



Automatic Hand Gesture Based Remote Control for Home Appliances

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Abstract-- Hand gesture based electronic device control is gaining more importance nowadays. Most of electronic devices focus on the hand gesture recognition algorithm and the corresponding user interface. This project presents an accelerometer mostly based on hand gesture recognition algorithm which is used to control electronic/electrical devices. The hardware module consists of an accelerometer, microcontroller, infrared transmission module for sensing and collecting accelerations of hand motions. Users can use this hardware module to control the infrared devices by making hand gestures. The hand gestures made are determined by the accelerometer and are transmitted wirelessly to a target device. Dynamic hand gesture tracking and recognition system can simplify the way humans interact with consumer electronic equipments. With the development of modern technology and Android smart phone, people are benefitted more and more. Bluetooth technology, which aims to exchange data wirelessly in a short distance using short-wavelength radio transmissions. For the devices which do not use IR (infrared), Bluetooth is providing a necessary technology to create convenience and controllability. Considering its normal working area of within short range, it is especially useful in a home environment which includes centralized control of home appliances. With dramatic increase in smart phone users, smart phones have become an all-purpose portable device and is helping people for their daily use.

Keywords—Accelerometer, Hand gesture, IR, Bluetooth

I. INTRODUCTION

Gesture is defined a motion of limbs or any other body part which are made to emphasize speech. It can also be defined as an act or a remark made as a sign of attitude. A gesture is scientifically categorized into two distinctive categories: dynamic and static. A waving hand means goodbye is an example of dynamic gesture and the stop sign is an example of static gesture. It is necessary to explain all the static and dynamic gestures over a period of time in order to understand full message. Gesture recognition is interpretation of human motion by computing device. Hand gesture can be detected by controller that contains accelerometers to sense tilting and acceleration of movement.

The basic purpose of this system is to provide a means to control electronic devices (capable of infrared communication) using hand gestures. Thus, this system will act like a remote control for operating all the consumer electronic devices present in a house, but this will be achieved through hand gestures instead of pushing buttons. Gestures can be recognized by using sensors, accelerometer etc. Accelerometer-based gesture recognition performs matching or modeling in time domain, there is no feature extraction stage. The detected and recognized hand gestures are used as the command signals for controlling devices, Some user interfaces, e.g., icon-based interface or motion-based interface are adjusted accordingly in order to support natural hand control.

Hand Gesture Based Remote is a device to replace all other remotes used in households and perform all their functions. Normally in homes, remotes are used for appliances like TV, CD player, Air Conditioner, DVD Player and Music System. Remotes are also used for lights ON/OFF control, Door Opener etc. All these devices can be controlled by one Universal Remote. Though the technology is synchronized for all remotes (Infrared Transmission and ON/OFF modulation in the range of 32-36 KHz), there is no agreed convention on code format for data transmission. Communication between remote and appliances is established by following a predefined code.

The Bluetooth wireless technology is set to revolutionize the way people perceive digital devices in our homes and office environment. This wireless technology is useful in home environment, where there exists an infrastructure to interconnect home appliances. This technology is suitably used for home automation in a cost-effective manner.

Nowadays, it is almost impossible for home inhabitants to go for a day without interacting with the home appliances. Although remote control of “home appliances” such as TV, DVD, windows, lights, etc. serves well for ordinary people with acceptable physical or emotional comfort, they can provide more for the dignity, security, and well-being of elderly or disabled people. One can imagine a situation where a person has lost some of his/her physical mobility. In the absence of suitable controls, he/she would need a caregiver to assist with the operation of home appliances, with the attendant expense and loss of independence and privacy. But with adequate assistance, this person might be able to live independently at his/her home. The current home appliances are often equipped with remote controllers operating via infrared (IR) light signals. Each household is likely to own several remote controllers, which are often incompatible with

each other and have different structure. The concept of universal remote control was developed in order to merge different remote control devices into single device.. A URC learns IR command sets from each appliance and operates the appliance selected by a user. There are two fundamental steps involved in the control procedure of a URC: target object selection and command issuing. To select a target object for operation, a user might press a button, turn a rotary wheel, or touch an icon depending on how the panel of the URC is designed. To issue a command, a user needs to point the controller to the target appliance and press a specific button on the controller. Subsequently, the controller emits the infrared signal to the selected appliance for the specified operation.

II. DESIGN OF THE SYSTEM

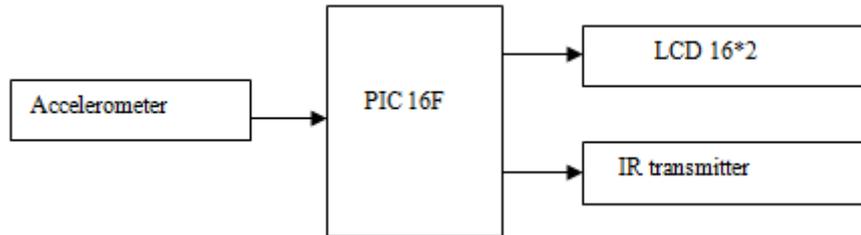


Fig: Block diagram of transmitter section

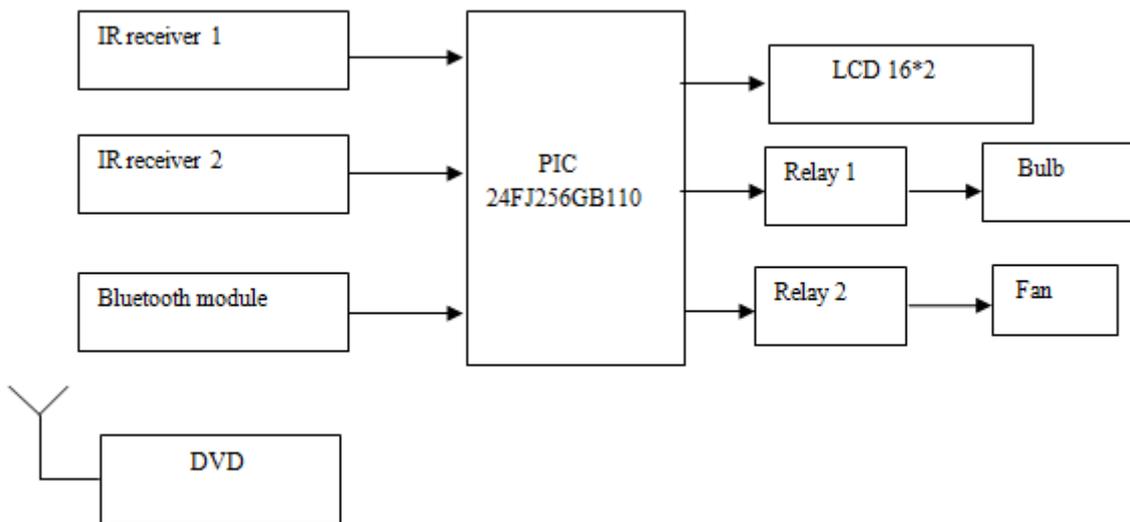


Fig: Block diagram of receiver section

A. Work flow of the system

- 1) *Accelerometer*: It is used for making the gestures. Gestures made are up, down, left, right. It basically operates in tri-axial mode but for convenience we are just considering the 2 axes.
- 2) *IR transmitter and PIC microcontroller 16F*: The data to be transmitted is given to micro-controller through accelerometer. Then the data is converted into digital form with the help of inbuilt A/D Converter present in micro-controller. The digitized data is then transmitted through IR LEDs.
- 3) *Bluetooth module*: In this, the commands for controlling the device is given through the mobile/smart-phone. The Bluetooth module at the receiver then accordingly controls it. The devices which are to be controlled by the Bluetooth are bulb, fan.
- 4) *IR receiver and PIC24F*: In the receiver section, IR signals are detected by IR receiver module. PIC 24 is SFM which has 4 UARTs, of which first is used to control the devices using Bluetooth, second is for fan and the third is for bulb. Based on the hand gestures made at the transmitter, the devices (bulb, fan, DVD player) connected at the receiver are controlled.

III. HARDWARE DESCRIPTION

- A. *Accelerometer*: It is used for making the gestures. Gestures made are up, down, left, right. It basically operates in tri-axial mode but for convenience we are just considering the 2 axes.



- B. *IR transmitter and PIC microcontroller:* The data to be transmitted is given to micro-controller through accelerometer. Then the data is converted into digital form with the help of inbuilt A/D Converter present in micro-controller. The digitized data is then transmitted through IR LEDs.
- C. *Bluetooth Module:* In this, the commands for controlling the device is given through the mobile/smart-phone. The Bluetooth module at the receiver then accordingly controls it. The devices which are to be controlled by the Bluetooth are bulb, fan.
- D. *IR Receiver:* In the receiver section, IR signals are detected in a IR receiver module. Based on the hand gestures made at the transmitter, the devices (bulb, fan, DVD player) connected at the receiver are controlled.

IV. SOFTWARE DESCRIPTION

A. Transmitter Section

1) For IR based devices:

1. Start.
2. Make hand gestures with the help of accelerometer.
3. These signals are then processed in the microcontroller.
4. After processing the signals are wirelessly transmitted to the receiver through IR leds.
5. Stop

2) For Bluetooth based devices:

1. Start.
2. Make commands from the smart-phone for controlling the devices.
3. These commands are then wirelessly send to the receiver.
4. Stop.

B. Receiver Section

1) For IR based devices:

1. Start
2. The signals transmitted from the transmitter section are received with the help of IR receiver module.
3. The devices are turned off/on, intensity, speed are controlled based on the hand gesture commands given at the transmitter section.
4. Stop.

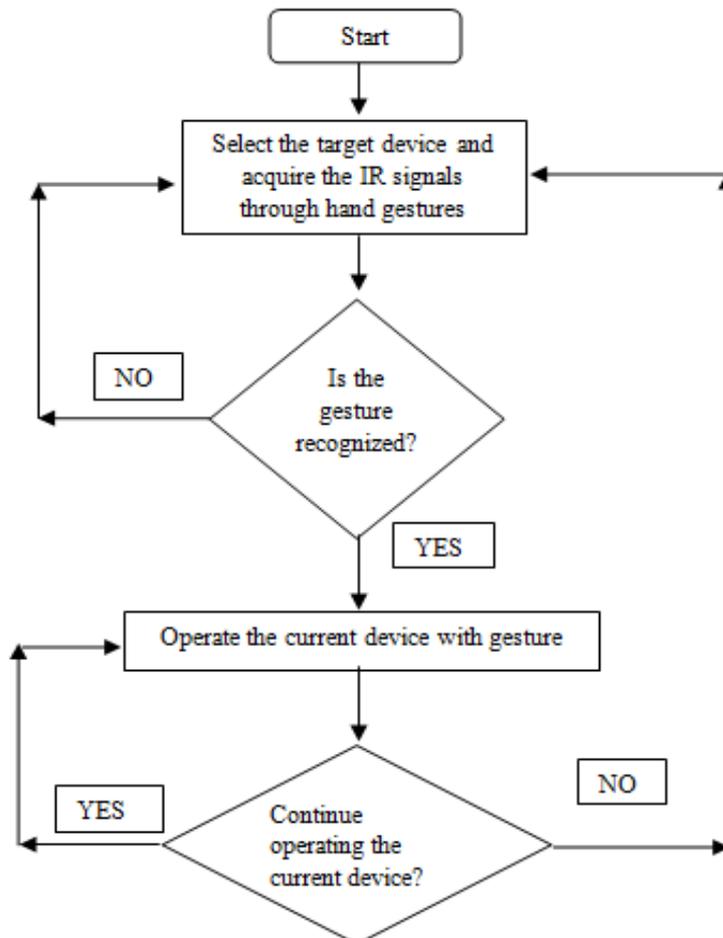


Fig: Flowchart for IR controlled devices

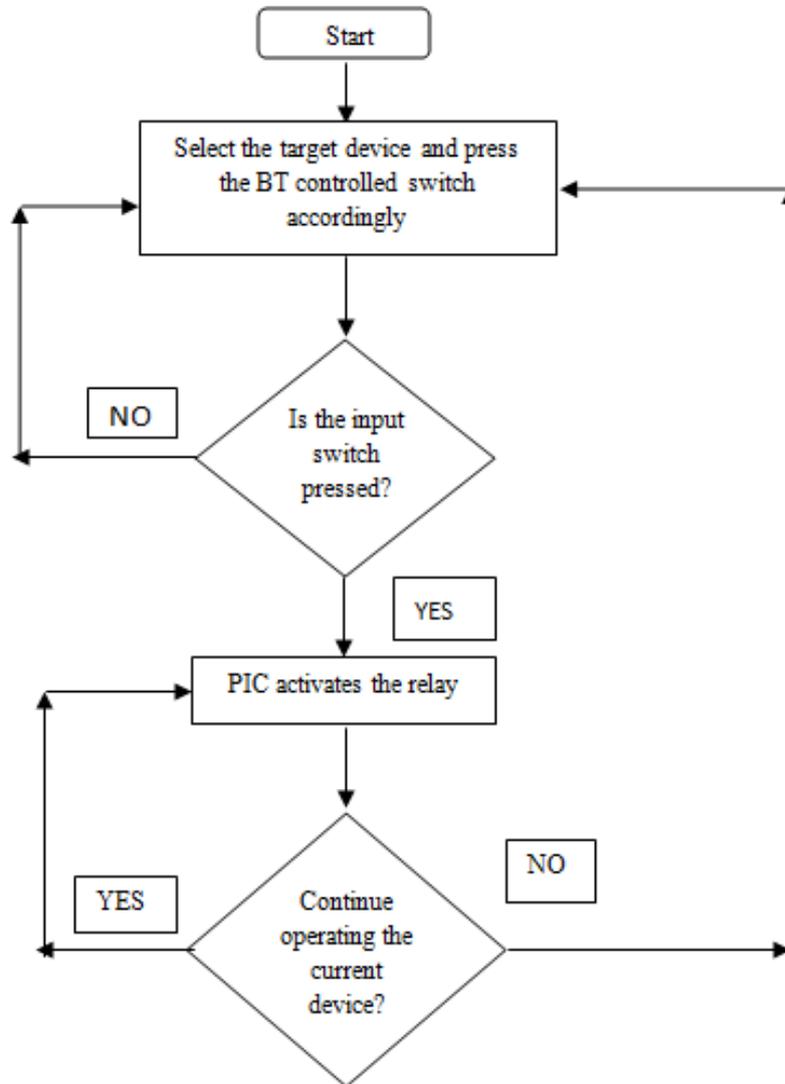


Fig: Flowchart for Bluetooth controlled devices

V. ADVANTAGES

- A) Low power requirement.
- B) Simple circuitry as it does not require special hardware.
- C) Higher security as directionality of the beam helps ensure that data isn't leaked or spilled to nearby devices as it is transmitted.
- D) Devices can be controlled more comfortably.

VI. DISADVANTAGES

- A) It has distance limit in controlling devices.
- B) Line of sight communication as transmitters and receivers must be almost directly aligned (i.e. able to see each other) To communicate.
- C) Speed: data rate transmission is lower than typical wired transmission.

VII. APPLICATIONS

- A) It can be used in any IR device.
- B) To overcome situations where normal cabling is difficult or financially impractical.
- C) It can be used in home theatre system where short distance communication is required.
- D) Suitable for physically impaired people to operate the devices within the room.

VIII. COCNCCLUSION

The objective of this project is to develop such a system which will help physically impaired to control home appliances by hand gestures using accelerometer. This provides comfort and convenience for common users as well, especially in home theatre system. Wireless Bluetooth technology is also used for home automation for physically impaired.

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