ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)
Vol 5, Issue 1, January 2018

Home Automation using Bluetooth System

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Abstract: Automatic operation of performing devices is the term automation, with limited or decreased human effort. Wireless technology's reach is growing day by day. Wireless technology plays a significant role in automation in today's world. It means automation will free technology from interruption by humans. Home automation is one of the emerging technologies these days. To render it more secure and effective, low-cost communication technology such as Wi-Fi, Bluetooth would reduce costs. Bluetooth is a wireless modems used during home automation applications. It is not a strategy of operating costs, popular in use and used up to 90 meters of length. Bluetooth, used exclusively for data exchange, adds new capabilities to the smartphones. With the support of android program, we can link and monitor household appliances and provide protection for aged, elderly people. Paper's concept is to manage households electrical or electronics devices like lights, fan. It also allows for activated home security and emergency warnings. Auto off lights can save energy at night time. Smoke sensor will sense smoke or gaseous leaks, triggering app warnings on their smartphone. Our home automation works smartly by improving the quality of life and supplying consumers with convenience."

Keywords: Smart Home, Bluetooth, Android, Smart Phone, Arduino, GUI, Automation system, Protocol.

INTRODUCTION

Wireless devices are becoming more popular all over the world and customers enjoy this wireless lifestyle that offers them the relive of the well-known cable anarchy under their desk that continues to rise. Digital devices now form a network with embedded Bluetooth technologies in which appliances and apps can connect with each other. Today smart home is one of Bluetooth's main features [1]. Based on the Bluetooth system type, running over unauthorized, globally available 2.4GHz bandwidth, it can connect digital devices within a range of 9-90 m at speeds up to 2.9 Mbps. With this feature of Bluetooth this paper suggest a Bluetooth enabled home automation system. While developing a home automation program there are few issues involved. The program should be flexible to allow for the easy integration of new devices into it. It should provide the host side with a user-friendly interface, so that the machines can be easily set up, tracked, and managed.The program should also provide certain monitoring tools, so that it can be monitored if there is a problem with the system. The overall system should also be quick enough to realize the true potential of wireless technology. Finally, the device should be budget-effective so as to support its use in smart home. This paper uses smartphones and Arduino board to implement Bluetooth enabled centrally controlled home automation system [2]. Such a system will allow users to be in charge of Bluetooth lighting, a fan in his house. All that the user needs is an Android smartphone, present nowadays in almost everybody's pocket and a control circuit. Communication is formed between the microcontroller and the smartphone using Bluetooth, a common wireless technology used for data sharing. The program also focuses on smoke detection and temperature monitoring by providing application security against unauthorized users.

1.1 Protocol of Home Automation:

The protocol of home automation system supports the connectivity within a home automation network between the control systemi.e. server andhome appliances. The correspondence includes the process of initializing the system and the process of processing of the data.The protocol is built above the software stack of Bluetooth. This fits the layer concept suggested by Special Interest Group in Bluetooth [3]. The HAP was based on the core of the Bluetooth protocol architecture which consists of three stacks, taking into account the requirements of home automation environment.

1.1.1. L2CAP:

L2CAP is Logical Link Control and Adaptation Protocol used in home automation. It is a multipathing layer of the

ISSN (Online) 2394-2320

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Vol 5, Issue 1, January 2018

protocol that allows Bluetooth to multiplex three various channels with low energy. It also allows for the segmentation and reassembly of packets larger than the inherent radio can supply.In simple mode, L2CAP supplies packets with up to sixty four kilobyte of configurable payload, with 672 bytes as the maximum MTU, and 48 bytes as the minimum mandatory MTU support. With retransmission and flow control modes, L2CAP can be optimized by running retransmissions and CRC tests for stable or intermittent data per path.

1.1.2. SDP:

SDP is Service Discovery Protocol.It is used to enable equipment to discover which services support each other and which parameters to connect to each other. When connecting a mobile phone to a Bluetooth headset, for example, SDP would be used to assess which Bluetooth profiles the headset supports. SDP provides the means to locate an app for you to print, or to search through the variety of other resources that Bluetooth apps will give you in the field. To use the service create a separate (non-SDP) connection [4].

1.1.3. RFCOMM:

RFCOMM isRadio frequency communication.The RFCOMM Bluetooth protocol is a simple set of communication protocols made in addition to the L2CAP protocol including emulated serial RS-232 ports. The protocol is based on TS 07.10 of the ETSI specification. RFCOMM is often called the emulation of serial terminal. The serial port model for Bluetooth is based on that protocol.RFCOMM provides the consumer with a quick, reliable data source, similar to TCP. Most telephony-related profiles use it specifically as a carrier for AT instructions, and as a connectivity layer for OBEX over Bluetooth as well. Due to its widespread support and publicly available API on most operating systems, many Bluetooth devices use RFCOMM. In comparison, programs which have used a serial port.

The configuration process of HAP systems makes use of the improved SDP features to query system information and resources. L2CAP supports HAP data services with multiplexing protocol, segmentation, and reassembly capability [5].RFCOMM promotes wireless technology and combines house management systems with transportation capability. A typical home automation system based on Bluetooth consists of a control server and several client modules. Given the Bluetooth entry price, having multiple Device Controllers connected to a Bluetooth device will be more cost effective [6].

IMPLEMANTATION OF SMART HOME BASED ON BLUETOOTH

The smart home system uses an Android-based Bluetooth enabled phone for its operation, and the microcontroller Arduino. Key components of this system are given below.

2.1. Arduino Unit:

Arduino is an open-source, simple andcheap hardware and software-based electronics platform. Arduino boards can read inputs-light on a sensor, a finger on a button or a Twitter message-and turn it into an output-activate a motor, switch on an LED.The Arduino system has become very famous with people just beginning with, and for good reason, electronics. As comparison to most previous programmable circuit boards, the Arduino doesn't need a special piece of hardware to install new code onto the board— you can easily use a USB cable. In fact, the Arduino IDE uses a modified version of C++, which makes programming easier to learn.Ultimately, Arduino offers a standard contract factor that splits the micro-controller's functionality into a more portable bundle. The Uno is one of the most common boards in the Arduino family and an excellent choice for beginners.It includes everything required for microcontroller support [7]. The user either have to connect it to a device using a USB cable or use an AC-to-DC converter to control it. The Arduino circuit serves as a connection between the part of the program and part of the project hardware. Figure1 is showing diagram of Arduino with its pins, storage device and all other components [8].

Fig. 1: Arduino Device

2.2. Bluetooth Unit:

ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)
Vol 5, Issue 1, January 2018

Fig. 2: HC-06 Unit of Bluetooth

Bluetooth is a wireless communications technology mainly used for swapping information for short distances from fixed and mobile devices, and building personal area networks (PAN). The utilized Bluetooth module allows us to transmit and receive signals.The Bluetooth module used here is the HC-06 unit 2. It is a simple-to-use Bluetooth SPP (Serial Port Protocol) unit, designed to set up transparent serial wireless connections. The HC-06 Module Bluetooth is a master or slave module the factory environment is slave by nature. Only commands will customize the function of the module [9].No connection to another Bluetooth device can be initiated by the slave modules, but they can accept connections. Master module can open a connection with other devices. Figure 2 is showing a HC-06 unit of Bluetooth with its pins.

2.3. Android *Based Cell-Phone:*

Android is mobile device software stack that comprises an O.S, middleware, and main features. Android O.S is Linux based, and programs are rendered in java as a language running on Google's virtual machine called Dalvik. We use open source android platform for this automation system and security.Android application which consists of controlling the lists of devices as lights, fans by room. First user must start application, the username and password for authorized user is given for security purpose. If the user is approved, he will be asked to make Bluetooth ON. Then, he will have a serial communication list of available devices.When attached to HC-06 it will be navigated to the main screen consisting of a list of devices that it wants to control as it does on or off, view current temperature, set time for auto off devices at night time. As our system is based on Bluetooth technology, system includes wireless connection to mobile and Bluetooth HC-06 module.Bluetooth unit and all apps are directly connected to the Arduino Uno Board with the help of wires and breadboard [10]. It system works on client-server model, here Bluetooth is working as server in mobile, while HC-06 acts as host. Fig.3 is showing home automation based on Bluetooth controller.

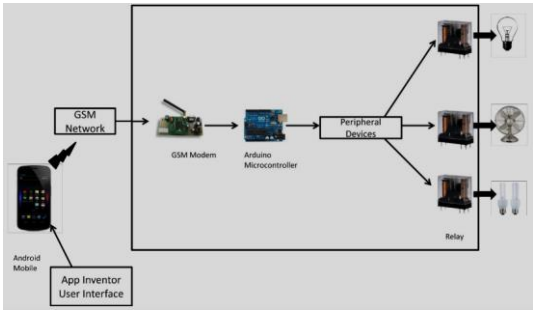

Fig. 3: Bluetooth Based Home Automation

2.4.GUI:

Android program has to start clicking on its mobile icon to monitor and control household appliances. Type the username and password, type the program and switch Bluetooth ONetc. Then matched system list appears and pick Bluetooth serial device i.e.HC-06.On the screen all lights, fan, temperature, auto off button and door safety buttons have emerged. To monitor this, click buttons ON/OFF or LOW/HIGH. Smartphone then sends its order to devices via Arduino Uno board using Bluetooth communication.Pressing the Temperature tab, a textbox displaying current room temperature has been activated. By pressing on the AUTO OFF button, the time has to be set in 12 hr format, then the lights are automatically turned off by showing telephone-side pop up warning. User-side warning message is displayed as smoke or gas leaks.Security button for Gate to be triggered at night for thief safety purpose, when door is opened buzzer starts continuous alarm sound to person alerts. Figure 4 is showing different functioning of cell phone in controlling home appliances with the help of GUI based system.

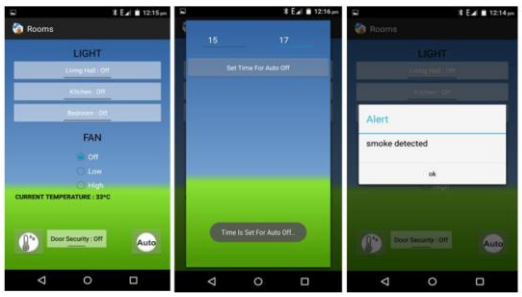

Fig. 4: Android GUI System with Different Functioning Mode

2.5. Application of Home Automation System via Bluetooth:

Application of smart home system is given below.

- Switch home appliances such as turning ON / OFF lights in each room and turning off the fan, turning it on LOW / HIGH speed within the range of Bluetooth android smartphone applications.
- In respect to the lighting management system, AUTO OFF lights can be quickly adjusted at night by arranging time to avoid power wastage in residential transit.
- Smoke detector will detect smoke or gas leakage condition triggering consumer mobile warning message illuminated.
- Capable of knowing current temperature in the room.
- If the customer is at home or out of the house security activation, if the door is opened by the thief, the buzzer begins continuing the warning tone for warn notification.

CONCLUSION

This project aimed to develop a home automation system based on wireless Bluetooth technology. The outcome is the HAP that allows users in the home environment to control and monitor different wired devices over a Bluetooth network. The aim of this paper is to developing such an application is not only for ordinary people, but also for elderly and disabled people. System allows users to monitor and control household appliances such as lamps, ventilators. By setting time it involves auto off lights at night. We can also see actual temperature.This protects residence by bringing attention when it senses smoke or spills gas. In terms of safety, windows and doors are protected by setting alarm in the event of any movement of the robbery. The concept is viable because, as opposed to other schemes, the cost is very small and easy to manage, free to use.The essence of this initiative is such that it provides great potential for further improvements. The use of security cameras, motion sensors to alert registered customers, will provide more access to house. Glass braking sensor can be used for door and window by setting greater security. In smoke weather, the owner must call to warn them and contact the fire department.

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