEY

Above explained detailed functionality speaks about our methods of preventing accidents, methods by which we can control the movement of chair and working of Health Monitoring System. Till now from our detailed survey and deep knowledge of problems our only motive is to prevent them from existing. If any way sum threat is detected, the functionality should be smart enough to stop the motion further and respond accordingly.

The 2011 census report states that there is an increase in country's disabled population by 22.4% between 2001 and 2011. In 2001 count of disabled was 2.19 crore in 2001, which has gone up to 2.68 crore in 2011 out of which 1.5 crore are males and 1.18 crore are females. Most of the disabled are those with physical disability, accounting for 20.3% for total disabled population. [2]



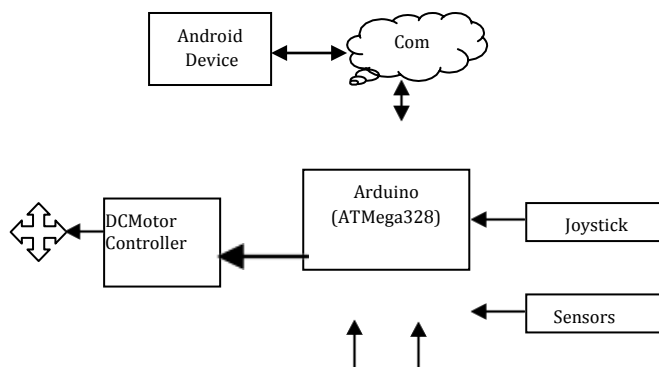
Graph -1: Proportion of Disabled population

The graph which is labeled as “Proportion of Disabled population in India (2001-2011)” shows population of disabled people in India has dramatically increased both in rural as well as in urban area also, over the span of ten years. Hence, we have made an attempt to ease the living standard of these people.

V.SYSTEM ARCHITECTURE

The below figure gives you the detailed idea of various connections established between microcontroller and other sensors for proper functionality

Block diagram:



Hardware

ATMega328 Microcontroller:



Fig -1: ATmega328 Microcontroller

The Atmel 8-bit AVR RISC-based microcontroller combines 32 kB ISP flash memory with read-while-write capabilities, 1 kB EEPROM, 2 kB SRAM, 23 general purpose I/O lines and 32 general purpose working registers. The device operates between 1.8-5.5 volts. ATmega328 is commonly used in many projects and autonomous systems where a simple, low-powered, low-cost micro-controller is needed. Perhaps the most common implementation of this chip is on the popular Arduino development platform, namely the Arduino Uno and Arduino Nano models.

LCD Module:



Fig -2: LCD Module

A 16X2 LCD is connected with Arduino at 7,8,9,10,11 and 12pins to display the reading of various sensors

Joystick:



Fig-3: Joystick Module

A joystick is an input device consisting of a stick that pivots on a base and reports its angle or direction to the device it is controlling. We are using dual axis XY joystick biaxial button PS2 module. This module combines two potentiometers and a pushbutton switch into a solid mechanical package with an ergonomic thumb dome. This joystick is perfect for controlling motors, servos, etc. When using the 5V power supply, the default analogue output for X, Y is 2.5V. With the direction of the arrow, the voltage goes up to 5V and the opposite direction it goes down to 0V.

Sensors:



Fig -4: Ultrasonic Sensor

Sensors are the integral part of the system. Following sensors are also attached to the microcontroller:

Ultrasonic Sensors: This helps to detect whether there is any obstacle present or not. Sensor detects obstacle by sending continuous signal from transmitter and if there is obstacle then it will stop the wheelchair immediately.

Health Monitoring Sensors: Sensors like Pulse detecting sensors and temperature sensors are used for continuous evaluation of the patient's health and to notify about the same to its guardian through the mobile app.

Motor:



Fig -5: Motor Driver

Motors are arguably one of the most important parts of a mobile robotics platform. Overpowered motors cause inefficiency and waste the already limited supply of power from the on-board batteries, while undersized motors could be short on torque at critical times. The optimal rotation speed and the available speed range of the motor must also be taken into consideration. Too high of an output rpm from the motor shaft will cause the robot to operate at a fast, uncontrollable speed. Too low of an output and the robot will not be able to attain a suitable speed to meet the user's needs. Therefore, much consideration was put into the selection of the proper motor for the platform. DC motors are commonly used for small jobs and suited the purposes of the platform very well. We are using a 12V DC motor in our wheelchair with L293D motor driver.

Wheels:



Fig 6: Wheel

Wheelchair has four wheels, two rear wheels and two castor wheels, the two castor wheel are fixated in wheelchair base in front, all wheels have the same diameter. The drive wheels are in rear on either side of the base, allowing the chair to turn according to voice command, wheels engage directly to a gear train that transmit torque from motor to wheels by two grooves in each wheel and nut.

Wi-Fi module:



Fig 7: Wi fi Module

ESP8266 is an impressive, low cost Wi-Fi module suitable for adding Wi-Fi functionality to an existing microcontroller project via a UART serial connection. The module can even be reprogrammed to act as a standalone Wi-Fi connected device. It requires 3.3 V power. ESP8266 has features like 802.11 b/g/n protocol, Wi-Fi Direct (P2P), soft-AP and Integrated TCP/IP protocol stack.

GSM Module:



Fig 8: GSM Module

GSM/GPRS Modem-RS232 is built with Dual Band GSM/GPRS engine- SIM900A, works on frequencies 900/1800 MHz the Modem is coming with RS232 interface, which allows you connect PC as well as microcontroller with RS232 Chip (MAX232). The baud rate is configurable from 9600-115200 through AT command. The GSM/GPRS Modem is having internal TCP/IP stack to enable you to connect with internet via GPRS. It is suitable for SMS, Voice as well as DATA transfer application in M2M interface. The onboard Regulated Power supply allows you to connect wide range unregulated power supply. Using this modem, you can make audio

calls, SMS, Read SMS, attend the incoming calls and internet act through simple AT commands

B. Software

Arduino:

Arduino is a single-board microcontroller designed to make the process of using electronics in multidisciplinary projects more accessible. The hardware consists of a simple open-source hardware board designed around an 8-bit Atmel AVR microcontroller, though a new model has been designed around a 32-bit Atmel ARM. The software consists of a standard programming language compiler and a boot loader that executes on the microcontroller.

The Arduino board is made up of an Atmel AVR micro-processor, a crystal or oscillator (a crude clock that sends time pulses at a specified frequency to enable it to operate at the correct speed) and a 5V voltage regulator.

To program the Arduino, the Arduino IDE is used which is free software that enables programming in the language that the Arduino understands. In the case of the Arduino, the language is based on C/C++ and can even be extended through C++ libraries.

VI.ADVANTAGES

- The multiple modes of driving the chair minimize the effort of moving it around to a very low level.
- Number of IR sensors interfaced in the chair allows preventing the accidents from happening and providing reliable safety as well.
- This system is economical and compact.
- Health monitoring system will send the real time health information on the android application.

VII.FUTURE SCOPE

Further implementation of introducing a GPS system to locate wheelchair in emergency condition of patient and to send an alert message to near hospital and ambulance. A stair climbing wheels can also be installed in the existing prototype. These will increase the mobility level of chair to a very high standard, which will be highly efficient and less dependent on other sources to move. We can also install solar power panel for promoting the eco-friendly charging of this chair. A detachable metallic stair-case can be attached to climb slopes and small hurdles. We can also introduce some more health monitoring features. Hence, all these changes on a whole will prove to be a boon in medical field.

VIII.CONCLUSION

The desired completion of this project will enable a great ease in movement and socializing of disabled people with negligible human efforts. Also, it is easy to use and operate the movement in just one touch away. The module is compact and economical; the various sensors present in the prototype along with the accident

prevention system makes it very enhanced module, which is very reliable and helpful.

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