Android Wheelchair for Disabled Person

Ashik Abbas P[1], Dilna P V[2], Aparna Thamban[3], Susmitha T S[4] and Fepslin Athish Mon S[5]

[1,2,3,4]UG Scholar,[5]Assistant Professor

[1,2,3,4,5]Department of Computer Science and Engineering,

Royal College of Engineering & Technology, Akkikavu, Calicut University, India.

ashikabbas11@gmail.com[1], fepslin@gmail.com[5]

Abstract : The people with disabilities are facing problem for moving one place to another. An android based wheelchair can provide a feasible solution to their problem. The android technology provides a new approach of human interaction with machines or tools. This design helps the people with disability to live their life with less dependence on others. This project is designed to control a wheelchair by using an android application with facilities of button movement, voice system and accelerometer movement. It also includes the features such as obstacle detection, displays basic needs of patient with an alert, heart rate monitoring, temperature monitoring and an automatic message on emergency condition. In addition, line following algorithm based movement is also included. A Wi–Fi camera is embedded in the wheelchair for totally disabled person, so that the others can control the wheelchair. The control unit consists of PIC16F877A microcontroller with Bluetooth module HC05, Heart beat sensor, temperature sensor LM35, Infrared sensor and L293D motor driving IC for controlling motor.

Keywords – Accelerometer, Android, Button, HC05 Bluetooth module, Heart beat sensor, Infrared sensor, PIC microcontroller, Temperature sensor (LM35), Voice control, Wi-Fi camera.

I. Introduction

Modern world is getting crowded with disabled people as a result of natural calamities and other man-made disasters. These disabled people are facing a lot of difficulties in daily life activities. The wheelchairs with different technologies are available in the modern world. Such as wheelchair controlled with joystick, voice, accelerometer, eyeball movement, head movement, brain control etc are present. But they cost huge amount of money which makes it non-affordable to normal peoples. The electrical wheelchair need to be charged often by the excess use with normal batteries, we here use high power Li-ion batteries to power the wheelchair which has a long battery life and its recharges at a much faster rate. The android wheelchair we designed for the disabled person is an ultimate integration of multiple types of embedded and software systems at a low cost. Integration of several facilities into one specific system could provide varieties of choices and comfort to the patient and the people surrounding the patient. People with normal disabilities could use the joystick mode to control the wheelchair around. Peoples with no hands could use the voice mode to control it. People with no vocal power can also use the accelerometer to move the wheelchair by tilting the android phone. Peoples who are totally disabled could use the line following method to move automatically from one point to another and a 3rd party can assist by watching the live camera feed from the wheelchair in a 3rd party application installed in secondary phone. It can be used along different areas using the Bluetooth connection from an android device. Making the life of such people easier is the main goal of our wheelchair.

International Journal of Computer Science and Engineering Communications,
Volume.5, Issue.4 (2017): Page.1675-1681
www.ijcsec.com

II. RELATED WORKS

S.Shaheen and A.Umamakeswari[1]proposed "Intelligent wheelchair for people with disabled person". It is based on ARM7 processor. Basic requirements are assigned in a 4*4 keypad. By pressing the keypad people can direct the wheelchair. The wheelchair follows the path using line following algorithm. An automatic call goes to doctor on emergency condition by using GSM modem. Basic needs will display in a LCD display.

Mr. Khagedra Joshi, Mr. Virendra Gupta, Ms. Monika Gosavi and Mr. Sandip Wagh[2] proposed "A multifunctional smart wheelchair". It consists of AVR microcontroller ATmega328. It uses temperature sensor LM35 to detect body temperature of the patient and ultrasonic sensor for obstacle detection. The line follower circuit is designed to move the wheelchair in a pre defined path.

Prof R S Nipanikar, Vinay Gaikwad, Chetan Choudhari, Ram Gosavi and Vishal Harne[3] proposed an "Automatic wheelchair for physically disabled persons". It is based on ARM7 processor. Voice recognition chip HM2007 is used for voice controlled movement. It also move based on joystick and accelerometer.

K A A Aziz, M H Mustafa, N M Z Hashim, N R M Nuri, A F Kadmin and A Salleh[4] proposed a "Smart android wheelchair controller design". It is an android based wheelchair.

III.   PROPOSED SYSTEM

The proposed system contains multiple facilities which make the patients moving from one place to another a lot easier than carrying around in armed wheelchair. The system uses PIC microcontroller and different sensor module provide accurate data for its smooth functioning. The system is powered by a 12V battery.IR sensors provide obstacle on the way and immediately stops the wheelchair with a notification of "Obstacles Detected". A temperature sensor and heart beat sensor is included in the wheel chair to monitor the patients' health condition and keep the doctor notified of the patient's condition. A dedicated page is allotted in the android application for the notification of the patients' needs in the android Smartphone. The wheelchair works in 4 different modes. Joystick is the basic working of the wheelchair which has movement in 4 directions and a stop button for emergency stopping. Voice mode is the second operating section in which the wheelchair is controlled by the voice of the patient and it makes controllable by the patient alone. The third operating feature is the Accelerometer. It uses the accelerometer of the Smartphone to move the wheelchair around irrespective of its axis. Tilting of the Smartphone in hand makes the movement the wheelchair.
Line following is an additional feature that is made in the hardware control level.   It follows the line in which it is specified by the users on the ground. A black and white line is made closer in the ground and the wheelchair looks for the dark and light area and follows it. When it meets a junction it asks for the user's permission to makes directional changes. Wi-Fi Camera is used as an Add-on in the system to make the movement effective on the go. A video player will be available in the screen with a live stream from the wheelchair. It helps in controlling the wheel chair from a distant room in the house. The live feed is made through a dedicated system or cloud storage.

International Journal of Computer Science and Engineering Communications,
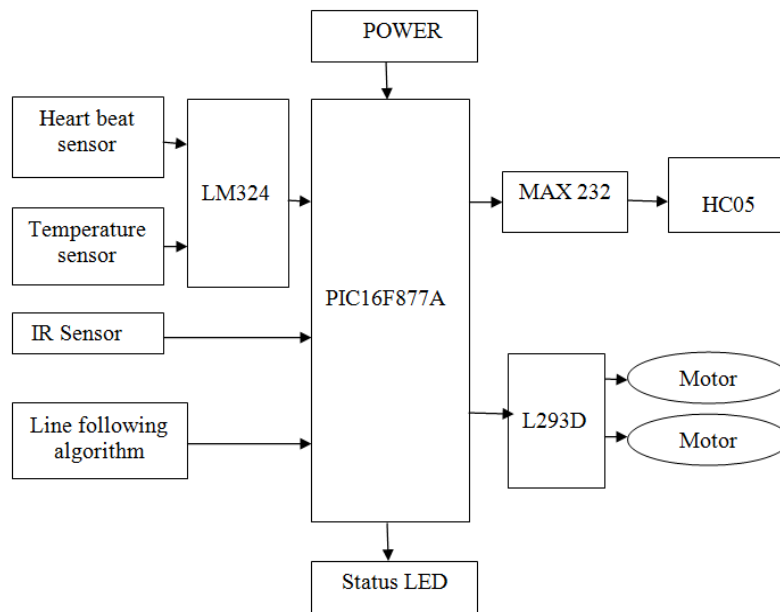Volume.5, Issue.4 (2017): Page.1675-1681
www.ijcsec.com

Fig 1.1: System Architecture

3.1 PIC16F877A

The Microcontroller PIC16F877A is a 40pin programmable interrupt microcontroller. It uses 5V power supply and has a clock cycle of 20MHz. It has the memory of 368 Byte of RAM, 256 Byte ROM, 14K Flash Memory. It is designed on the architecture of Haward Architecture. UART, USART, CAN, LIN, SPI and Ethernet are the communication protocols of PIC16F877A.

3.2 Temperature sensor

LM35 is the temperature sensor. The sensor detects the temperature in centigrade. When the output is high, it automatically notifies the doctor by sending a message to the doctor's mobile phone.

3.3 Bluetooth module HC05

HC05 is a Bluetooth module which is used to connect the embedded system with the android application. Range of HC05 in between 1M to 30M and the frequency range of HC05 in between 2.4 GHz to 2.48GHz [2]. It is based on master slave configuration.

3.4 Obstacle detector

For obstacle detection IR sensor is used. It has a range of about 10cm.when the signal is send as high output, the wheelchair automatically stops no matter which mode it is in.

3.5 Line follow

Line follow is implemented using line follow algorithm. Two IR sensors are placed in front of the wheelchair to detect the black and white surface. Wheelchair continues to move forward on the white surface and when it reaches the black surface, IR sensor absorbs the black and sends a high input signal. And wheelchair stops respectively.

International Journal of Computer Science and Engineering Communications,
Volume.5, Issue.4 (2017): Page.1675-1681
www.ijcsec.com

3.6   DC Motors

The motors used here is 12V, 100 RPM geared motors. The motors move in particular direction according to data from the L293D IC.

3.7   MAX232

MAX232 is an integrated circuit which consists of dual transmitter/dual receiver. It converts RS232 signals into TTL-Compatible digital logic signals and vice versa. Its operating voltage is from +3.0v to +5.5v. MAX232 is a 16 pin interfacing IC.

3.8   L293D

L293D is a motor driving IC, which is used to drive the DC motor in two directions. Using a single L293D IC we can control two DC motors. It is a 16 pin IC. The working of the L293D is based on H-Bridge concept. A single L293D IC contains two H-Bridge that rotate two DC motors independently.

3.9   LM324

LM324 is a comparator IC. Here it is used for converting the output of temperature and HB sensor into digital data. The IC consists of 4 independent op-amps. It is a 14 pin IC.

IV.   SOFTWARE

4.1   Android Studio2.2.3

Android studio 2.2.3 is the latest version of integrated development environment for android platform.

4.2   Diptrace

Diptrace is software which is used to developing a schematic diagram of the embedded system. It is EDA/CAD software which consists of 4 modules. They are schematic capture editor, PCB layout editor, component editor and pattern editor.

4.3   MPLAB

MPLAB is a freeware development environment which is used for the development of embedded system on PIC microcontroller. It supports project management, code editing and debugging. It also support programming on 8-bit/16-bit/32-bit microchip.

V. EXPERIMENTAL RESULT
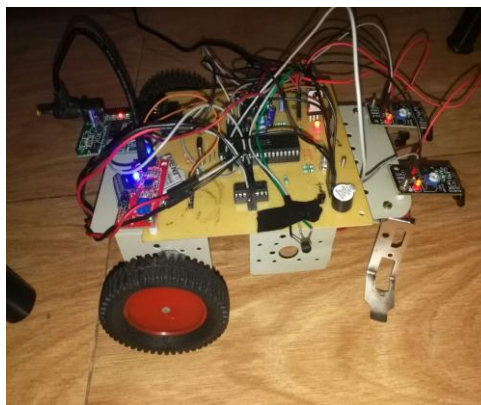
This is the working model of the wheelchair with different level of controlling and sensing. It includes vast features and facilities, so that patient can use it in effective and useful way.
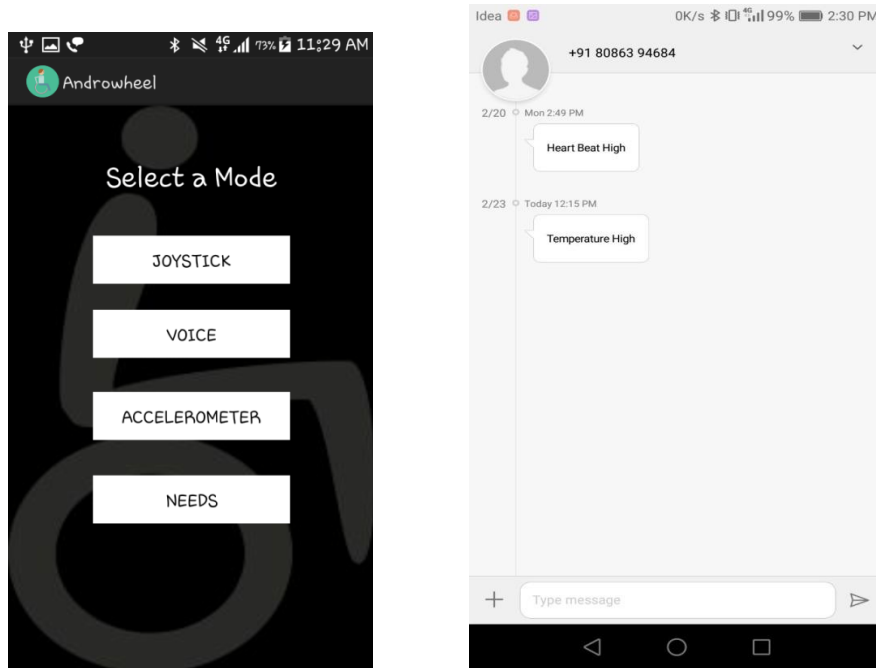
The above figure shows the mode page of the android application. Here four different modes are available. Joystick, Voice and Accelerometer are used for the movement of the wheelchair. The patient can select any of the modes for their movement. Last mode is used to indicate the basic needs of the patient. If the patient who cannot speak can use this mode for indicating their basic need. This shows the received message in doctor's phone in emergency condition such as when heart rate or temperature is high.

VI. ADVANTAGES

- Easy to use

The wheelchair doesn't require any additional knowledge for it operations and the basic controls are very easy and fun to learn.

- Low Cost

The wheelchair use components which have low cost but effective and hence make it a low budget and more affordable product to commoners.

- Accurate in movement

The wheelchair uses various sensors which help in the accurate measurements and outputs which make it work in an effective and simple way.

- Integration of multiple choices

The wheelchair has different modes for its operating which I suitable for different types of people with different types of disabilities.

International Journal of Computer Science and Engineering Communications,
Volume.5, Issue.4 (2017): Page.1675-1681
www.ijcsec.com

- Latest software upgrades

The system is made along with the latest technology in android development. It supports the android versions from KitKat (4.0.0) and up.

- It is powered by battery which makes it portable and it is of light weight than other automatic wheelchair hence easier to carry around

- Less complexity

The wheelchair is easy to use and has simple control methods which can use by any people of any age.

- Can be mounted on to an existing wheelchair.

The system can be implemented on to an existing wheelchair with minimum upgrading effort.

- Wheelchair is compact and economical

This wheelchair is made of most available components which can make it an economically affordable system.

- Low power consumption

The system uses less power consuming components which in turn make the system last for a long time on a used 12V battery.

- Reduces the manpower

The system has the advantage of auto-control than manpowered wheelchair which is less effort consuming.

VII. CONCLUSION

This system helps the disabled person to move to any place without the help of others. This provides ease of living and is suitable for patient with different types of disabilities. As the system uses android Smartphone for controlling the accuracy is increased. It has three modes of controlling i.e. button control, voice control accelerometer control. IR Sensor is used for obstacle detection. Health of patient is monitored using temperature sensor and heart beat sensor and based on this an automatic message goes to doctor. Basic requirements of patient can be displayed with an alert, so that others can fulfill it. We can also add new technologies to this system. The running cost of this wheelchair is less compared to the similar ones.

VIII. FUTURE SCOPE

This wheelchair is suitable for patients with different types of disabilities. Still there is scope of improving the wheelchair. We can include eye ball control, head movement, brain control. Presently this wheelchair cannot climb stairs. So this feature also can include in the future.

REFERENCE

[1] S. Shaheen, A. Umamakeswari "Intelligent Wheelchair for People with Disabilities" International Journal of Engineering and Technology (IJET),Volume 5, Feb-Mar 2013, ISSN: 0975-4024.

International Journal of Computer Science and Engineering Communications,
Volume.5, Issue.4 (2017): Page.1675-1681
www.ijcsec.com

[2] Mr. Khgendra Joshi, Mr.Virendra Gupta, Ms. Monika Gosavi, Mr. SandipWagh "A Multifunctional Smart Wheelchair" International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE), Volume 4, ISSUE 6, May 2015, ISSN-2278-909X

[3] Prof.R.SNipanikar, Vinay Gaikwad, ChetanChoudari, Ram Gosavi, Vishal Harne"Automatic Wheelchair for Physically Disabled Persons" International Journal of Advanced Research in Electronics and communication Engineering (IJARECE), Vol.2,ISSUE 4, April 2015

[4] K. A. A. Aziz, M. H. Mustafa, N. M. Z. Hashim, N. R. M. Nuri, A. F. Kadmin, A .Salleh "Smart Android Wheelchair Controller Design", International Journal for Advance Research in Engineering and Technology(IJARET), Volume 3 ISSUE 5, May 2015,ISSN 2320-6802

[5] Thangadurai .N, Kartheeka .S "Intelligent Control Systems for Physically Disabled and Elderly People for Indoor Navigation", International Journal for Research in Applied Science and Engineering and Technology(IJRASET) Volume 2, Issue 9, September 2014, ISSN 2321-9653.

[6] M Prathyusha,K.SRoy,Mahaboob Ali Shaik "Voice and touch Screen Based Direction and speed control of wheel chair for Physicallly challenged using Arduino,"IJETT,vol. 4,issue 4, April 2013.

[7]Ritika Pahuja, Narendra Kumar "Android Mobile Phone controlled Bluetooth Robot using 8051," IJSER vol. 2,issue 7,July 2014.

[8]PIC Microcontrollers: An Introduction to Microelectronics, Elsevier, 2011

[9]Embedded C Programming and the Microchip PIC, Cengage Learning, 2004

[10]Programming 16-Bit PIC Microcontrollers in C, Elsevier, 2011.