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Mobile orientation based home automation for disabled and physically challenged

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ABSTRACT

In this paper we present a new way of controlling our home appliances by changing the orientation of the mobile phone. This solution helps the disabled and physically challenged people to easily control appliances without moving from one place to another. This method provides several advantages over traditional home automation interfaces. As the mobile phone consists of many built in sensors like Proximity Sensor, Accelerometer, Gyroscope, etc. By this proposed method we can retrieve more from what the mobile phones are capable of. The values of change in perpendicular directions that is (x, y, z) are transmitted to controller module (Arduino Nano) using Bluetooth Technology with the help of an android application. Particular symbol codes are programmed at the controller end to perform specific tasks.

Keywords— Accelerometer, Android Application, Bluetooth Technology, Arduino Nano.

1. INTRODUCTION

There are number of persons who are disabled or physically challenged and therefore dependent on others due to loss of self-mobility. Disability might be blindness i.e., 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. Home automation technology is used in a growing number of households today. With more products on the market and various companies competing for business, these products are becoming more affordable and accessible than they have ever been. Perhaps one of the best uses for home automation technology is to keep people with disabilities and the elderly safe and comfortable, especially if they do not live near their loved ones. The following are three ways that home automation can be beneficial: Easier Home Access, Control Home Comfort, Automatic Control with Sensors.

2. PROBLEM STATEMENT

The main objective of this project is to utilize the capability of mobile phone for controlling the home appliances. This project aims to provide an easy way to disabled and physically challenged to control appliances in a cost effective manner.

3. RELATED WORKS

For achieving this goal there are various approaches which are as follows:

3.1 Vision based hand gesture recognition

Vision based Gesture recognition has the potential to be a natural and powerful tool supporting efficient and intuitive interaction between the human and the computer. Visual interpretation of hand gestures can help in achieving the ease and naturalness desired for Human Computer Interaction (HCI). This has motivated many researchers in computer vision-based analysis and interpretation of hand gestures as a very active research area.

3.2 Hand Gesture Based home automation

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. 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.

3.3 Bluetooth based home automation

Home automation system is designed which can be controlled by any smartphone. The automation system connects with the smartphone through Bluetooth. The smart phone sends control signals to switch home appliances ON or OFF by an android app through Bluetooth interface.

3.4 Internet based home automation system

Home automation system allows controlling home appliances through a remote. The remote can be an IR remote, RF remote or even a mobile phone. An internet based home automation system could be most accessible setup because such a system can be controlled from anywhere and anytime. Like, one is returning home and before leaving office and getting into the car, he can switch on the AC of his living room so that by the time he reaches home, the living room is already cooled. Such an advantage can be availed only on a home automation which is controlled over the internet.

4. INTRODUCTION TO THE SYSTEM

As we know that smartphones are the perfect combination of multiple hardware and sensor modules in a cost effective and compact manner, so why don't we utilize it to its fullest. In our approach for developing Mobile orientation based home automation we are going to develop prototype model of a house. By using MIT App Inventor we have made an android application which detects the orientation of the mobile phone by capturing the data of inbuilt accelerometer and sends the signal accordingly to the controller with the use of Bluetooth technology. These signals are received at the controller end through which the relay module is connected which performs the switching actions accordingly. With the help of this system we are able to eliminate the cost of accelerometer and Bluetooth module which is traditionally used in the systems available. We are also utilizing the capability of the smart phone because it consists of many in built sensors which are not used all the time. And one of the major advantage of this proposed system is that now everyone has a smartphone with them and according to statistics the number of smartphone users in India is estimated to increase to about 442.5 million in 2022.

5. SYSTEM DESCRIPTION

5.1 Android application

Android application is a software running on Android OS. In our project we are building the application using MIT Application Inventor. In our application we will be collecting information of coordinates in 3 dimensional corresponding to the orientation of our phone using inbuilt accelerometer and assigning particular coordinate values to the switching ON or switching OFF mechanism of the home appliance.

5.2 Bluetooth transmission

Bluetooth is based on exchange of data between various devices over a short distance wirelessly. It is standardized as IEEE 802.15.1. In our project we are using the smartphone inbuilt Bluetooth Technology for transmission of signals from the application to the Bluetooth module attached to microcontroller Arduino Nano.

5.3 Controlling the relay module

A relay module is a hardware used to perform switching mechanism i.e., turn on or off a circuit associated with it. We are using relay module to switch ON or OFF a home appliance. It accepts control signals from microcontroller and correspondingly it either turns ON or OFF a particular home appliance.

6. PROPOSED SYSTEM

6.1 Proposed method

The method which we are using for controlling home appliances is based on the orientation of the smartphone, i.e. the home appliance will either turn ON or turn OFF corresponding to particular orientation of the smartphone. We are using an application for android smartphone which we've created using MIT app inventor. App will use the (x, y, z) coordinates determined through inbuilt accelerometer to know the orientation of the smartphone. Particular values of (x, y, z) which are determined from a particular orientation are assigned a signal which will represent either switch ON or switch OFF for a particular home appliance. In this method we will be using a smartphone with inbuilt accelerometer sensor and Bluetooth along with Arduino Nano and a relay module.

6.2 System Overview

- (a) **Accelerometer:** Accelerometer is an inbuilt sensor in a smartphone which detects the tilting motion and orientation of the smartphone.
- (b) **Bluetooth technology:** Bluetooth is a wireless technology used to transfer data between various Bluetooth enabled devices over a short distances.
- (c) **Arduino Nano:** The microcontroller which we are using is Arduino Nano. It is a compact board based on the ATmega328 (Arduino Nano 3.x) or ATmega168 (Arduino Nano 2.x). It is powered by a Mini-B USB cable, 6-20V unregulated external power supply to pin 30 or 5V regulated external power supply to pin 27. It has 14 Digital I/O pins and 8 Analog Input pins.

(d) **Relay module:** Relay module is a hardware device used for switching of devices remotely. Devices can be remotely powered ON or OFF by using relay module.

6.3 Block diagram

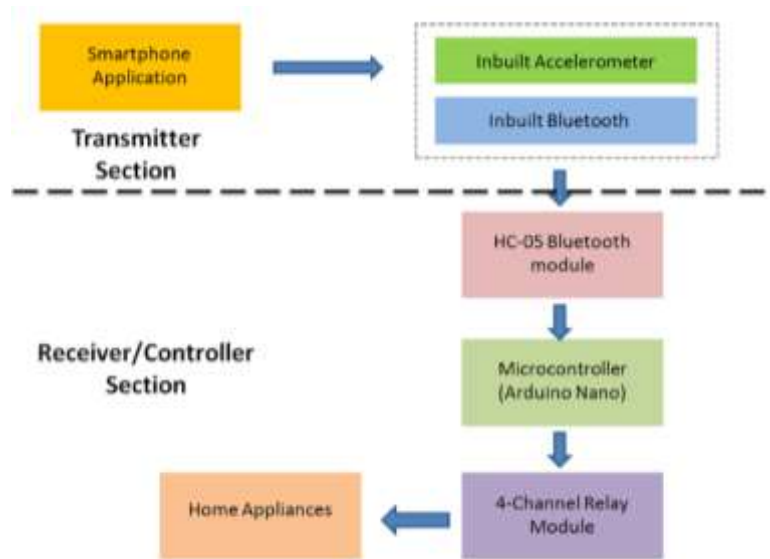


Fig. 1: Block Diagram

7. METHODOLOGY

Following are the steps in our approach:

1. Designing an android application to retrieve the values perpendicular distance.
2. Determining the orientation and the synthesizing the desired signals to be transmitted.
3. Transmit the final synthesized signal to the controller using Bluetooth Technology.
4. Reception of the signal from mobile device.
5. Controlling the home appliances by sending the control signals to the relay module which performs the switching actions.

8. WORKING MODEL

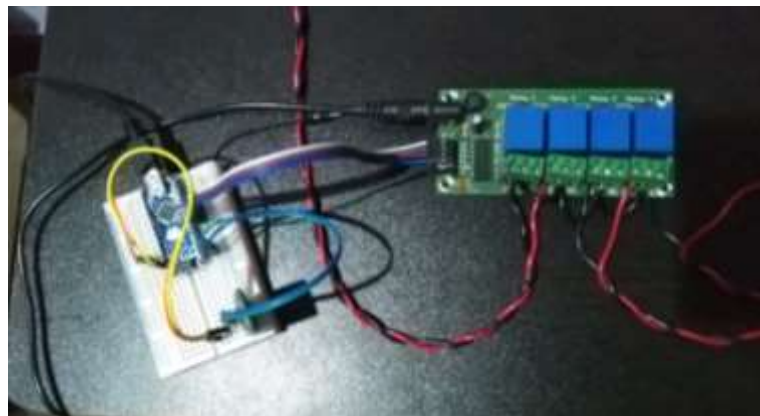


Fig. 2: Connection of Arduino Nano with Relay Module at the receiver side



Fig. 3: Home appliances which are shown by bulbs



Fig. 4: Working receiver section of the project

9. EXPERIMENTAL OUTCOMES



Fig. 5: Bluetooth not connected



Fig. 6: Pressing Connect Device bar shows nearby Bluetooth devices



Fig. 7: All appliances are OFF



Fig. 8: Tilting forward turns ON TV



Fig. 9: Tilting backward turns ON Light



Fig. 10: Tilting left turns ON Fan and right tilt turns ON AC

10. CONCLUSION

Smartphone orientation based home automation is cost effective solution since it uses built-in accelerometer and Bluetooth technology. It is physically challenged and disabled friendly way for home automation. With this method we discovered the new use of smartphones and its capabilities.

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