Intelligent ROBOTIC WHEELCHAIR

An Helping Hand for Disabled

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ABSTRACT

**Being disabled brings about a feeling of isolation from the outside world and a sense of dependability as we have to depend on others help for just moving from one place to other and many other basic needs. Wheelchair has solved this problem to an extent as it’s provides personal mobility for the aged and disabled. But it is very difficult for the disabled people to use the manual power of the wheelchair independently. As a solution to this problem, the approach is to develop a power wheelchair which can be controlled with a simple android device using IOT technology. In this approach the technology initially used to control robots i.e., to control a power wheelchair using an android device either by touch joysticks or by voice commands or by gesture.**

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Keywords— Wheel Chair, Disabled Persons, IOT Technology, Joystick, Gesture

# INTRODUCTION

The developed prototype has a mechanism that enables the user to transform from sit-to-stand (STS) posture and vice versa. With the help of the developed wheelchair, the user will also be able to adjust the posture of his upper body using an adjustable back support using two linear actuators. This configuration will allow the user to use the wheelchair as a mobility device as well as for rehabilitation purposes without the need of external support. The availability of STS and back adjustment mechanisms will allow the user to do regular exercising which will enhance blood circulation as sitting for long periods inflates lower limbs disability. The proposed configuration will help in enhancing the functional capabilities of end-users allowing for increased independence and ultimately quality of life.

Product design is the concept of systematic approach in understanding the user requirement, existing deficits, possible improvement and inventing new designs through idea generation, concept development, and concept realization thereby bringing newer products and solutions for the better quality of life. A chair with wheels designed as a replacement for walking is known as wheel chair. This is used for movement of physically disabled, elder people, children who have difficulty and are unable to walk. This device comes in many variations like self propelled, propelled by the motor or with the help of an attendee to push. Figure 1 & 2 shows the parts of rigid frame and X frame wheel chair and its parts. At present patients are facing problem while defecating. Patients needs to be lifted up and helped to remove the dress and make them defecate, which is discomforting to the patients in emergency condition. The design of back rest in the existing wheel chair creates repetitive stress injury if the patient is sitting for a long time. The present design of brake needs to be improved for better impact and application of brake in slope area. Arm rest creates obstruction while shifting the patient from wheel chair to vehicles, no solution in the existing design to make ease of shifting of patient to transportation vehicle.

**Problem Statement :**

Robotic technologies have the potential to improve the lifestyles of people suffering from one or more disabilities. Related developments are often grouped under the terms Rehabilitation Technologies or Assistive Technologies. They attempt to restore human abilities that have been reduced or lost by disease, accident, or old age. Mobility is one such function.

There are many reasons why a person may not be able to travel freely, including motor control problems, spinal injuries, and amputation. A wheelchair is a mechanical device that can often assist. It effectively uses wheels and mechanical support to overcome a loss of legs or leg control. Manual wheelchairs can be operated by persons who have the use of their upper body or someone available to assist. Powered wheelchairs have been developed for when either of these cases does not apply. However, these devices typically require a high level of user control and this is something precluded by many severe forms of disablement. In recent decades many groups have researched the possibilities of robotic wheelchairs. These endeavours are aimed at creating ‘intelligent’ devices that can sense information from their environment and respond in useful ways.

**II. LITERATURE SURVEY**

A healthy person discharge his duties efficiently without taking help of other person but unfortunately on the other hand, physically handicapped person either from birth or due to some misshaped in his life or at some stage of life is dependent on others to perform any kind of work. They need support of other person for performing their routine tasks such as for going hospital, malls for marketing etc. Considering these in mind, the present work is focused on the history of wheel chairs, market surveys, and physically challenged people requirements. On the basis of gathered information design the wheelchair which has low cost and approachable for poor and middle class population. It is suitable for such person who has no leg(s). The designed wheel chair is battery operated and can take turn in either direction (left/right) through handle, having bicycle type breaking arrangement and also moves on curbs, steep inclinations and normal roads with a speed of 6 km/hr or travels 32km in 5.32 hours at a stretch. For safety of the person there is a provision of safety belt in the wheel chair. [1]

The needs of many individuals with disabilities can be satisfied with traditional manual or powered wheelchairs, a segment of the disabled community finds it difficult or impossible to use wheelchairs. There is extensive research on computer-controlled chairs where sensors and intelligent control algorithms have been used to minimize the level of human intervention. This project describes a wheelchair for physically disabled people. Our goal is to design and develop a system that allows the user to robustly interact with the wheelchair at different levels of the control and sensing. A dependent-user recognition using Head movements and infrared sensor integrated with wheelchair. A wheelchair can be driven using acceleration sensor and Head Movements with the possibility of avoiding obstacles. Our project Automatic wheelchair basically works on the principle of acceleration, one acceleration sensor, provides two axis, acceleration sensors whose output varies according to acceleration applied to it, by applying simple formula we calculate the amount of tilt & output of tilt will decide to move in which direction. Sensor gives x-axis & y-axis o/p independently which is fed to ADC & then µC & depending on the pulse width it decides to move or not. On chair Obstacle sensors will be installed. Total 4 sensors will be installed for detection of wall/obstacle in the forward, backward, left & right direction. We are trying to build a controlled wheelchair; the system will understand and obeys natural language motion commands such as “Take a right.” Various technologies are used for developing such a system. [2]

Robotic wheelchairs extend the capabilities of traditional powered devices by introducing control and navigational intelligence. These devices can ease the lives of many disabled people, particularly those with severe impairments, by increasing their range of mobility. A robotic wheelchair has been under development at the University of Wollongong for some years. This thesis describes on going work towards the ultimate aim of an intelligent and useful device. [3]

Hand gesture wheelchair system is trending nowadays for disabled peoples. In this we designed a hand gesture wheelchair system for a disabled person using the raspberry pi. This is useful for disabled peoples who face difficulty in moving one place to another in daily life. Normally wheelchairs are driven by the help of other persons or by ourselves. Various type of wheelchairs is constructed like joystick control, eye control and head control systems. And in the proposed is required to operate the joystick for the movement of the chair. The redesign of manual wheel chair was considered for this project. The design of wheel chair started by means of literature review to know its evaluation from earlier to the present generation. Market study was carried out to know the present competitors available in the market with cost analysis of the existing product. Ethnography study was done to observe the need, the importance of the existing product and to address the design gap in the existing product to the user need through questionnaires. The feed back was taken from different users and attendees, concept generation and design execution was done by the implementation of design methodologies like Quality Function Deployment, Mind mapping, Product Design Specification. The final output is a wheel chair which gives multiple option to the user and attendee by providing ease of defecation, cleaning and changing of clothes. Adjustable back rest, arm rest, leg rest provides comfort for the patient while resting. The adjustable arm rest provide ease of shifting the patient from chair to the bed or to the vehicle. Facility provided for keeping plate while having food, reading and keeping water bottle. Additional to this alarm facility is provided to inform the attendee that there is a need of his / her presence to the patient. Validation of the prototype is done and usage is found satisfactory. [5]

The paper based on the work “Robotic wheelchair using android, touch-setup, speech and gesture control” is designed with the help of above surveys which was taken as a reference for building the project. The entire project is mainly processed with the help of Raspberry-Pi.

# III. METHODOLOGY

## **Block Diagram**

The below block diagram tells us about the connections of entire circuit diagram of wheel chair using raspberry-pi according to software implementation.

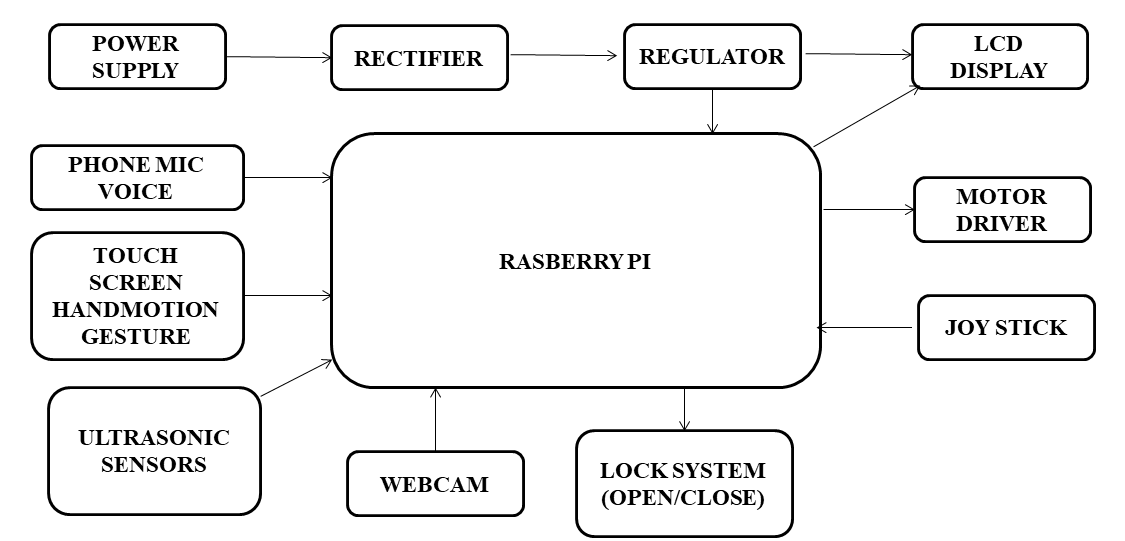


Fig 1: Block Diagram

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## **Methodology**

Raspberry-pi is mainly used for controlling the robotic wheel chair. A separate power supply cable is plugged in to one of the slot of USB charger connected to power supply and another c-type cable of phone adapter is used to connect the raspberry-pi. Initially the c-type cable is connected to power supply. Further 12v phone adapter cable is connected to the power supply and external power supply of 5v is used. ADC converter is used in the circuit as raspberry-pi does not have any internal converters . L293D driver is used to control the motors and power extension board is used to distribute the power to all the modules. plug in the two USB cables of camera and mick to the raspberry-pi. An ultrasonic distance sensor is used to detect the obstacle, a buzzer is interconnected to the sensor which will sounds when object is less than 40m. External ON/OFF Switch is used to control the whole application. after the application starts running the external switch is made off so that the face recognition program will run and further whole program will be executed. the operation of robotic wheel chair is functioned using commands obtained from joystick, Mems and USB microphone.

This signal is used to control the direction of the motors. The axis of movement and the corresponding commands that are given to the motors for driving the wheel-chair. In case of lifting the wheelchair, the directions forward and backward of the joystick will be as the command for sit and stand. A tolerance is taken into consideration in reading the values of the joystick, for some stability issues.

The joystick is selected to control the movement of the four motors; the two lifting and two driving motors. The joystick is considered to be an input to the system where it consists of two potentiometers, one controls the vertical direction and the other controls the horizontal direction by moving the stick. When the stick is moved vertically or horizontally the values of the potentiometers change respectively and give an analogue signal (0– 1,024) to the raspberry-pi.

**IV. SOFTWARE IMPLEMENTATION**

March 14 is known as Pi Day because the date represents the first three numbers in the mathematical constant π (3.14). We're celebrating with our coverage of everything Raspberry Pi related. If you've never even thought of what HTML means, you can still create amazing gadgets using Raspberry Pi and a bit of imagination.

What you'll need to get started with Raspberry Pi:

* The Pi: Raspberry Pi 4.
* For downloading the software: SanDisk Ultra 16GB micro-SD card.
* For adapting the micro-SD card to your computer: SanDisk Mobile Mate micro-SD card reader.
* The power supply: Cana-kit 5V Raspberry Pi Power supply.
* You'll need this to type: Verbatim Slim-line Keyboard.
* For pointing & clicking: Logitech B100.
* The monitor connector: Amazon Basics HDMI.
* For internet hardwire: Amazon Basics Ethernet cable.
* You'll also need a monitor or TV that accepts either HDMI or composite video input. HDMI works best, but composite video is workable. Many Raspberry Pi projects use an internet connection, so you'll also want a Wi-Fi dongle or Ethernet cable.

Download the Raspbian operating system on the Raspberry Pi :

1. Select Raspbian.
2. Click Install.
3. When the warning window pops up. Click yes to confirm. This is just letting you know that the micro-SD card will be overwritten with an uncompressed version of the Raspbian operating system.
4. Wait for the installation process to complete.

Once the installation process is finished, Raspbian will automatically begin to boot.

Configure your Raspberry Pi :

1. Click Menu in the upper left corner of the screen.
2. Select Preferences in the dropdown menu.
3. Select Raspberry Pi Configuration under Preferences
4. When the configuration window appears, click on the Localisation tab.
5. Click on Set Locale… to set your location.
6. Click on Set timezone… to set your local time.
7. Click on Set Keyboard… to set your keyboard language.
8. Reconfiguring your Raspberry Pi will require a reboot. When the reboot window appears, click Yes to continue.

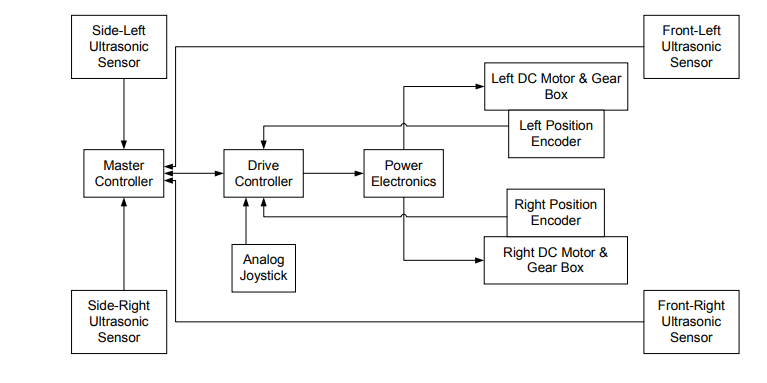
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Fig 2: Design Flow

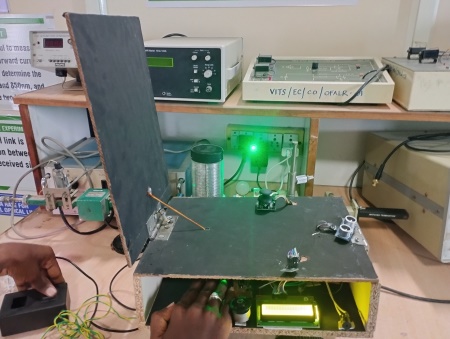
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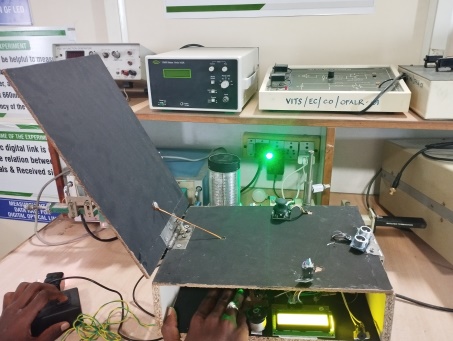
**V. RESULTS**

At the point when the whole circuit is ON hotspot management setup should be done to the raspberry-pi. The project should be connected to a particular mobile hotspot system with a username : “**project**” and password : “**project1234**”. The entire hotspot settings should be done for getting connected to the raspberry-pi.

At the point when the whole circuit is connected to the network as mentioned the raspberry-pi window is displayed by connecting it to the VNC Viewer.

The face detection is done and the working process starts as mentioned in the flow chart and program.





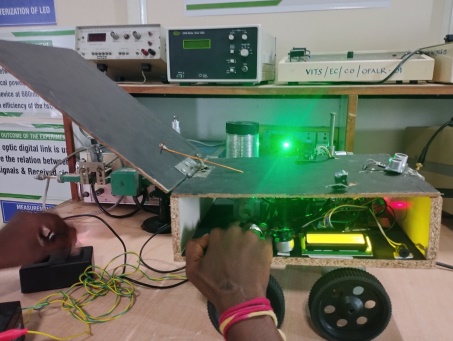


Fig 2: Inclination of wheel chair in .

**VI. CONCLUSION**

The knowledge gained for the product design education is used to analyze the existing wheel chair product by means of detailed Market research, product study, problem identification, concept generation, concept finalization, detailing, and mock up modeling of the finalized concept. Validation of the prototype is done and usage is found satisfactory.

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