

# Smart Wheelchair using Raspberry Pi

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**Abstract—** This advance system can be used by disabled people to move around conveniently. Patients with paralysis or leg disability face difficulty for reaching places. Some people try to use walker. In many cases patient lose the balance and fall and injuries occurs. In order to prevent from such circumstances our system can be used. This system is powered by raspberry Pi and it is equipped with a Bluetooth module, A GSM and GPS module, driver motor and wheel chair. The user can input command to command for operating this wheelchair movement. The transmitter and the receiver circuit interact with each other using RF communication in Bluetooth module.

*This system also has an emergency feature, the user needs to press the help button to for an emergency. This system automatically senses the GPS coordinate to the care taker. In case the if the patient is unable to press the button, then they can simply speak the help command into the mic for an emergency. After powering the system on, the phone number gets configured. Then patient can*

*move by using button commands. Patient can use forward and backward buttons to move in front or back direction and to stop on some certain place they can press stop button, and to turn left or right there are left right button.*

**Keywords—** Smart wheel chair, Injuries occur, raspberry pi equipped, emergency commands, audio or button commands.

## I. INTRODUCTION

A smart wheel chair is a wheel chair moves with the help of navigational controls and an electric motor instead of moving it using man power. The navigational controlled with the help of a small Android screen touch. Most of the physically disabled person uses traditional wheelchairs. they are operate by hands or by a second person if patients is unable to drive it. This is very difficult for that person if another person is not there for support. In that case there is always requirement of a second

person. Thus the patients have to be dependent on another person.

What will happen if wheelchair start moving with the audio and controller input like forward, backward, left and right? The disable person can move anywhere he wants

without the help of second person and independently. There will be no need to use hands for moving the wheelchair. We are trying to implement this concept through our project “Smart wheel chair using Raspberry Pi” The name itself indicates the meaning the wheelchair which is intelligent. The wheelchair takes command from users and accordingly to that it moves in required direction. The person who is unable to move chair by hands can move this wheelchair just by giving the command. This is the boon for paralyzed people. Hence the chair, the patient can go anywhere independently.

And main benefit of it is whenever any disable person wants help from their relative or the nearby persons. They can send them indication or notification to them telegram bot. Because this wheel chair also had GPS & bluetooth module they can also use this to send their location and message for help on their mobile. Due to this system they can communicate with any authorised person (either relatives any authorised or caretaker person) who’s info is registered in that raspberry memory. This project module also help disable person even critical conditions on roads. The smart wheelchair provides its location to authorised person constantly when they are ON and moving on path. So that admin can monitor what’s his condition in real time. this are few main benefits and ideas that are added to this project to make it helpful for disable people during critical condition in life This is economical and fully automated. Hence physically disabled people can use this wheelchair easily and live their life happily. In this paper, the design of a Smart wheelchair is presented.

## II. PROBLEM ARISES

Most of the disable people uses traditional wheel chair. where the disable person need help of other person and its depend on another for their

movement. The second one problem is its operated by hands if person is unable to drive. Sometimes for long distance pushing chair by hands its difficult. At present wheel chair will operate manually or by using accelerometer sensor. But the main disadvantage of accelerometer sensor is it produce an analog signal. In order to overcome that we want an effective algorithm that produces reliable result based on android app.

## III. SYSTEM ARCHITECTURE

The proposed system for the measurement contains three units: 1) Hardware unit, 2) Software unit and 3) User interface. The block diagram of the system is shown in Fig.1.

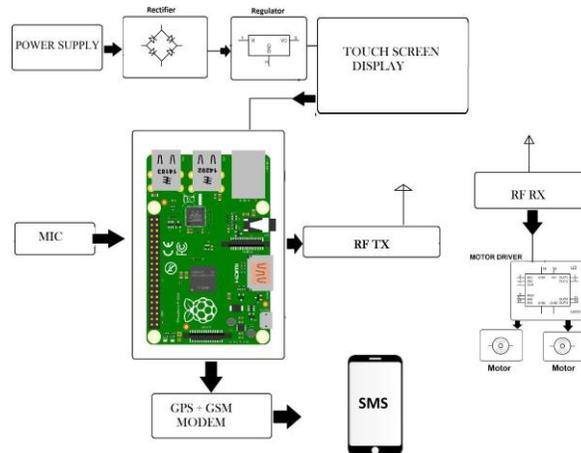


Fig. 1. Block diagram

1) Hardware unit: Detectors of electronic devices are advanced tools for **counter surveillance**. By using detectors you can detect wheelchair distance from obstacles. They can be used for inspection of path on which wheelchair is moved, distance covered, and emergency conditions identification so that they can warn host as well as neighbouring people. They help with searching of surveillance equipment such as: listening

devices, mobile phones, chip cards and cameras. The range of particular detectors varies, according to the needs of wheelchair size is differs.

- 2) Measurement unit- It consist of raspberry pi and microcontroller or respective device that can compute the commands from android phone. It can interfaced such that it can operate with Bluetooth module and driver circuit as well.
- 3) User Interface- Mobile interface shows direction information where wheelchair wants to move . It displays on LCD screen and if the emergency occure by pressing button or voice commands it gives, the local alert on telegram bot send the GPS location of wheelchair to the authorized person about situation and aware them
- 4) The alignment of the system is shown in fig 2.

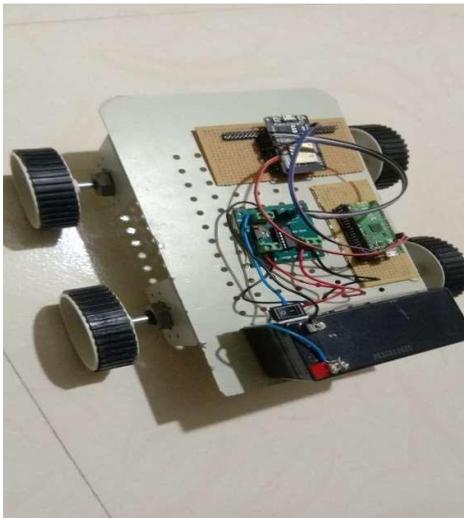


Fig2 Circuit architecture

The important component of the system are as follows:

- Rasberry Pi Pico
- L293D Motor Driver
- ESP32
- PCB

- Rechargable bttery
- Dummy wheel
- Chassis
- DC Geared Motor
- Tyres
- Male Headers
- Feamble heraders
- Jumper wires
- USB cable

5) *Motor Driver controller circuit* : Motor driver circuit MD10C is used to run motors. MD10C is PWM enable motor driver controller. The PWM output pins of microcontroller are connected to motor driver circuit. Motor driver controller has one PWM pin and one direction (DIR) pin. Speed of motor is controlled by PWM and direction pin is used to run the motor in clockwise or anticlockwise direction. Permanent Magnet DC motors are connected to motor drive circuit. In Table 3, motor driver control action has been discussed

D0	D1	D3	D4	Direction
1	1	1	1	Forward
0	0	1	1	Back
0	0	0	0	Stop
1	0	1	0	Left
0	1	1	0	Right

Table 3. Motor Driver Control Action

5) *Circuit Details and System Specifications*: The smart wheel chair control unit consists of integration of Raspberry pi microcontroller with Bluetooth module, GSM module SIM900, ultrasonic and infrared sensors, temperature sensor LM35 and motor driving circuit for controlling motor’s speed. are combine by presenting the circuit diagram of smart

wheelchair

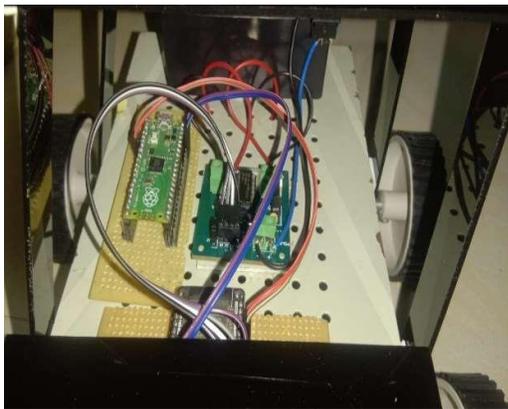


Fig. 3 Circuit alignment

3) *Raspberry pi*: The **Raspberry Pi** is a tiny computer about the size of a deck of cards. It uses what's called a **system on a chip**, which integrates the CPU and GPU in a single integrated circuit, with the RAM, USB ports, and other components soldered onto the board for an all-in-one package.

The interfacing of raspberry pi with LCD is shown in Fig. 4.

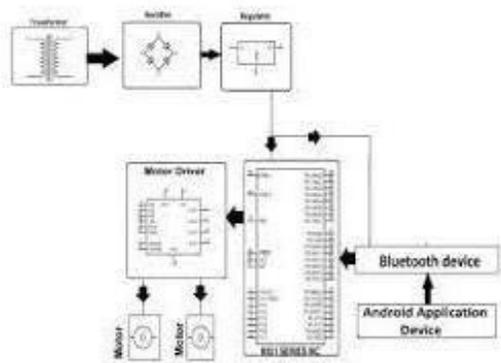


fig.4 . Raspberry PI and LCD interfacing

Also the buzzer is attached as an output device for generating local alert. The estimation of vibration and speed values from the output of TIA is done by the raspberry. Therefore, it is important to understand the logic of variation in the signal, according to which the code can be developed for the wheel chair . This logic is explained in the measurement principle.

#### IV. PRINCIPLE OF MEASUREMENT

##### A. Specification measurement:

The system Specifications has been described in Table

4. which gives approximation measurement of wheelchair during working. Its calculation is taken under with host sitting on chair. Table 4. Specifications of Smart Wheelchair

Fig. 4. Transimpedance amplifier

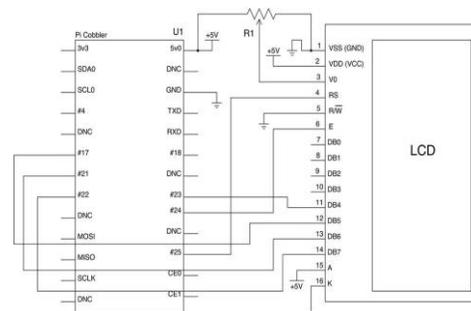
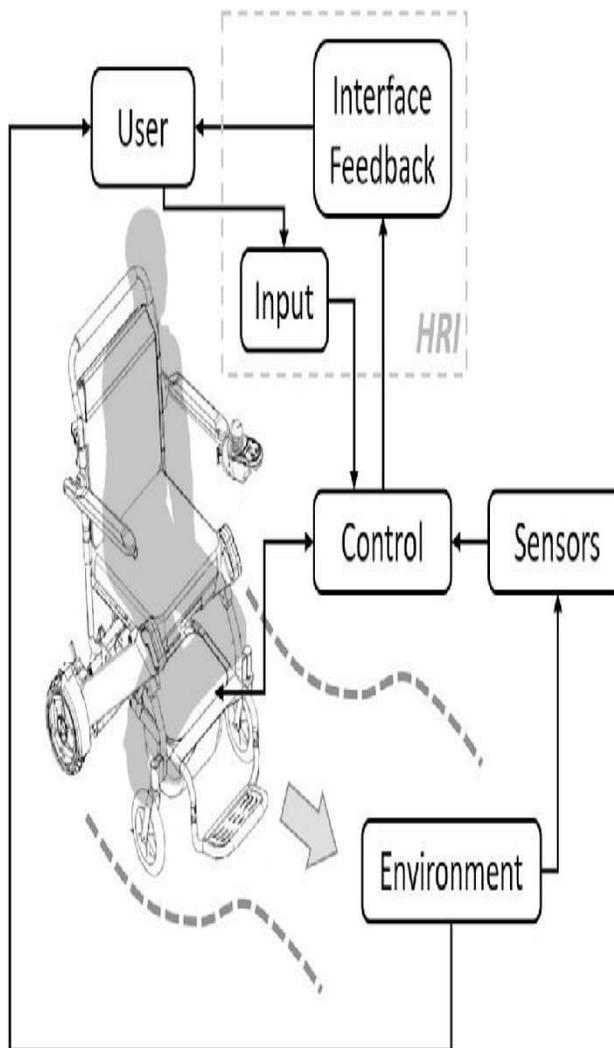


Fig. 5. Vibration measurement concept



Parameters

Height	4.1
Width	1.6 feet
Weight	43kg
Wheel Diameter	36cm
Speed	3.31km/hr
Supply Voltage	24V,5V
Supply Current	8 A
Load Capacity	85kg

B. Vibration measurement

because in real time application wheelchair is going to move with person sitting on them. So the weight required to push wheel chair and person needs to generate the power supply for whole system. Based on their complexity of circuit and power required to push wheel chair is only come in the reality when we use raspberry pi. Also we have this whole system because normal supply didn't fulfill the requirement of system.

Our Purposed smart wheel chair provides a safe and reliable system with presence of person and timeline. It provides an easily accessible and variety of functionalities. In this paper, we developed a wheel chair system which includes ultrasonic and infrared system to automatically track the path along with a little intelligence of taking location. Thus, the disable person can be self-reliable safe and independent with the help of this easily controllable wheel chair.

Further improvement to the above implemented sensors make the system more user friendly and avoid accidents by self-learning.

## V CONCLUSION

The whole concept based on raspberry pi as a processing unit. We also have the option to use raspberry pi pico or other microcontroller as a processor but we used raspberry. It's

In this paper, we present a technique for object which is vibrating in back and forth direction with respect to its mean position. As shown in Fig. 5., the surface of the vibrating object deviates from its equilibrium position (0). The entire deviation from one extreme

point (+1) to another extreme point (-1) forms one cycle of vibration. As the light emitted from the laser strikes the vibrating object, the reflected light is detected by the diode. Depending on the position of the object at the instant, the distance travelled by the beam varies. Hence the intensity of the beam at that instant varies by following the inverse square law, which states that the intensity ( $I$ ) light beam is inversely proportional to square of the distance ( $d$ ) it has travelled,

$$I \propto (1/d^2)$$

At the output of the detector, we get signal with amplitude varying with the vibration of the object. In that way sensor detect distance of surrounding object.

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