ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

Smartphone Based Wheelchair Control and Monitoring of Environment

V.Keerthi Kiran
Assistant Professor,
Department of Electronics & Communication Engineering,
Raghu Institute of Technology,
Visakhapatnam, A.P 531162, India.

R.S.Madhavi
UG Student,
Department of Electronics & Communication Engineering,
Raghu Institute of Technology,
Visakhapatnam, A.P 531162, India.

B.Padmavathi
UG Student,
Department of Electronics & Communication Engineering,
Raghu Institute of Technology,
Visakhapatnam, A.P 531162, India.

K.Rohit Reddy
UG Student,
Department of Electronics & Communication Engineering,
Raghu Institute of Technology,
Visakhapatnam, A.P 531162, India.

V. Prem
UG Student,
Department of Electronics & Communication Engineering,
Raghu Institute of Technology,
Visakhapatnam, A.P 531162, India.

Abstract:

About 19 percent of world-wide populations are using a wheelchair because of their disability. Great people like Stephen Hawking and Max Briton whose lives have been permitted to the wheelchairs because of the diseases affected to them[2].This project is to build a prototype wheelchair for the disabled people especially old aged ones to make their lives self-reliant, self-independent which will thereby restore their willpower and confidence and bring back their happiness.

The main idea is to implement Smartphone based wheelchair control which allows the person with disability to locate their wheelchair and move in a specific direction by using an android application. The wheelchair can be operated remotely using internet linked application and incase of failure of internet it can be operated using Bluetooth technology.

Keywords:-Raspberry-Pi, Web camera, Motor drivers, Bluetooth

INTRODUCTION

Life of human beings is the most precious when compared to other things on this earth. Many inventions have taken place for making comfortable and easy living. But at the same time the inventions are more useful to physical handicapped persons [2]. This motivates the scientists all over the world to offer more scientific devices to help those people, at the same time one who cannot move by their own[1]. This development helps those disabled people to use a Smartphone for giving instructions to the wheelchair to move in a specific direction through an android app[2]. So that they need not completely dependent on others and at the same time if the wheelchair is placed far away from them they can remotely control with the help of web camera mounted on it. If the internet is unavailable we can control using Bluetooth which is interfaced to the system. Incase if the person is completely paralyzed and is unable to give instructions, their guardian can monitor and control the wheelchair using internet/Bluetooth module[1].

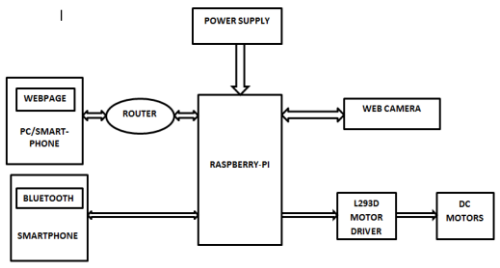

Fig 1.Blockdiagram

Cite this article as: V.Keerthi Kiran, R.S.Madhavi, B.Padmavathi, K.Rohit Reddy & V. Prem, "Smartphone Based Wheelchair Control and Monitoring of Environment", International Journal & Magazine of Engineering, Technology, Management and Research, Volume 6 Issue 4, 2019, Page 19-24.

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

MATERIALS AND DESIGN

An autonomous wheelchair or smart wheelchair is "a uniquely modified poweredwheelchair which is equipped with a control system and variant sensors" which can also be named as a mobile robot base, to which a seat has been attached. Smart wheelchairs aredesigned to help the people who are suffering with severe mobility impairment, visual impairments, etc. The primary purpose of the autonomous wheelchair is to reduce or eliminate the user's full responsibility on stirring the wheelchair[5]. They are also specifically designed with respect to the user's situations and disabilities.

A smart wheelchair comes in two different forms,one is a standard power wheelchair where it consists of a computer interfaced with sensors and the second one is a mobile robot base to which a seat has been added. Smart wheelchairdesigns are modified versions which are available in the market with high cost[5].

Fig2. Powered wheelchair

Our proposed smart wheelchair which comes under second category mentioned is designed using the following elements:

RASPBERRY-PI:

Raspberry-Pi is similar to a computer but with limited computational capability. The Raspberry -Pi board which inbuilt comes with ports like USB ports, an Ethernet port, an SD card slot, Wi-Fi antenna ports and so on. But the peripherals, like a keyboard, mouse, or monitor are connected to the Raspberry pi using the respective connectors. It can be easily interface with different kinds of modules because of the availability of driver packages for raspberry pi. The advanced version is Raspberry Pi 3 Model B which comes up with on board 5GHz, Wi-Fi and Bluetooth module and supports HD video streaming. Raspberrypi acts as an interface between the web page, motor drivers and the smart phone.It controls the data transmission between the user and the wheel chair.

Fig3. Raspberry-Pi board

L293D MOTORDRIVER:

The l293d motor driver has a power supply upto 16 volts. It has a 16 pin configuration which is also called as an H-bridge because it can operate two dc motors simultaneously. L293D driver is a device which is used to control the motors in either clockwise or anti clockwise direction. It has 4 input pins (2,7,10,15)which are connected to the Raspberry-Pi GPIO pins(14,18,20,24) and the two VDDpins(8,16) and enable pins(1,9) are combined toVCC and the 4 pins(4,5,12,13) are used as ground.

Fig 4. Motor Driver

DCMOTORS:

For the mechanicalmovementofsmart wheelchair, it is driven by DC motors attached to the wheels.The DC motors are controlled using l293dwhich is interfaced to the Raspberry Pi[2]. The two dc motors are connected to

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

the 4 output pins(3,6,11,12) which are present in l293d motors drivers.

Fig5.DC Motor

BLUETOOTH MODULE:

Bluetooth is the foremost development in the wireless communication which replaces the wired connection[1]. Raspberry Pi 3 Model B which has on board Bluetooth module with an operating range of 10mts.The operating frequency of Bluetooth module is 2.4GHz with Enhanced Data Rateupto 3Mbps.

The Bluetooth module has a transmitter and receiver pins which are connected to the raspberry-pi GPIO pins for exchanging of data[2]. It has 4 pin configuration where pin1 is VCC, the transmitting pin(2)and the receiving pin(3) are connected to the raspberry pi GPIO pins(10,12) and pin 4 is said to be ground.

WEB CAMERA:

The camera is fixed on the front end of the wheelchair which communicateswith the Raspberry-Pifor sending the visuals to the Smartphone.It has a capacity of sending and receiving data through internet and alsocompresses the data. The IP address of web camera is registered to the router then the router delivers the information viaWi-Fi to the android application which was installed on the Smartphoneby the user[2].

Fig 6.Web Camera

SYSTEM IMPLEMENTATION

A. Installing OS and Configuring Raspberry Pi:

First we need to install Raspbian on micro SD card that will be used in Raspberry Pi. We can download the latest image of Raspbian OS from Raspberry Pi website at [8]:

After successfully installing Raspbian OS on Raspberry Pi, we need to update software. To do this we need to run following Linux commands [8]:

$ sudo apt-get update
$ sudo apt-get upgrade

B. Web camera Configuring as IP camera:

After successfully installing Raspbian OS on Raspberry Pi, we need to convert our web camera into IP (Internet Protocol) camera for streaming the video on the smartphone. So for that web camera is configured through Putty terminal with the IP address of Raspberry Pi.

C. Design of webpage:

The Raspberry Pi can become a web server by installing and running a server application, Apache.Raspberry Pi will host a website that any device on the same network can access. Apache is installed on Raspberry Pi using the following command:

sudo apt-get install apache2 –y

To access the web page from another computer you need your Raspberry Pi's IP address. To find the IP address type in LX Terminal:

Ifconfig

Instead of a static page, you can make a dynamic one that is capable of changing without you manually uploading files to it. A popular way of doing this is to use a scripting language called PHP. To use PHP on the Raspberry Pi you need to install it first with module package for Apache:

sudo apt-get install libapache2-mod-php5 php5 –y

The webpage consists of user commands for the movement of wheelchair. It sends the command to motor driver which enables the GPIO pins. Input of the

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

raspberry pi is connected to the router to allow data transmission [5].

D. Building of UI through Bluetooth Application

For accessing the Bluetooth, Bluetooth SPP Pro application is installed on smartphone and paired with the Raspberry Pi using password.After connecting the device,the keyboard settings are made.The button settings function is assigned so that it can link with the code which is present in TX terminal and allows the command to move the way the user wants.

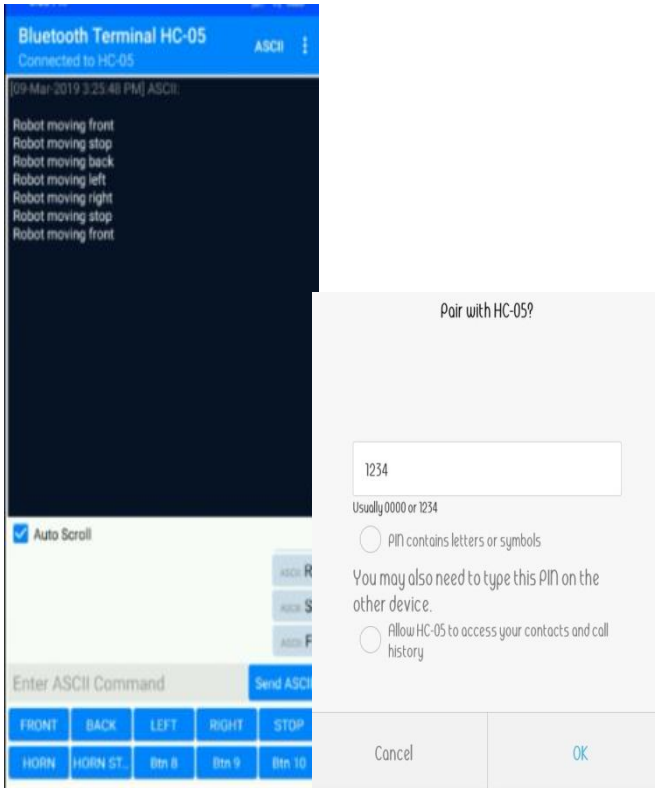

Fig 7. Pairing of Bluetooth devices

Implementation

Initially start the mobile application and check for the signal scan for an input then we must further go through Wi-Fi or Bluetooth as an input.If yes,thenWi-Fi acts an input then further we must go through the IP address and depending on live streaming we must give the input whether to go left, right, stop or forward.If no, then Bluetooth acts as an input which is used using BluetoothSPP pro application which scans the input and gives the input directions for the wheelchair directions.

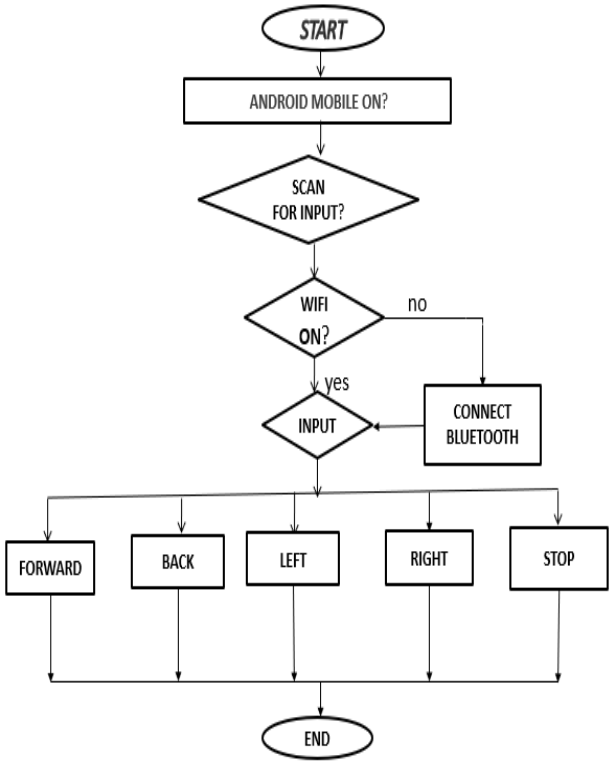

Fig 8. Flowchart.

V.RESULTS

Smartphone based wheelchair is built using the Raspberry Pi is shown in the following figure.

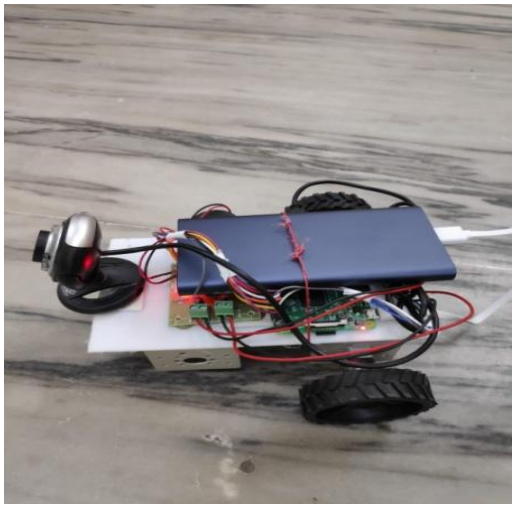

Fig 9. Experimental setup.

The wheelchair can be controlled by the user commands send to the Raspberry Pi through the webpage which is shown in below figure:

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

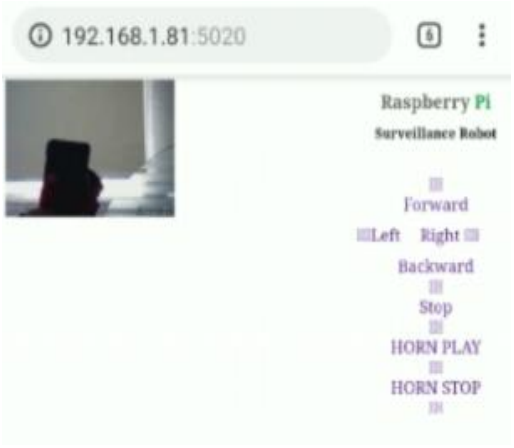

Fig 10. Webpage User interface

The wheelchair can be operated using Bluetooth interface and controlled by the commands in the Bluetooth SPP pro application. The user interface is shown in the below figure:

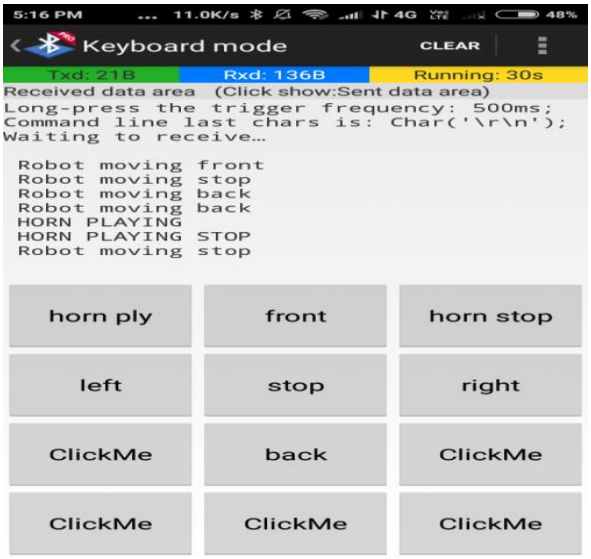

Fig 11. Smartphone User interface

VI.CONCLUSION

The Smartphone based wheelchair control and monitoring of environment is designed which is very useful to the disable people to lead their life independentlyandeffortlesslyto control their wheelchairwith reasonablemanufacturing cost.By using android application and camera we can have a clear guidance about the barrier which are surrounded by them and they can locate the wheelchair over a wide range.

In keeping view of future ourSmartphone based wheelchair control can beupgraded with sensors incase if the patient faces any heart problems or any emergency,message will be sent to the attendant and he can respond immediately to the patient and take necessary action.

REFERENCES

[1] Roger Achkar,Gaby Abou Haidar, Hasan Dourgham, Dani Semaan,Hashem Araji.”Mobile controlled wheelchair”,2015 IEEE European Modelling Symposium (ESM),2015.

[2] Herman,stepen. Industrialmotorcontrol.6th ed.Delmar,CengageLearning,2010,pp.191-251[DEC.07,2014]

[3] World health organization. “Top ten facts on disability.”http://www.who.int/features/factfiles/disability/facts/en/,[feb.9,2014]

[4] Anusha, S., M. Madhavi, and R. Hemalatha. "HOME AUTOMATION USING ATmega328 MICROCONTROLLER AND ANDROID APPLICATION." (2015)

[5] Karen Rispin and Joy Wee, “Comparison between Performances of Three Types of Manual Wheelchairs Often Distributed In Low-Resource Settings”, Journal Disability and Rehabilitation: Assistive Technology, Volume 10, Issue 4 (2015) pp. 316-322.

[6] Liao Lu, Ping Yi Deng, Ying Wu, Jie Jun Bai, Yun Xiao Zhang, Yi Xiang, Liang Jin Shi and Rusen Yang, “Control System of Powered Wheelchairs Based on Tongue Motion Detection”, International Journal of Software Science and Computational Intelligence, Volume 8, Issue 4, (2016) pp. 60-76.

[7] https://doi.org/10.4018/IJSSCI.2016100104.

[8] http://www.raspberrypi.org/downloads/

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

Author Details:

V.Keerthi Kiran received M.Tech Degree in Telematics from VR Siddhartha College of Engineering, Vijayawada, AP, India and B.TECH Degree in Electronics and Communications Engineering from VITAM College Of Engineering, affiliated to Jawaharlal Nehru Technological University Kakinada, AP, India, in 2013 and 2015 respectively. He is an Assistant Professor in Dept. of ECE, Raghu Institute of Technology, his research of interest includes IOT and Embedded Systems. He has authored more than 4 Research papers in National and International Conferences and Journals.

R.S.Madhavi is pursuing B.Tech Degree in Electronics and Communications Engineering from Raghu Institute of Technology, affiliated to Jawaharlal Nehru Technological University Kakinada, AP, India.

B.Padmavathi is pursuing B.Tech Degree in Electronics and Communications Engineering from Raghu Institute of Technology, affiliated to Jawaharlal Nehru Technological University Kakinada, AP, India.

K.Rohit Reddy is pursuing B.Tech Degree in Electronics and Communications Engineering from Raghu Institute of Technology, affiliated to Jawaharlal Nehru Technological University Kakinada, AP, India.

V. Prem is pursuing B.Tech Degree in Electronics and Communications Engineering from Raghu Institute of Technology, affiliated to Jawaharlal Nehru Technological University Kakinada, AP, India.