Capsense Based Bluetooth Home Automation

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Abstract: *In this modern world of advancement everybody wants that they can do everything through their mobile phones. In this paper we have purposed the solution of home automation through the use of Bluetooth technology with the inbuilt feature of capsense technology. The introduced system operates from Bluetooth app which is connected to the Bluetooth module of the system. Add to it, it can also control by capacitive touch on the physical board. The proposed system is implemented on a microcontroller module, through an embedded platform. Through the use of this system one can control their home appliances through their mobile phone from anywhere.*

Keywords: Capsense, Bluetooth, Home automation, Microcontroller, Relays

1. Introduction

There is an increasing demand for smart homes, where appliances react automatically to changing environmental conditions and can be easily controlled through one common device. Everything is modernising in this modern world, convenience and technology is the priority of everybody. Moreover, technology can meet the need of convenience for the sake of the humans. Home automation is considered as the residential extension of a building automation. It usually includes centralized control of lighting, heating, air conditioning, appliances, gates and doors security locks, as well parts for other purposes, in order to provide improved convenience, energy efficiency and security. It essentially offers to the users access control to devices Home automation can also offer you with the capability of providing you the safe home and no concern about the security of your home. However, for all this is to happen you will have to need various types of sensors which help you to do the monitoring of your home.

The earliest works for this systems can be traced back to the turn of the century when telephone and electrical wiring were implemented in most modern homes. In more recent times the proliferation of telecommunication technologies has re-channelled developer's efforts towards the use wireless technologies in achieving the design of a smart home. The availability of multiple wireless technologies such as Bluetooth, GSM, Infrared, ZigBee, Wi-Fi and RFIDs has made the concept "smart home" a commercially viable one.
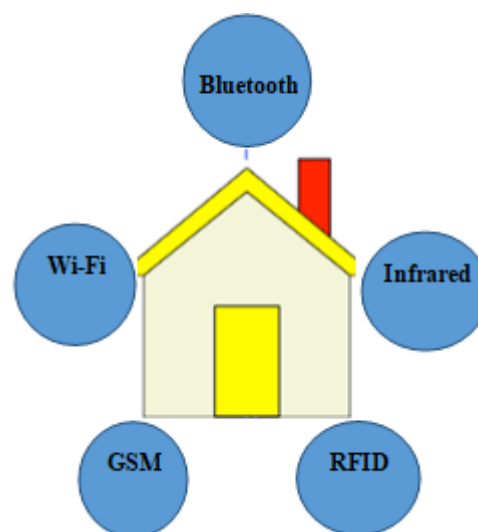

Figure 1: Different types of wireless technologies for home automation

In this paper we have proposed the solution for the home automation through the use of Bluetooth which is connected to the IOT platform through the extension of connection to the IP server. The reason behind authors have chosen the Bluetooth technology for the home automation is that a user can control their home appliances without the use of internet which is cost effective add to it, every device like smart phones and even Symbian's comes with the Bluetooth as it is the oldest wireless technology. Authors have also connected this Bluetooth technology to the IOT server which provide the user with the advantage that they can control their home appliances from anywhere in the world which is the major advantage of the IOT based Bluetooth home automation. Moreover, this system also has the capacitive touch technology on their PCB surface so that user can also control directly by the physical board without the use of Bluetooth which is the advantage when user do not have the mobile phone in their hand.

Using Bluetooth to control appliances reduces human efforts without compromising on efficiency and it also saves time, more reliable than wireless technologies like Wi-Fi and infrared etc. This circuit can be operated up to a distance of 10 to 30 metres if user is using the system through android app rather than IOT platform but it can be controlled from anywhere with the use of IOT platform. Moreover,

flexibility for new devices and appliances. Smart home system tends to be wonderfully flexible when it comes to the accommodation for new devices.

2. System Design

In this paper authors have design the home automation product with the use of various hardware components which is mentioned below:

- ULN
- Atmega16
- Relays
- LED
- Capacitors
- Resistors
- HC-05 Bluetooth module

Here authors have used the capacitor as the sensor for sensing the human touch on the PCB. Different techniques can be used to detect the human touch. It is very easy to detect the human touch as our human body has very good electrical property which provide us the advantage to detect the touch efficiently.

2.1 Capacitor as a sensor?

A capacitance switch uses only an electrode, which can be placed behind a non - conductive panel such as wood, glass or plastic. The switch works using body capacitance.

A capacitive sensor converts a change in position, or properties of the dielectric material into an electrical signal. Capacitive sensors are realized by varying any of the three parameters of a capacitor: distance (d), area of capacitive plates (A), and dielectric constant (er) which is shown by the below mentioned formula:

$$C=F (d, A, er)$$

These sensors' functionalities range from humidity sensing, through level sensing, to displacement sensing.

2.2 Bluetooth Technology

A Bluetooth technology is a high speed low powered wireless technology link that is designed to connect phones or other portable equipment together. It is a specification (IEEE 802.15.1) for the use of low power radio communications to link phones, computers and other network devices over short distance without wires. Here authors have selected HC-05 Bluetooth module. This module can be used in a master or slave configuration.

Figure 2: HC-05 Bluetooth module

2.3 ULN

ULN is a High voltage, high current Transistor Array IC used especially with Microcontrollers where we need to drive high power loads. This IC consists of a eight NPN Darlington connected transistors with common Clamp diodes for switching the loads connected to the output. This IC is widely used to drive high loads such Lamps, relays, motors etc. It is usually rated at 50v/500mA.

2.4 Architecture

Here creators have used the ESAT in place of Arduino and connected HC-05 and ULN with that. Below is the circuit diagram:
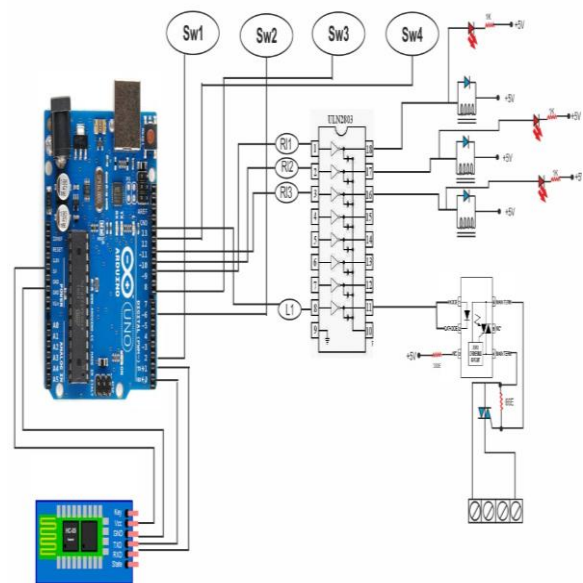

Figure 3: System architecture

3. System Implementation

As the above schematic diagram shows how the relays is controlled by the microcontroller to get your home appliances just one click away with the use of your smart phone. In addition, it can be physically control by the board also with the use of the capacitive on board touch if one does not have smart phone.

3.1 Operation

Above mentioned device provide the user with the following capabilities:

It can be controlled by the Bluetooth app and the on board touch. In addition to these capabilities, it can be controlled with the use of the server if the device is provided to the internet support through the use of Bluetooth tethering. ESAT ISP is connected with the capsense board which is then connected to the HC-05 Bluetooth module. Internet capabilities is provided through the Bluetooth tethering

3.1.1 Capsense technology
Capsense board is a development platform for building applications that use Capacitive Sensing. Board is integratedwith most of the commonly used sensors and

control block like Relays, MOSFET, ULN2803, Light sensors &Temperature Sensor. Once a finger press is introduced, a capacitance large enough to trigger a false press on a nearby sensor could be generated if positioned too close to the target sensor.An alternate method of decreasing nearby sensor sensitivity is the introduction of a ground trace betweenadjacent sensors. With the ground trace so close to each touch sensor pad, a larger base capacitance is generated. The capacitance generated with the introduction of a finger press will therefore have less of an effect on the percent shift of the oscillator frequency.

3.1.2 Bluetooth Module

Authors have selected HC-05 Bluetooth module to provide the Bluetooth capabilities to their system which is connected to the RX and TX pins of the microcontroller getting its power supply straight from the board as the board has the on board converter which convert the power supply straight to the 5V. As HC-05 Bluetooth module has 3.3 V level for RX/TX and microcontroller can detect 3.3 V level, so, no need to shift transmit level of HC-05 module. But one need to shift the transmit voltage level from microcontroller to RX of HC-05 module.

3.1.3 Internet of things

Internet of things is the technology which can connect any wireless device to the server. Future scope of this project will be connected the Bluetooth device to the server through the use of thinks speak IOT sever. But here user can only control their appliances either by the Bluetooth app or by the capsense technology. These two things can work simultaneously.
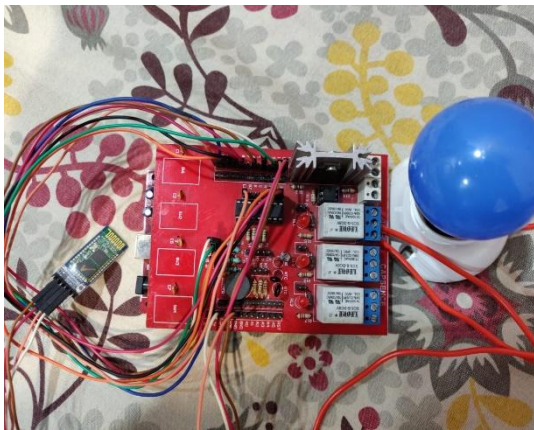

Figure 4: Image of our device

4. Conclusion

The work for Capsense based Bluetooth home automation is completed successfully with the use of ESAT ISP and capsense board connected with the Bluetooth module. It is reliable and scalable home automation system with low cost and easy to implement. It makes human life easy and comfortable. As an expansion, creators propose a non-specific IOT system and utilize distributed computing framework for interfacing.

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