International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 03 Issue: 04 | Apr-2016 www.irjet.net p-ISSN: 2395-0072

Android Based Home Automation System Using Bluetooth & Voice Command - Implementation

Bhavik Pandya[1], Mihir Mehta[2],Nilesh Jain[3],Sandhya Kadam[4]

[1] *Student,Department of Computer Engineering, K.J. Somaiya Institute of Engineering & Information Technology, Maharashtra, India*
[2]*Student, Department of Computer Engineering, K.J. Somaiya Institute of Engineering & Information Technology, Maharashtra, India*
[3]*Student, Department of Computer Engineering, K.J. Somaiya Institute of Engineering & Information Technology, Maharashtra, India*
[4]*Assistant Professor, Department of Computer Engineering, K.J. Somaiya Institute of Engineering & Information Technology, Maharashtra, India*

Abstract– ***In this fast paced life of 21st century, automation plays a key role in human life. Home automation allows us to control household electrical appliances like light, door, fan, AC etc. It also provides home security and emergency system to be activated. Home automation not only refers to reduce human efforts but also energy efficiency and time saving. The main objective of home automation and security is to help handicapped and old aged people who will enable them to control home appliances and alert them in critical situations.***

This project put forwards the implementation of home automation and security system using Arduino microprocessor and Android smartphone. Home appliances are connected to the microprocessor and communication is established between the Arduino and Android mobile device or tablet via Bluetooth module. We would develop an authentication to the system for authorized person to access home appliances. The device with low cost and scalable to less modification to the core is much important. It presents the design and implementation of automation system that can monitor and control home appliances via android phone or tablet.

Key Words:*HAS, Android, Arduino, Bluetooth*

1. Introduction

Today's homes require sophistication control in its different gadgets which are basically electronic appliances. This has revolutionized the area of home automation with respect to an increased level of affordability and simplicity through the integration of home appliances with smart phone and tablet connectivity. Smart phones are already feature-perfect and can be made to communicate to any other devices in an ad hoc network with a connectivity options like Bluetooth. With the advent of mobile phones, Mobile applications development has seen a major outbreak. Utilizing the opportunity of automating tasks for a smart home, mobile phone commonly found in normal household can be joined in a temporary network inside a home with the electronic equipment. Android, by Google Inc. provides the platform for the development of the mobile applications for the Android devices. Home automation system is a mobile application developed using Android targeting its vast market which will be beneficial for the masses.

Automation of the surrounding environment of a modern human being allows increasing his work efficiency and comfort. There has been a significant development in the area of an individual's routine tasks and those can be automated. In the present times, we can find most of the people clinging to their mobile phones and smart devices throughout the day. Hence with the help of his companion – a mobile phone, some daily household tasks can be accomplished by personifying the use of the mobile phone. Analyzing the current smart phone market, novice mobile users are opting for Android based phones. It has become a second name for a mobile phone in layman terms. Home Automation System (HAS) has been designed for mobile phones having Android platform to automate an 8 bit Bluetooth interfaced microcontroller which controls a number of home appliances like lights, fans, bulbs and many more using on/off relay. This project presents the automated approach of controlling the devices in a household that could ease the tasks of using the traditional method of the switch. The most famous and efficient technology for short range wireless communication-Bluetooth is used here to automate the system. The HAS system for Android users is a step towards the ease of the

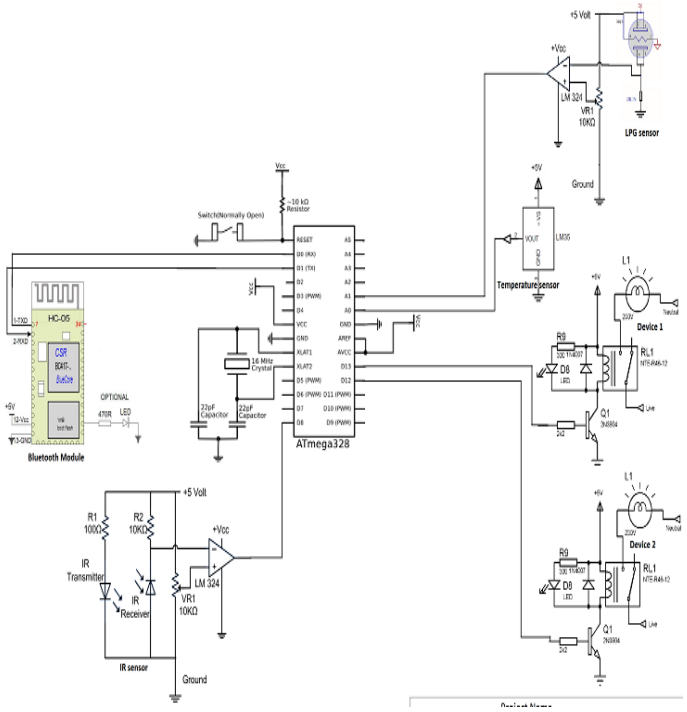
tasks by controlling one to twenty four different appliances in any home environment.

3. Proposed System

The proposed system will have following features:
1. Arduino
2. Devices controlled through android app, also through voice commands.
3. Mobile control
4. Bluetooth
5. LPG - Notification on mobile side
   - Buzzer goes on
6. Temperature - Notification on mobile side
- One device on (bi-default fan is connected to one relay)
7. Password for android app
8. If any person inside the home then automatically device turn on and vice versa.

4. IMPLEMENTATION

The circuit diagram of the proposed system is:



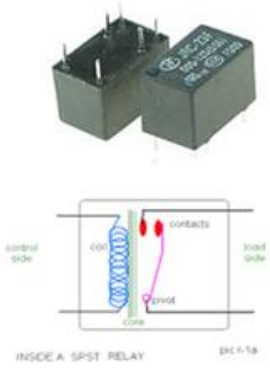
4.1 Hardware Requirements:

4.1.1 Arduino:

BLOCK : Microcontroller
TYPE : ATMEGA328
ANALOG/DIGITAL : Digital
PINS FOR INTERFACE : 20 Pins
PHOTO/CIRCUIT SYMBOL :

Arduino is a tool for making computers that can sense and control more of the physical world than your desktop computer. It's an open-source physical computing platform based on a simple microcontroller board, and a development environment for writing software for the board.Arduino can be used to develop interactive objects, taking inputs from a variety of switches or sensors, and controlling a variety of lights, motors, and other physical outputs. Arduino projects can be stand-alone, or they can communicate with software running on your computer (e.g. Flash, Processing, MaxMSP.) The boards can be assembled by hand or purchased preassembled; the open-source IDE can be downloaded for free.The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, 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.

4.1.2 Relay:

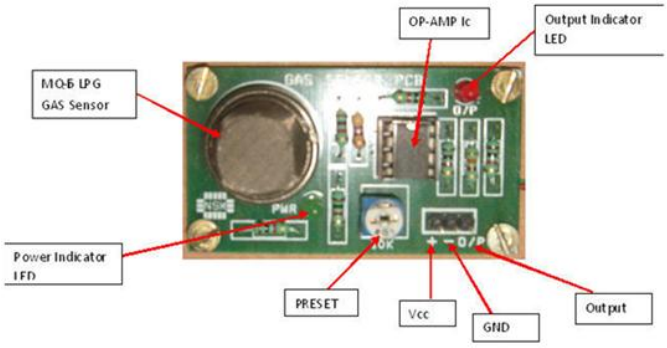


A relay is an electrical switch that uses an electromagnet to move the switch from the off to on position instead of a person moving the switch. It takes a relatively small amount of power to turn on a relay but the relay can control something that draws much more power. A relay is used to control the air conditioner in your home. The AC unit probably runs off of 220VAC at around 30A. That's 6600 Watts! The coil that controls the relay may only need

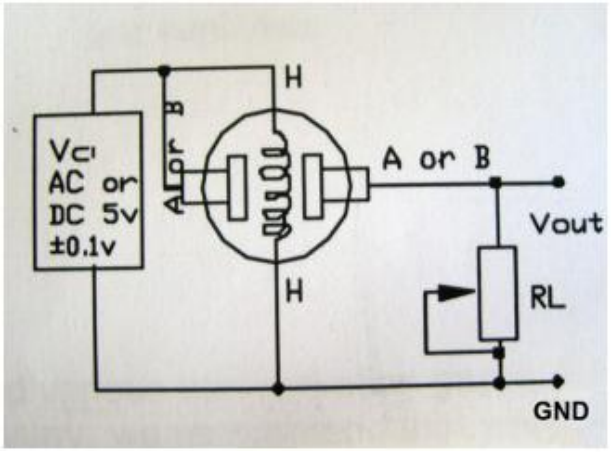
a few watts to pull the contacts together.A relay switch can be divided into two parts: input and output. The input section has a coil which generates magnetic field when a small voltage from an electronic circuit is applied to it. This voltage is called the operating voltage. Commonly used relays are available in different configuration of operating voltages like 6V, 9V, 12V, 24V etc. The output section consists of contactors which connect or disconnect mechanically. In a basic relay there are three contactors: normally open (NO), normally closed (NC) and common (COM). At no input state, the COM is connected to NC. When the operating voltage is applied the relay coil gets energized and the COM changes contact to NO. Different relay configurations are available like SPST, SPDT, DPDT etc, which have different number of changeover contacts. By using proper combination of contactors, the electrical circuit can be switched on and off.

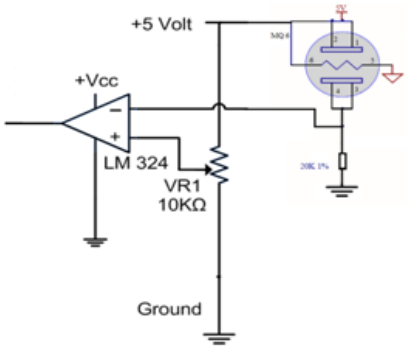
4.1.3 LPG SENSOR

BLOCK: Input
TYPE: MQ-6
ANALOG/DIGITAL: Analog
PINS FOR INTERFACE: 3Pins
PHOTO/CIRCUIT SYMBOL:



DESCRIPTION:
MQ-6 sensor is a simple-to-use liquefied petroleum gas (LPG) sensor, suitable for sensing LPG (composed of mostly propane and butane) concentrations in the air. The MQ-6 can detect gas concentrations anywhere from 200 to 10000ppm.MQ-6 semiconductor sensor is Combustible Gas Sensitive. The MQ-6 gas sensor is made up of SnO2 which has lower conductivity in clean air. A simple electro-circuit is used here which is used to convert the changing conductivity into corresponding output signal of gas concentration. Both Methane and Propane can be detected easily by MQ-6 sensor because it has high sensitivity towards Methane, Propane and Butane. It is a low cost sensor suitable for different application.
WORKING PRINCIPLE:
In TGS gas sensors the sensing material is a metal oxide, most typically SnO2. The oxygen gets adsorbed on the crystal surface with a negative charge when the metal oxide crystal such as SnO2 is heated at a particular temperature in air. The donor electrons on the crystal surface are then transferred to the adsorbed oxygen which results in leaving positive charges in the space charge layer. Thus the surface potential serves as a potential barrier against the electron flow. The electric current flows in the sensor through the combination parts (grain boundary) of SnO2 micro crystals. Adsorbed oxygen forms a potential barrier at the grain boundaries which prevents carriers to move freely. The electrical resistance of the sensor is recognized by this potential barrier. The surface density of the negatively charged oxygen decreases in the presence of deoxidizing gas which reduces the barrier height in the grain boundary. This reduced barrier height decreases the sensor resistance.The presence of dangerous LPG leakage in the cars, service station or in the storage tank environment can be detected using the Ideal Gas Sensor. This LPG gas leakage detector unit can be easily integrated into a unit that can sound an alarm or give a visual suggestion of the LPG concentration. The sensor has both admirable sensitivity and rapid response time. This sensor can also be used to sense other gases like iso-butane, propane, LNG and even cigarette smoke.The output of the sensor goes LOW as soon as the LPG sensor senses any gas leakage from the storage. This is detected by the microcontroller and the LED & buzzer is turned ON. After the delay of few milliseconds, the exhaust fan is also turned ON for throwing the gas out and it continues sending message as 'GAS LEAKAGE' to a mobile number which is pre-defined.You can use 5V DC or across H-H pins. One of the H pins goes to the power and the other one is connected to the ground. The pin A is connected between the power and the ground. The pin B gets an analog voltage when the sensor is active. Also across the output you need the resistor RL. Before you connect the resistor use a potentiometer to tune and get accurate values. Generally RL value is between 20k-200k.The alcohol sensor is an analog device. It uses voltage divider to measure the change in voltage as shown in the figure below. Also it can be converted into digital by using a comparator LM324.



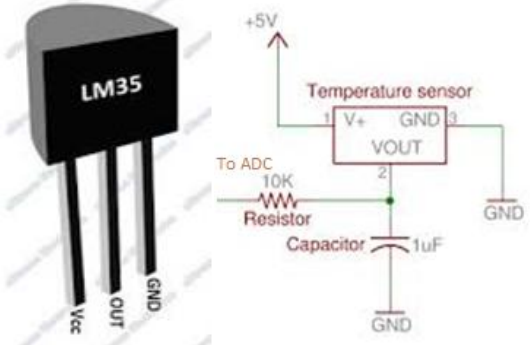


TRUTH TABLE:
High (Above reference voltage): LPG sensed
Low (Below reference voltage): LPG not sensed

POSSIBILITIES:
- Gas leak detection system
- Fire/Safety detection system
- Gas leak alarm
- Gas detector

4.1.4 TEMPERATURE SENSOR

BLOCK: Input
TYPE: LM35
ANALOG/DIGITAL: Analog
PINS FOR INTERFACE: 3Pins
PHOTO/CIRCUIT SYMBOL:



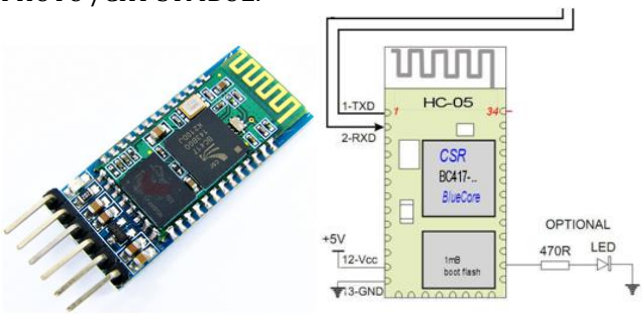
The LM35 is precision integrated-circuit temperature sensor, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. It can be used with single power supplies, or with plus and minus supplies. +5V supply is provided by using 7805 regulator IC. When IC senses the temperature, it gives linear voltage as +10.0mV/°C at the Vout pin of IC. This Vout pin is connected to the +V(IN) of A/D Converter. An A/D converter operates on the successive approximation principle. Then, ADC converts this analog voltage into a digital 8-bit code and transmits it at DB0-DB7 pin which is connected to the port 3 of 89S52 microcontroller.LM35 produces 10mV for every degree of temperature change so we can condition Vin of IC to produce Vout of 2.56V for full scale output. So we have set Vref/2 to 1.28. This makes Vout of ADC0804 correspond directly to sensed temperature.Connect the +Vs Pin to 5v and GND to GND. The output must be connected to the analog input.
TRUTH TABLE:

Temp.(C)	Vin(mV)	Vout(d7-d0)
0	0	00000000
1	10	00000001
2	20	00000010
3	30	00000011
10	100	00001010
30	300	00011110

POSSIBILITIES:
- Power supply temperature monitoring
- Thermostat controls
- Environmental monitoring
- Cell phones

4.1.5 BLUETOOTH MODULE

BLOCK: Communication
TYPE: HC-05
ANALOG/DIGITAL: Digital
PINS FOR INTERFACE: 4 Pins
PHOTO /CKT SYMBOL:



DESCRIPTION:
Bluetooth is a specification for a small form-factor, low-cost radio solution providing links between mobile computers, mobile phones and other portable handheld devices, and connectivity to the Internet. It will enable users to connect a wide range of computing and telecommunications devices easily and simply, without the need to buy, carry, or connect cables.It is a wireless technology that operates on an unlicensed radio spectrum. There is no charge for communicating between two

Bluetooth devices. Bluetooth is intended to get around the problems that come with both infrared and cable synchronizing systems. The hardware vendors, which include Siemens, Intel, Toshiba, Motorola and Ericsson, have developed a specification for a very small radio module to be built into computer, telephone and entertainment equipment. From the user's point of view, there are three important features to Bluetooth:

1. Its wireless. When you travel, you don't have to worry about keeping track of a briefcase full of cables to attach all of your components, and you can design your office without wondering where all the wires will go.
2. It's inexpensive.
3. You don't have to think about it. Bluetooth doesn't require you to do anything special to make it work. The devices find one another and strike up a conversation without any user input at all.It is a wireless protocol that is used to communicate from one device to another in a small area usually less than 30 feet. Bluetooth communicates on a frequency of 2.45 gigahertz, which has been set aside by international agreement for the use of industrial, scientific and medical devices (ISM). Bluetooth's founding members include Ericsson, IBM, Intel, Nokia and Toshiba.Bluetooth was designed to allow low bandwidth wireless connections to become so simple to use that they seamlessly integrate into your daily life. A simple example of a Bluetooth application is updating the phone directory of your mobile phone. Today, you would have to either manually enter the names and phone numbers of all your contacts or use a cable or IR link between your phone and your PC and start an application to synchronize the contact information. With Bluetooth, this could all happen automatically and without any user involvement as soon as the phone comes within range of the PC! Of course, you can easily see this expanding to include your calendar, to do list, memos, email, etc. This is just one of many exciting applications for this new technology! Can you imagine walking into a store and having all the sale items automatically available on your cell phone or PDA? It is a definite possibility with Bluetooth.

System Architecture

Bluetooth communication occurs in the unlicensed ISM band at 2.4 GHz. This is an unlicensed band and, in most countries, includes the frequency range from 2400 to 2483.5 MHz. of course, as always when dealing with international standards, there are a few exceptions. The primary geographies with exceptions are France (2446.5 to 2483.5 MHz) and Spain (2445 to 2475 MHz). The transceiver utilizes frequency hopping to reduce interference and fading. A typical Bluetooth device has a range of about 10 meters. The communication channel can support both data (asynchronous) and voice (synchronous) communications with a total bandwidth of 1 Mb/sec. The supported channel configurations are as follows:

Configuration	Max. Data Rate Upstream	Max. Data Rate Downstream
3 Simultaneous Voice Channels	64 kb/sec X3 channels	64 kb/sec X3 channels
Symmetric Data	433.9 kb/sec	433.9 kb/sec
Asymmetric Data	723.2 kb/sec or 57.6 kb/sec	57.6 kb/sec or 723.2 kb/sec

The synchronous voice channels are provided using circuit switching with a slot reservation at fixed intervals. A synchronous link is referred to as an SCO (synchronous connection-oriented) link. The asynchronous data channels are provided using packet switching utilizing a polling access scheme. An asynchronous link is referred to as an ACL (asynchronous connection-less) link. A combined data-voice SCO packet is also defined. This can provide 64 kb/sec voice and 64 kb/sec data in each direction.Bluetooth devices can interact with one or more other Bluetooth devices in several different ways. The simplest scheme is when only two devices are involved. This is referred to as point-to-point. One of the devices acts as the master and the other as a slave. This ad-hoc network is referred to as a piconet.

Specifications:

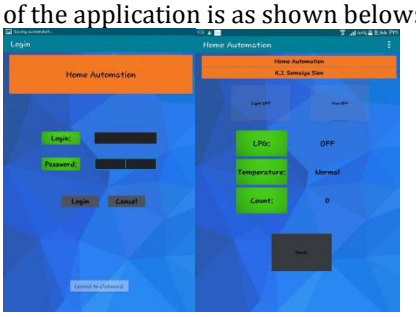
- FCC Approved Class 1 Bluetooth® Radio Modem
- Extremely small radio - 0.15x0.6x1.9"
- Very robust link both in integrity and transmission distance (100m) - no more buffer overruns!
- Low power consumption : 25mA avg
- Hardy frequency hopping scheme - operates in harsh RF environments like WiFi, 802.11g, and Zigbee
- Encrypted connection
- Frequency: 2.4~2.524 GHz
- Operating Voltage: 3.3V-6V
- Serial communications: 2400-115200bps
- Operating Temperature: -40 ~ +70C

A Bluetooth module is widely used with Microcontroller to enable Bluetooth communication. This module cam be interfaced using the UART in 8051 microcontroller where the data are transmitted in the form of packets. The pins TX and RX pin of the HC-05 form the path for data transmission and reception. These TX pin of HC-05 must be connected to the RX pin of 8051 and vice versa. Whereas the key pin of the module is used to set the password for pairing the module with our devices.

3.2 Software Requirements

3.2.1 Basic 4 android

Used for coding of the android application. The front end of the application is as shown below:



3.2.2 Arduino.cc

Used for coding of the Arduino microprocessor. The developed code is then burnt to the chip using a USB cable [7].

4. CONCLUSIONS

The purpose of the system is to use mobile phone's inbuilt Bluetooth facility for automation. Different hardware and software unit of the system are described. The complete application software has been designed using Android, using C Language. The HAS furnishes a good paradigm for any Automation System based on Android Mobile Phone and Bluetooth.

REFERENCES

[1] N. Sriskanthan and Tan Karand. "Bluetooth Based Home Automation System". Journal of Microprocessors and Microsystems, Vol. 26, pp.281-289, 2002.

[2] Muhammad Izhar Ramli, Mohd Helmy Abd Wahab, Nabihah, "TOWARDS SMART HOME: CONTROL ELECTRICAL DEVICES ONLINE" ,Nornabihah Ahmad International Conference on Science and Technology: Application in Industry and Education (2006).

[3] Al-Ali, Member, IEEE & M. AL-Rousan,"Java-Based Home Automation System R." IEEE Transactions on Consumer Electronics, Vol. 50, No. 2, MAY 2004.

[4] Pradeep.G, B.Santhi Chandra, M.Venkateswarao, "Ad-Hoc Low Powered 802.15.1 Protocol Based Automation System for Residence using Mobile Devices", Dept.of ECE, K L University, Vijayawada, Andhra Pradesh, India IJCST Vo l. 2, SP 1, December 2011.

[5] E. Yavuz, B. Hasan, I. Serkan and K. Duygu. "Safe and Secure PIC Based Remote Control Application for Intelligent Home". International Journal of Computer Science and Network Security, Vol. 7, No. 5, May 2007.

[6] Amul Jadhav, S. Anand, Nilesh Dhangare, K.S. Wagh "Universal Mobile Application Development (UMAD) On Home Automation"

[7] https://www.arduino.cc/en/main/howto