International Journal of Research in Engineering, Science and Management
Volume-2, Issue-2, February-2019
www.ijresm.com | ISSN (Online): 2581-5792

Intelligent Wheel Chair based on Hand Gesture Control

S. Krishnakumar
PG Student, Department of Electronics and Communication Engineering, Government College of Technology, Coimbatore, India

***Abstract*: Robots of the future should communicate with humans in a natural way. The purpose of this project is to present a reliable system of human-computer interfacing based on hand gestures, which could be interpreted and adequately used in controlling a remote robot's movement. This project aims the development of an intelligent wheelchair working on hand gesture control and not by the usual method of keypad for the physically handicapped people. The Locomotion of the wheelchair is controlled by a microcontroller unit. The physically handicapped people will have the option of controlling the system through hand gesture wirelessly from ranges up to several meters and will have the independence of using the wheelchair without the help of any other people.**

***Keywords*: Micro-electro mechanical systems (MEMS), wheelchair, Gesture.**

1. Introduction

In today's time, an estimated 1% of the world's population needs a wheelchair. An increased percentage of elderly and disabled people who want to enhance their personal mobility, for them wheelchair is the best assistive device. A disabled or an invalid individual (usually the disability of the lower part of the body) can find it convenient to move around and maneuver using the help of a chair constructed on wheels which can either be pushed by another individual or propelled either by physical force or electronically. Such a chair is called as a Wheelchair [1].

Traditional wheelchairs have some limitations in context to flexibility, bulkiness and limited functions. Our approach allows the users to use human gestures of movement like hands and synchronize them with the movement of the wheelchair so that they can use it with comfort and ease on all kinds of terrains without the hurdle or cardiovascular problems or fatigue. Some existing wheelchairs are fitted with pc for the gesture recognition. But making use of the pc along with the chair makes it bulkier and increases complexity. This complexity is reduced by making use of the mems accelerometer, the size of which is very compact and can be placed on the fingertip of the patients. Other existing systems, which make use of the similar kind of sensors are wired, which again increases the complexity of the system. They also limit the long range communication. This complexity is removed by using the RF transmission. Signals through RF travel larger distances. Irrespective of line of sight communication, signals through RF travel even when there is obstruction between the transmitter and receiver.

2. Overview of the intelligent wheelchair

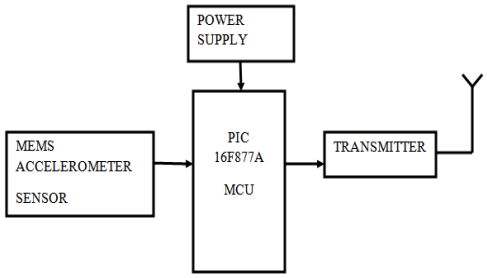

Fig. 1. Transmitter block diagram

The Transmitter section consists of switches and RF Transmitter module. The switches are used for different direction of movement (forward, reverse, left, right) of the wheel chair. The RF Transmitter is supplied with 9V and the operating frequency range is 434MHz. When a logical 0 (data line low) is being sent, the transmitter is OFF. When a logical 1 is being sent, the carrier is fully ON. It consists of Encoder IC for encoding the parallel data into serial data and they are transmitted through antenna.

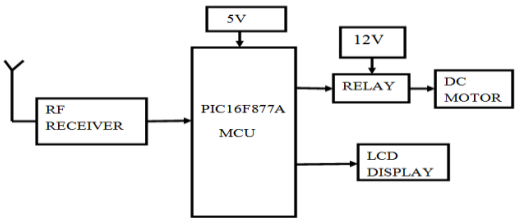

Fig. 2. Receiver block diagram

The Receiver section consists of RF Receiver module, PIC16F877A Microcontroller, DC motor and LCD display.The datas from transmitter are received through antenna and inbuilt decoder IC decodes the serial data into original data.They are given to the PIC16F877A Microcontroller.The Microcontroller

is supplied with 5V DC and has operating frequency of 4MHz. DC motor is interfaced with PIC MCU.The Microcontroller output is in the form of logic 0's and 1's so relay is used to drive the motor and the relay is supplied with 12V DC.Based on the output from the microcontroller the dc motor rotates in different directions (Forward, Reverse, Left, Right). The LCD display is used to indicate the direction of wheel chair.

3. ADXL335 MEMS accelerometer

The ADXL335 MEMS (Micro Electro Mechanical Sensor) is a small, thin, low power, complete 3-axis accelerometer with signal conditioned voltage outputs. The product measures acceleration with a minimum full-scale range of ±3 *g*. It can measure the static acceleration of gravity in tilt-sensing applications, as well as dynamic acceleration resulting from motion, shock, or vibration. The user selects the bandwidth of the accelerometer using the CX, CY, and CZ capacitors at the XOUT, YOUT, and ZOUT pins. Bandwidths can be selected to suit the application, with a range of 0.5 Hz to 1600 Hz for the X and Y axes, and a range of 0.5 Hz to 550 Hz for the Z axis. The ADXL335 is available in a small, low profile, 4 mm × 4 mm × 1.45 mm, 16-lead, plastic lead frame chip scale package (LFCSP_LQ).

Fig. 3. MEMS sensor

4. PIC microcontroller

PIC16F876A has built in 10-bit Analog-to- Digital Converter module (A/D) with fast sampling rate approximately 0.632 MHz and good linearity (_1 LSb). It has high current sink/ source (25mA) for digital input/output. It has 3 external interrupt pins and four timer modules. The PIC16F876A features 256 bytes of EEPROM data memory, self-programming, an ICD, 2 Comparators, 2 PWM functions, and a Universal Asynchronous Receiver Transmitter (USART). All of these features make it ideal for more advanced level A/D applications [3].

5. RF Module

The RF module, as the name suggests, operates at Radio Frequency. The corresponding frequency range varies between 30 kHz & 300 GHz. In this RF system, the digital data is represented as variations in the amplitude of carrier wave. This kind of modulation is known as Amplitude Shift Keying (ASK). Transmission through RF is better than IR (infrared) because of many reasons. Firstly, signals through RF can travel through larger distances making it suitable for long range applications. Also, while IR mostly operates in line-of-sight mode, RF signals can travel even when there is an obstruction between transmitter & receiver. Next, RF transmission is more strong and reliable than IR transmission. It uses a specific frequency unlike IR signals which are affected by other IR emitting sources. Above listed qualities makes RF, a better substitute for wireless communication [3].

6. Model description

The circuit model works on the wheels of chair switching relays & motors with MEMS sensor placed on patients hand. MEMS is used to send tilt signal to the wheelchair i.e., left or right or front or back. These tilt signals are passed to the controller as instructions. According to the program written for the controller, controller will give instructions to the wheelchair via relay. Here relay acts as a switching circuit. According to the relay operation wheelchair will move in that corresponding direction. If both the inputs to the Motor Driver are Low and high at the same time than the motor is in halt position. If the first output is high, Second output is low then DC Motor moves forward. If the first output is low, second output is high as shown in the circuit model figure 4 then DC Motor moves reverse.

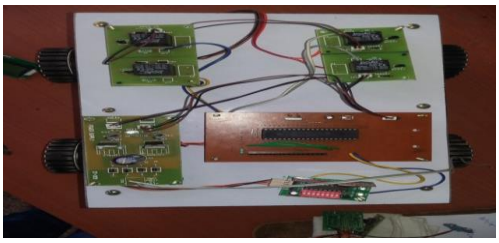

Fig. 4. Receiver section

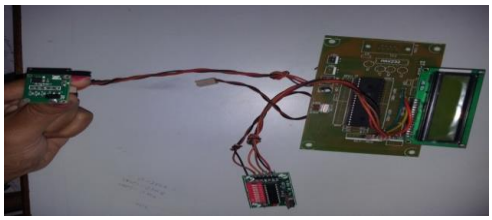

Fig. 5. Transmitter section

7. Conclusion

With the development of the project it can be successfully implemented on a larger scale for the handicapped people. The low cost of the assembly makes it really a bonus for the general public. The wireless system will be a boost to the confidence and will power of physically challenged people as it will help them to be self-reliable. As a part of further development the project can be developed with addition voice recognition

features through on board processing and power supply. There can also be the application of intelligent home navigation for handicapped people to go through the entire house and get help from technological interface for the navigation. The object avoiding and careful navigation principle can be improved with algorithm based image processing technology.

References

[1] Diksha Goyal and Dr. S.P.S. Saini "Accelerometer Based Hand Gesture Controlled Wheelchair" International Journal on Emerging Technologies 4(2): 15-20(2013)

[2] shreedeep Gangopadhyay, Somsubhra Mukherjee and Soumya Chatterjee "Intelligent Gesture Controlled Wireless Wheelchair for the Physically Handicapped" Proceedings of Fifth IRAJ International Conference, 15th September 2013, Pune, India.

[3] Monika Jain, Hitesh Joshi "Tongue Operated Wheelchair for Physically Disabled People" International Journal of Latest Trends in Engineering and Technology (IJLTET) Vol. 4 Issue 1 May 2014.

[4] V.Bonato, A. Sanches, M.Fernandes, J.Cardoso, E.Simoes, and E.Marques, "A Real Time Gesture Recognition System for Mobile Robots", International Conference on Informatics in Control, Automation, and Robotics, August 25-28, Set-bal, Portugal, 2004, INSTICC, pp. 207-214..

[5] R. H. Liang, M. Ouhyoung, a real-time continuous gesture recognition system for sign language Face and Gesture Recognition, 1998, pp.558–565.

[6] Gowri Shankar Rao, D. Bhattacharya, Ajit Pandey and Aparna Tiwari, "Dual Sensor Based Gesture Robot Control Using Minimal Hardware System", International Journal of Scientific and Research Publications, Volume 3, Issue 5, May 2013.

[7] R. Posada Gomez, L. H. Sanchez Medel, "A Hand Gesture System of Control for an Intelligent Wheelchair", Proc. ICEEE, pp. 68-71, 5-7, Sept. 2007.

[8] S Van Delden, "Visual Detection of Objects in a Robotic Work Area Using Hand Gestures", IEEE International Symposium On Robotic and Sensors Environments (Rose), 2011.

[9] Nguyen Kim-Tien, Nguyen Truong-Thinh and Trinh Duc Cuong, "A Method for Controlling Wheelchair Using Hand Gesture Recognition", Robot Intelligence Technology Applications 2012-Advances in Intelligent Systems and Computing Volume 208, 2013, pp. 961-970.