NOVATEUR PUBLICATIONS
INTERNATIONAL JOURNAL OF INNOVATIONS IN ENGINEERING RESEARCH AND TECHNOLOGY [IJIERT]
ISSN: 2394-3696
VOLUME 2, ISSUE 4, APR.-2015

HAND GESTURE BASED HOME AUTOMATION FOR VISUALLY CHALLENGED

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ABSTRACT

Rehabilitation engineering is the application of engineering sciences and technology to improve the quality of life for the people with disabilities. A device is designed for the visually challenged people to aid them in operating the home appliances individually. A Microelectromechanical Systems (MEMS) accelerometer is used to sense the accelerations of a hand in motion in three perpendicular directions that is (x, y, z) and transmitted to wireless protocol using Radio Frequency (RF). The RF signals transmission frequency is 2.25 GHz. The gesture code templates are already stored in the microcontroller at the receiver section. The received gestures and the hand gesture shown by the visually challenged is recognized and compared with the templates stored in the receiver. If the templates match the stored templates, then accordingly the home appliances are controlled.

KEYWORDS:- Microelectromechanical Systems; Radio Frequency

INTRODUCTION

Blindness means inability to see, lack of visual perception due to physiological and neurological factors. Blind people need some self assistance in carrying out some basic activities at home. As per the statistics given globally 285 million people are visually impaired, 39 million blind and 246 with low vision. Blindness is the condition of visual impairment. Blindness also occurs in combination with epilepsy, hearing impairments, intellectual disability, cerebral palsy, autism disorders and many others. A blind person feels difficult in controlling the home appliances. The recent technologies contribute a sophisticated life for the blind people.

The authors [1] designed a Radio Frequency technology based home appliance control system through voice and mobile for visually impaired and physically challenged people. In[2] a mobile technology based home automation system is established based on the Short Message Service/General Packet Radio Service mobile phone and microcontroller. The AT modem driver, power failure resilient and text based command processing software output for facilitating the microcontroller in sending and receiving data through cell module is designed along with the

development of java application to send and receive commands for controlling the home appliances. A device is developed to recognize eight hand gestures based on the signal from three axes MEMS accelerometer. Based on the gestures, commands are displayed on the Liquid Crystal Display (LCD) and played using speaker[3]. The authors proposed a three various gesture recognition models for recognizing seven hand gestures. Three accelerometers detect the accelerations of hand motion in three directions and transmit the data to the personal computer through a wireless Bluetooth protocol[4]. A hand gesture based human computer interaction system is designed with a small hand worn wireless module that consists of 3 – axis accelerometer and a wireless Zigbee transceiver with microcontroller[5]. A Global System for Mobile Communication (GSM) based home automation system is integrated with Internet and speech recognition modules to pave way for remote control of home appliances[6]. The obstacle recognition system using ultrasonic sensor, DRFC (Duplex Radio-Frequency Camera) and GPS technique is developed[7] for the visually impaired person. A wireless voice recognition system is build up using LabVIEW to control the electrical appliances at home[8]. A wireless home automation system is fuelled to meet the needs of elderly and disabled people by employing voice commands, touch screen responses and Zigbee technology to control the lights and other electrical appliances at home[9]. In[10] authors discussed in controlling home appliances through voice to text SMS and mobile is used as a remote control to benefit the visually challenged and elderly people.

PROPOSED SCHEME

A MEMS accelerometer based home automation system is designed for visually challenged and partially paralyzed persons. The system comprises accelerometer, microcontroller, RF transmitter and receiver and the communication is through RF signals. The accelerometer senses the hand gestures and signals are transmitted to receiver section through RF transmitter. RF receiver receives the transmitted signal compares with the already stored gestures, only when the similar hand gestures are identified, then the home appliances are controlled.

2.1 RF Transmitter Section

The hand gestures are sensed using three MEMS accelerometers placed in the gloves to be worn by the person. The sensed signals are given to the PIC microcontroller that is powered by 5V. The signals from PIC microcontroller is given to the RF transmitter and Liquid crystal display. The LCD displays the status of the home appliance to be controlled. The RF transmitter operates at a frequency of 434 MHz, transmits the signal to the RF receiver.

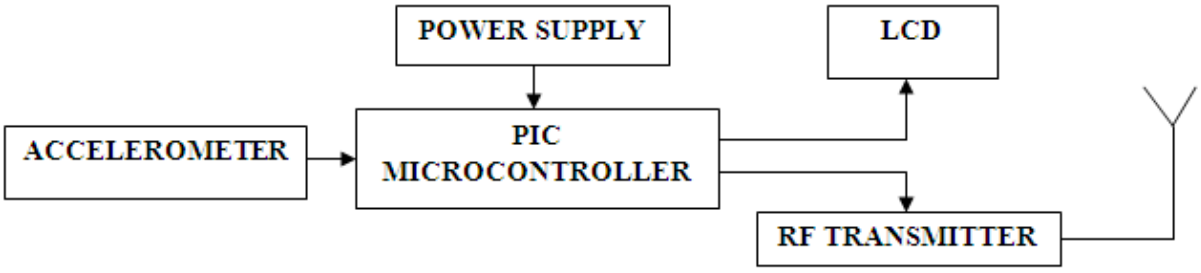

Fig.2.1. Block Diagram of RF Transmitter section

2.2 RF Receiver Section

The transmitted data is received by an RF receiver operating at the same frequency as that of the transmitter. The received signals are given to the PIC microcontroller that compares the received and stored hand gestures, and then the signals are given to the home appliances to control them.

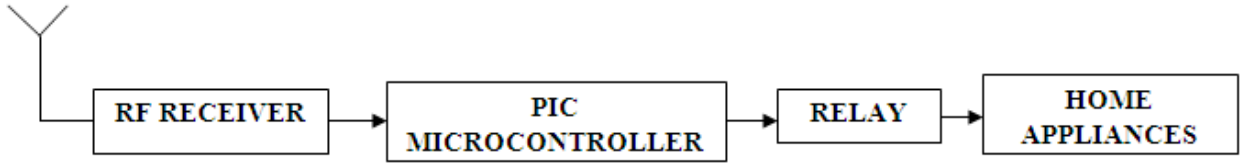

Fig.2.2. Block Diagram of RF Receiver section

SYSTEM DESIGN

3.1 MEMS Accelerometer

MEMS accelerometers shown in fig.3.1 are micro-electromechanical systems basically used to measure the static and dynamic force of acceleration. In the proposed work three accelerometer sensors are used for interaction with home appliance using recognized hand gestures.

Fig.3.1MEMS accelerometer

3.2 Microcontroller

The microcontroller is the controlling unit of the device that controls all the operations. PIC16F877A employs Reduced Instruction Set Computer (RISC) Architecture, is an 8-bit Microcontroller System. The microcontroller receives the hand gesture signal from the accelerometer sensor and it provides the signal to the transmitter unit and display unit.

3.3 RF Transmitter

In fig.3.2. the RF transmitter shown operates at a frequency of 434 MHz. An RF transmitter receives serial data from controller and transmits it wirelessly through RF antenna. The transmission occurs at the rate of 1Kbps - 10Kbps.

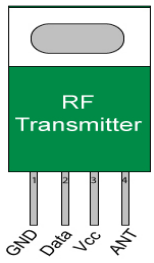

Fig.3.2 RF Transmitter

3.4 Liquid Crystal Display

A liquid crystal display is a flat panel electronic visual display, based on the properties of liquid crystals. Depends upon the hand gesture received, LCD displays the status of the home appliance to be controlled.

3.5 RF Receiver

The wireless RF receiver in fig.3.3 receives the data with an operating frequency of 434MHz, same as that of the transmitter. The RF receiver works well with microcontroller to create a simple wireless data link. The received radio frequencies are sent to the microcontroller.

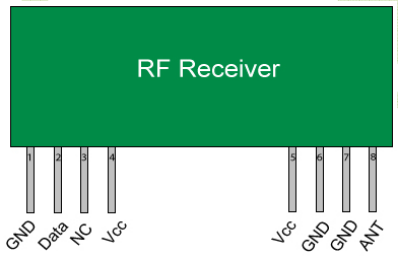

Fig.3.3 RF Receiver

3.6 Relay

A relay is an electromechanical device that is triggered by an electrical current shown in fig.3.4. The current flowing in one circuit can switch ON and OFF a current in another circuit. Relays are employed in this device to switch ON and OFF the home appliances.

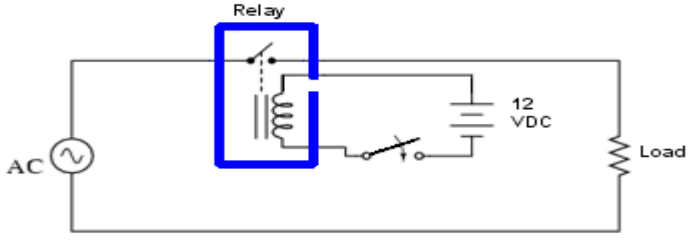

Fig.3.4 Relay Circuit

RESULTS AND DISCUSSION

The MEMS accelerometer recognizes four types of hand gestures such as UP, DOWN, HORIZONTAL and VERTICAL. The three direction accelerometer accelerates the hand gestures and the signals are sent to the microcontroller at the receiver section. The reference gestures are already stored in the microcontroller at the receiver as templates. The received inputs are matched with the reference gestures, based on the corresponding gesture recognition devices are controlled. The gesture UP is meant to turn ON the fan, DOWN gesture to turn OFF fan, HORIZONTAL gesture to turn light ON, VERTICAL gesture to turn light OFF. The various hand gestures can be used in controlling the different home appliances. Fig 4.1 shows the hardware of transmitter unit and Fig 4.2, 4.3, 4.4 shows the hardware of receiver unit during light, Fan ON and OFF state.

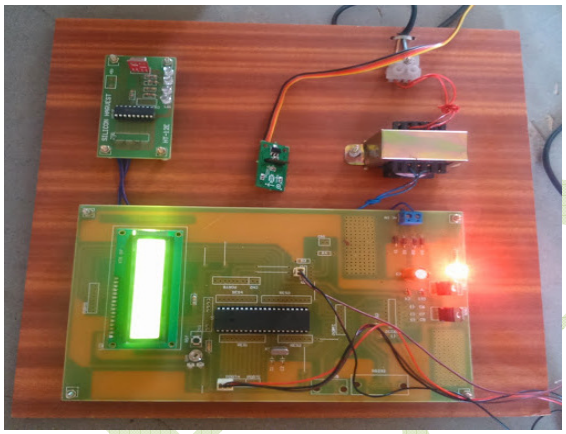

Fig. 4.1.Hardware of Transmitter Unit

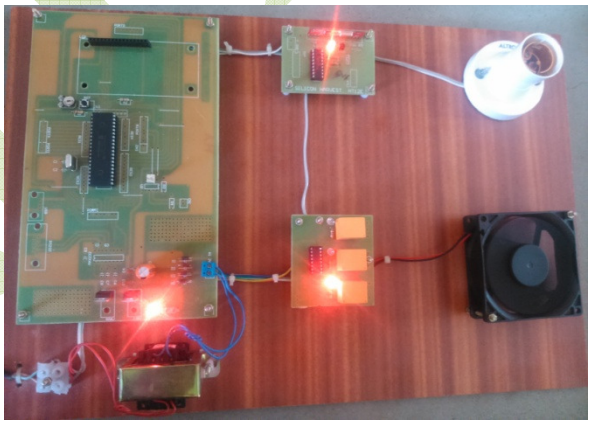

Fig. 4.2.Hardware of Receiver Unit (Fan ON)

Fig. 4.3.Hardware of Receiver Unit (Light ON)

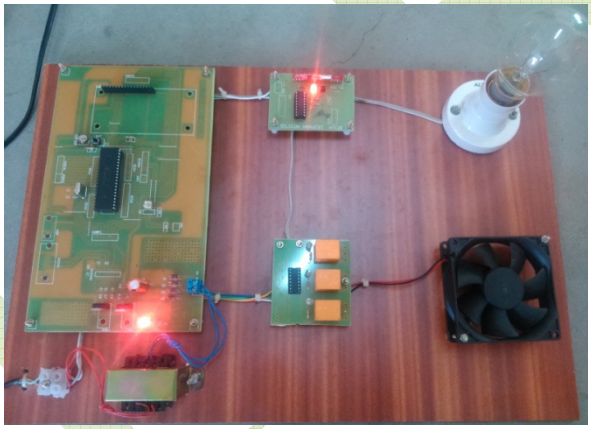

Fig. 4.4.Hardware of Receiver Unit (Light OFF and Fan OFF)

CONCLUSION

The stored gesture in the receiver section is compared with the hand gestures shown by the visually challenged. The stored template matches with the received inputs then the LCD displays the comments in regard to the home appliances controlled. The two devices controlled are fan and light for compactness of the device design. In future more home appliances can be controlled by incorporating those devices with newer versions of gestures, also implemented in every home at low cost. The device helps the aged persons too.

REFERENCES

[1] Ramya V and Palaniappan B Article*: Embedded Home Automation for Visually Impaired, International Journal of Computer Applications 41(18):32-39, March 2012. Published by Foundation of Computer Science, New York, USA. BibTeX.*

[2] Van Der Werff M J, Xu W L, Gui X, *Activation of Home Automation System via Mobile Technology, In RCO.Ed (Ed.) ENZCon'04: Proceedings of the Eleventh Electronics New Zealand Conference. pp. 235 – 240.*

[3] Alice Linsie A, Mangaiyarkarasi J, *Hand Gesture Recognition Using MEMS For Specially Challenged People, International Journal of VLSI and Embedded Systems-IJVES, Vol 04, Issue 02; March - April 2013, pp. 238-241.*

[4] Ruize Xu, Shengli Zhou, and Wen J. Li, *MEMS Accelerometer Based Nonspecific-User Hand Gesture Recognition, IEEE SENSORS JOURNAL, VOL. 12, NO. 5, MAY 2012, pp. 1166 – 1173.*

[5] Wan S1, Nguyen HT, *Human Computer Interaction using hand gesture, Conf Proc IEEE Eng Med Biol Soc. 2008;2008:2357-60.*

[6] Yusekkaya B, Kayalar A.A, Tosun M.B, Ozcan M.K, Alkar A.Z, A GSM, *Internet an Speech Controlled Wireless Interactive Home Automation System, IEEE Transactions on Consumer Electronics Volume 52 Issue 3, August 2006, pp. 837-843.*

[7] Do-Hoon Kim, Chungbuk, Cheongju,, Heung-Gyoon Ryu, *Obstacle recognition system using ultrasonic sensor and Duplex Radio-Frequency Camera for the visually impaired person, 13th International Conference on Advanced Communication Technology (ICACT), February 2011, 326 – 329.*

[8] Arthi.J.E, Jagadeeswari M, *Control of Electrical Appliances through Voice Commands, IOSR Journal of Electrical and Electronics Engineering (IOSR-JEEE), Volume 9, Issue 1 Ver. V (Feb. 2014), pp. 13-18.*

[9] Kirankumar T, Bhavani B., *A Sustainable Automated System for Elderly People Using Voice Recognition and Touch Screen, International Journal of Science and Research (IJSR), Volume 2 Issue 8, August 2013, pp.265-267.*

[10] Faisal Baig, Saira Beg, Muhammad Fahad Khan, *Controlling Home Appliances Remotely through Voice Command, International Journal of Computer Applications (0975 – 888),Volume 48– No.17, June 2012, pp. 1-4.*