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Hand Gesture Based Home Automation

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ABSTRACT: Controlling the home appliances and electronic gadgets through an infrared remote control is now in general. But the same controlling tasks can be done more easily. The primary motive of proposing the new system of hand gesture remote control is to remove the need to look into the handheld remote and to search for a specific key for specific function. An accelerometer, gyroscope and magnetometer is used to recognize the hand gestures in 3 perpendicular directions and transmitted through wireless protocol using radio frequency. The data is received by the hub section which controls the home appliances according to the decisions made. This project proposes a simple and easy way of controlling the home appliances.

I. INTRODUCTION

Gesture is defined as a motion of limbs or any other body part which is 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. Gesture recognition is the process by which gestures made by the user are used to convey the information for device control. In everyday life, physical gestures are a powerful means of communication. A set of physical gestures may constitute an entire language, as in sign languages. A primary goal of Gesture recognition research is to create a system which can identify specific human gestures and use them to convey information or for device control. Interface with computers using gestures of the human body, typically hand movements.

Hand gesture can be detected by controller that contains accelerometer and gyroscope which is attached to the glove. It used to sense tilting and acceleration of movement. Many materials are used for the glove including leather, cotton and plastic. The cotton gloves proved to be ideal for this application, since the sensor is attached firmly and the glove can easily be removed without destroying the sensors.

The data is transmitted through an RF. The basic purpose of this system is to provide a means to control electronic devices 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. Normally in homes, remotes are used for appliances like TV, CD player, Air Conditioner, DVD etc. All these devices can be controlled by GESTO. Communication 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.

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. The GESTO is suitably used for home automation in a cost effective manner. In this system data from the xyz –axis of the accelerometer and gyroscope module is given to the transmitter. From there the encoded data is send to the receiver hub. The received data is decoded and given to the microcontroller. Decision making is done by the microcontroller using the received data. According to the decisions the device such as fan, light and music system will function.

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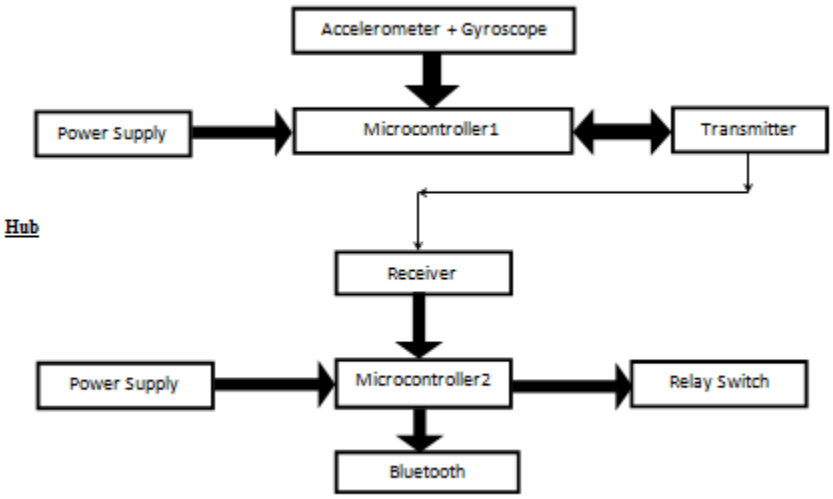
II. PROPOSED SYSTEM

Our system tries to overcome these problems and limitations. The most important aspect of our gesture control system is that it doesn't use complex hardware systems. We does not use a camera at all. We do not deal with the image extraction and its manipulation. No complex segmentations and reconstructions are made here.Apart from the techniques such as histogram, Neural Network classifier, machine reading languages we use the Arduino programming platform .The Gyroscope and accelerometer is the main component of the system. It is used to recognize the various hand gestures and send the data to microcontroller1.The microcontroller1 will send the characters to the receiver through the transmitter. The microcontroller2 which is preprogramed will make decisions according to the characters received. Various devices such as fan, light and music system will function accordingly to this decision.
This project mainly consists of a Hand Gesture Recognition section and a Control hub section. The hand gesture recognition section consists of a gyroscope and accelerometer, a microcontroller and a transmitter. The control hub consists of a receiver, a microcontroller, a relay switch and a Bluetooth module.

Gesture Recognition Section



The glove circuit consists of 3-axis accelerometer and gyroscope. The glove, a simple electronic-glove that transforms the hand movement into real time data for applications. The accelerometer and gyroscope to be attached to the glove to capture the hand gestures. Data from the xyz –axis is taken by the accelerometer and gyroscope module, and the 8bit data stream is given to the microcontroller1. The 8bit data output is then given to the transmitter from there the data is send to the receiver hub.

The receiver section consists of an RF receiver, microcontroller, relays and appliances. Once the gesture commands are recognized, control characters are sending to the specified appliance by the decision made by the microcontroller according

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to the preprogramed data. Each appliance that has to be controlled has a relay controllingcircuit. Control characters correspond to the recognized commands are then sent serially from the central controller to the appliance control modules that are connected to the home appliances.

III.CIRCUIT DIAGRAM

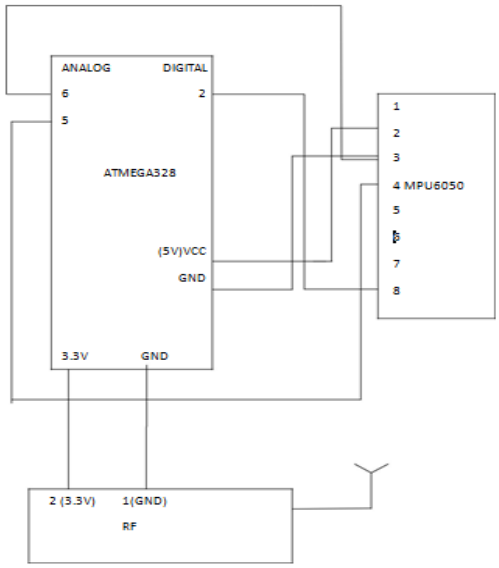

Fig. 2(a) Gesture reorganization circuit

ARDUINO UNO

The Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again. Arduino has been used in thousands of different projects and applications.

ACCELEROMETER AND GYROSCOPE

The MPU-6050 devices combine a 3-axis gyroscope and a 3-axis accelerometer on the same silicon die, together with an on board Digital Motion Processor (DMP), which processes complex 6-axis Motion Fusion algorithms. The device can access external magnetometers or other sensors through an auxiliary master I²C bus, allowing the devices to gather a full set of sensor data without intervention from the system processor. The MPU6050 has 6 built in 16 bit ADC channels, three for the gyroscope outputs and three for the accelerometer outputs. It communicates with the microcontroller using the I2C protocol.

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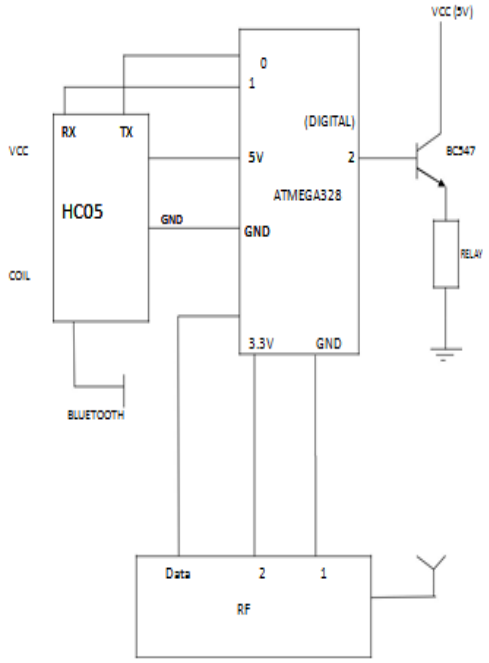

Fig.2 (b) Hub circuit

RF MODULE

An RF module (radio frequency module) is a small electronic device used to transmit and/or receive radio signals between two devices. In an embedded system it is often desirable to communicate with another device wirelessly. This wireless communication may be accomplished through optical communication or through radio frequency (RF) communication. For many applications the medium of choice is RF since it does not require line of sight. RF communications incorporate a transmitter and/or receiver.

This RF module comprises of an RF Transmitter and an RF Receiver. The transmitter/receiver (Tx/Rx) pair operates at a frequency of 434 MHz. An RF transmitter receives serial data and transmits it wirelessly through RF through its antenna connected at pin4. The transmission occurs at the rate of 1Kbps - 10Kbps.The transmitted data is received by an RF receiver operating at the same frequency as that of the transmitter. The RF module is often used along with a pair of encoder/decoder. The encoder is used for encoding parallel data for transmission feed while reception is decoded by a decoder.

BLUETOOTH: HC05

Bluetooth is a wireless technology standard for exchanging data over short distances (using short-wavelength UHF radio waves in the ISM band from 2.4 to 2.485 GHz) from fixed and mobile devices andbuilding personal area networks (PANs). It can connect several devices, overcoming problems of synchronization.

HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. Serial port Bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps

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Modulation with complete 2.4GHz radio transceiver and baseband. It uses CSR Blue core 04-External single chip Bluetooth system with CMOS technology and with AFH (Adaptive Frequency Hopping Feature). It has the footprint as small as 12.7mmx27mm.

IV. CONCLUSION&FUTURE SCOPE

The goal of our project was to design a useful and fully functional real-world product that efficiently translates the movement of hand to electrical signals that can control the home appliances. Our motivation is to help differentially able people to control the electrical appliances more easily. The gesture control automation system uses a glove to recognize the hand positions and outputs onto a display and control the electronic devices like fan, light, music system etc. The system was trained and tested for multiple users successfully. The proposed system has the advantage of low power consumption, simple hardware and hand gestures, easy to operate and user friendly.
This system can be implemented in in human-computer interaction since gestures are desired to play an important role. In future an RFID card can be used to identify the rooms and hence the system can be implemented for multiple rooms. By adding a barometer and magnetometer the degree of freedom of hand gestures can be increased. This system can be used in the future for sign language, robotics, games and various other applications.

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