

Smart Wheelchair with Advanced Assistance and Governing System for Disabled

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Abstract. This smart wheelchair model can be used by quadriplegic people to move comfortably. Sufferers with paraplegic or leg impairment face issue in achieving locations. A few people try and use a walker in many instances, the patient may also lose balance and fall and injure themselves. To avoid this state of affairs, our model can be used. This version is powered through a raspberry pi; it is geared up with LCD and RF module and atmega controller, Servo motor, a DC motor and a wheelchair. The user just needs to touch the displayed options for movement. The transmitter and receiver circuit communicate using RF communication. This version additionally has an emergency characteristic; the person ought to press the alert button in case of emergency. The patient can then circulate the usage of button instructions. The patient can use the forward and backward buttons to move forward or backward, and can press the stop button to stop at a certain point and to make the chair stand, the patient needs to click on stand up button. so that the person sitting on the wheelchair can stand allowing to pick any items without any help.

Keywords: Raspberry pi, motor controller, tft display, wireless communication, python, wheelchair

1. Introduction

This paper shows the possibility of making the wheelchair smart using more feasible way. Now-a-days it is very arduous to perform movements or regular activities for disabled. They do depend on others for their assistance. To overcome this, assistive devices like wheelchairs is used. Wheelchairs is fundamentally a chair fitted with wheels to move around for people who are disabled due to illness or injury. By using wheelchair, the person with disability can perform his/her daily activities independently. They do not need any assistance of other person. But there are many disabled who cannot move the wheelchair. Thus, smart wheelchair become a better option to use because it can be controlled easily with less efforts. Smart wheelchairs are energized with electricity with components like sensors, micro-controllers. With the help of micro-controllers and sensors the control of wheelchair becomes easy. One can use this wheelchair for various purposes. The primary

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grail of the smart wheelchair is to help the disabled to move around without the assistance of another person. By using this smart wheelchair, a person can move forward, backward, sideways on his own[2].

This project also helps the person to stand. It lifts the person to angle so that the person can stand. This wheelchair can be used by physically challenge people to move around conveniently. A few people try to use walker, oftentimes the affected person can mislay the stability and fall and can be bruised. Use of manual wheelchair can also promote their movement, but it requires the involvement of the other person, even if the affected person to move the chair, he/she requires to put more physical efforts. Thus, this smart wheelchair would be a better solution for the disabled persons which includes automation in its functioning and even a lesser effort.

2.Working Methodology

The Smart wheelchair consists of a wheelchair controlled by RF module. A Raspberry PI zero is permitted to approach the system without showing units. TFT display is used to operate the smart wheelchair. When the touch control is given input according to different modes in it the signals are transmitted to raspberry pi zero and then the RF module which operates at 433Mhz transmit wireless signal to the receiver at the other end that operates motors connected to wheelchair. This project needs a wireless communication that is fulfilled using a rf wireless module that operates at 433Mhz and takes input four data points and outputs the signal fed to those inputs and the receiver has four data output points that fed to a micro-controller and further the controller is connected to servo motors and has a motor driver points that fed to a micro-controller and further the controller is connected to servo motors and has a motor driver connected to it to operate. the motors connected to wheels to move forward ,backward, left or right[3,5]

Table 1 Displayed options for user to control motors

TEXT	MOVEMENT
Forward	Moves forward
Backward	Moves backward
Right	Right direction
Left	Left direction
Stand up	Lifting function
Stop	Holding
Alert	Emergency

The operation of whole circuit is done using Raspberry pi Zero 2w which has a1Ghz quad-core and 64-bit processor (Arm Cortex-A53) and stores data up-to 512MB SDRAM and this is powered using a micro USB pin. This also has an SD slot that enables to extend memory and helps connect to the virtual monitor in VNC viewer. A TFT 3.5 inch touch display is used to enable touch controls that makes more user

friendly handling and this display is enabled using spi communication in the command prompt using putty terminal. The receiver module consists of receiver module, micro-controller programmed in c , a motor driver connected to two dc motors and controller in direct connection with the servo motors[6].

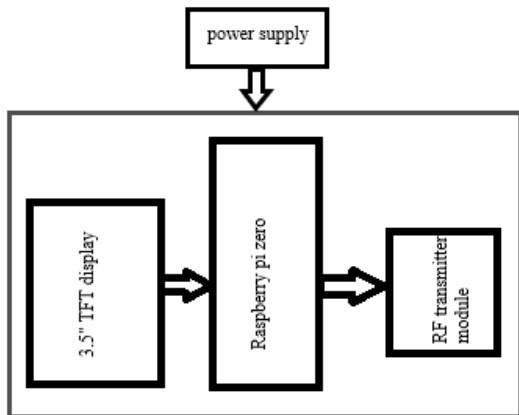


Fig-1. Block diagram of the transmitter module

The schematic of these controllers looks as below.HT12e encoder type to encode the signal and decode the signal at the receiver end with the HT12d decoder [10-11]. A motor driver L293d is used to operate two motors and based on the output signals received from the atmega controller.

The controller used is an At-mega 328p controller to control servo motors to make the wheelchair lift to an angle of 80degrees .The RF transmitter uses The motors operated with the pins connected at 9,11,12,A1 for the motor inputs and servo motors connected to analog pins at A4,A5 pins. Two dc motors that run at a rated voltage of 12v and produce 10 rpm as the output. The output controls are defined using python program.

2.1. Algorithm and mechanism with wireless communication using raspberry:

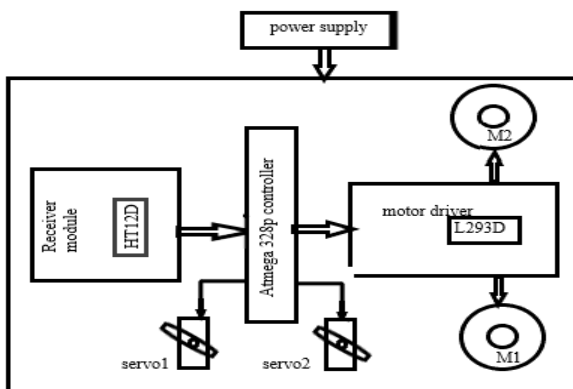


Fig-2 Block diagram showing the receiver end module

Step1: The variables are declared for different functions like” forward”,” backward” and the direction controls” right”, ”left”.

Step2: All the variables are initialized to zero at first. the GPIO pins are initialized to give

inputs to data pins.

Step3: import tkinter virtual screen to display input commands.

Step4: initialize pin configurations for data pins 12,16,20,21 to transfer data to transmitter rf module and a setup() function is declared for defining input and output pins.

Step5: each variable is given with a separate function to repeat variables when given as input.

The process involves a series of functions called at a particular interval based on the required functionality of the user.

a. A variable button is declared if bt is F then the signal is sent to receiver and encoded signal is decoded at receiver.

b. Another variable bt B is declared and the operations are declared using GPIO.output to data output pins.

c. If bt 'Right' is pressed signal is transferred to the right motor using the commands in the right function.

d. If bt 'Left' is pressed the predefined left function is called leaving the left motor to run.

e. If bt 'Stop' is pressed the stop function initiates the loop stopping the movement of the wheels.

f. If bt 'stand-up' is pressed the function gets called and HIGH signal is passed to the servo motors

Step6: The function call get initiated for the loops after the buttons are clicked in the tft display.

Step7: The conditionals for the motor operation are initiated in the loop () of the atmega controller.

Step8: The operators are then sent to the motor driver for further procedure.

Step9: The process is finally stopped or terminated.

2.2. Flowchart for interfacing raspberry pi and wireless controllers for the motors

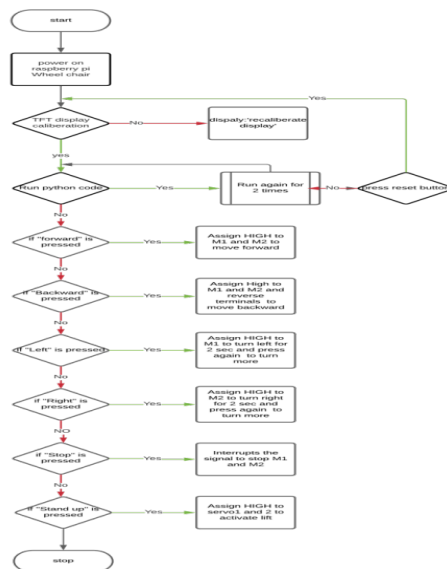


Fig3 .Flowchart of the process in smart wheelchair

3. Results and Discussion

Raspberry pi zero checks the input command given by the user and runs the program accordingly to match the required operation and give the exact output. Depending on the input given, the motor are operated using L293 motor driver. The input variations are read simultaneously using the program logic to interact with the wireless receiver.

The crucial components of the system are the wireless transmitter and receiver that operate at 433Mhz frequency. they establish a mode of communication between two different control modules. the connection is established between TX and RX only when the input power to the TX is given from the raspberry pi zero. The motor controller L293d helps in controlling the direction and rotation, helping user to control smart wheel chair more precisely. The most important functionality of the smart wheelchair is its ability to lift up-to an angle of 80 degrees helping the user to handle with the things at a higher place. this functionality is also enabled using wireless communication which more user friendly.

4. Simulation And Hardware Results:

Used Proteus software for wireless communication simulation

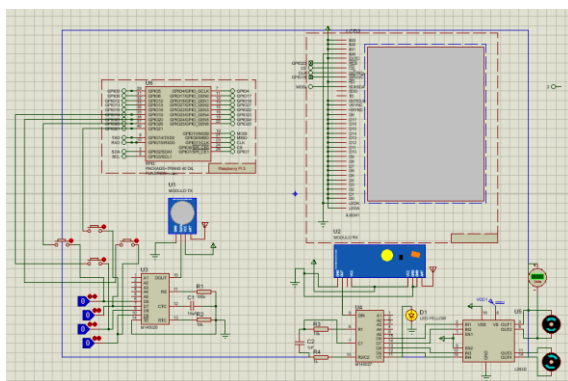


Fig-4. Motors move to and fro according to given input

When logic's are given as input from the transmitter to the receiver the motors move in a direction accordingly. when the logic of the data0 is given the motors rotate in forward direction, when input is given as HIGH to data1 the motors move in backward direction

,when there is an input given to the data2 pin the right motor rotates in clockwise direction and when the data3 pin is made HIGH the left motor rotates in clockwise direction and the stop command makes all the data pins to LOW allowing no motor to run. the stand up command makes the data pins 0,1,2 HIGH making the servo motors to activate.

5. Conclusion

The presented model of smart wheelchair that is operated tirelessly without any extra communicating wires and reducing the overall effort for disabled by using the lifting mechanism in the model and further increasing the user experience and the user interactivity with the touch display.

6. Future scope:

This model can be implemented into practical application that uses wireless communication and add sensors to avoid collisions and also include Artificial Intelligence to monitor the health status of the disabled using sensors that show the real time status in mobile or web applications. the lifting mechanism can be implemented practically using gear mechanism or stepper motors that are cheaper than the conventional pneumatic hydraulic actuators.

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