

Smart Home Automation System using Mobile Application

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Abstract - The main objective of this paper is to develop a remote controlled smart home automation system which is a low cost and user friendly. Due to advanced technology houses are getting smarter. It is the Era of centralized control system, also remote controlled switches. conventional wall switches located in different parts of the house becomes difficult for the user to go near them and operate it. It becomes more difficult for the elderly or physically handicapped people to near it and operate it. Remote controlled home automation system provides a modern solution using smart phones. In order to achieve this, a Bluetooth module is communicated to the Arduino board at the receiver end while on the transmitter end, a GUI application on the mobile sends ON/OFF commands to the receiver where home appliances are connected. By touching the specified location on the GUI, the home appliances can be turned ON/OFF remotely through this technology. The home appliances are operated by Arduino board through PIR sensors and Ultrasonic sensors.

Key Words: Home automation; Smartphone; Arduino; Bluetooth; Home appliances; ultrasonic sensor

1. INTRODUCTION

There is a Large demand for smart home automation, where appliances react automatically to changing environment conditions and can be easily controlled through one common device.

This project represent a possible solution whereby the user controls devices by using their mobile phones, where controls is communicated to the microcontroller from a mobile phones through its Bluetooth interface.

This paper presents the design and implementation of a low cost but yet flexible and user friendly cell phone base automation system .It can also provide remote control for the home appliances. This paper can be describe implementation and design of controlling various home appliances with smartphone application.

Automation system is helps to decrease the human labor as well as saves time and energy. Now days this system provide the facilities to elderly and handicapped people to perform their daily work and control the home appliances remotely.

In this project use Bluetooth to control the appliances. Bluetooth technology have been enhanced to provide for higher speed data transmission service through the use of more advanced modulation technology. This increases the

gross data transmission rate to 2 Mbps or 3 Mbps dependent on which Bluetooth device.

This is the Era of remote controls for all appliances like television sets and other electronic systems, which have made our lives easy. We are implementing a home automation which would give the facility of controlling tube lights, fans and other electronic appliances at home using a remote control. It is very cost effective. We are implementing a new system called Arduino based home automation using Bluetooth. This system is having low cost and can give the user, the ability to control any home appliance. This project helps the user to control all the home appliances using his/her smartphone.

Time is a very valuable thing. Everybody wants to save time as much as they can. New technologies are introduced to save time. To save people's time we are implementing Home Automation system using Bluetooth . With the help of this system we can control our home appliances from our mobile phone. We can turn on/off our home appliances within the range of Bluetooth.

2. HISTORY & BACKGROUND LITERATURE SURVEY:-

Challenges in Home Automation Security From a Homeowner's Point of View

1. There is a huge difference between what user thinks is the implementation of access control and the access control and security measures that are actually implemented.
2. The owner also has to consider the social implication of rejecting access to a guest. Though the owner may have to consider the guest's feelings, a guest may feel insulted. The owner may need to change user access control rules often which is a big security threat.
3. Along with home security system, there can be more devices connected to a home network like mobile phones which go with other user and connects to external other networks.
4. An attacker can compromise home automation system by using these devices as a gateway to home network when these devices get connected to home network because user are careless in this case.
5. Most of the times people are unaware, misinformed or careless about various security risks while choosing home automation system due to the money issue.

From a Security Engineer's Point of View

1. Unlike in companies, one can't enforce policies or security procedures that affect the convenience of people at home or their guests.
2. People are careless about even simple security policies.
3. Home may consist of people of different age groups e.g. Senior citizens which are not capable of understanding the technical aspect of the security system is more vulnerable to social engineering.
4. An attacker who hacks a home automation network can cause a wide range of damage, including theft, vandalism, emotional harm, permanent damage to electronic devices, loss of reputation, financial damages, blackmail, environmental damages, physical harm to a home's inhabitants, granting unauthorised access to anyone.
5. The mixed ownership of devices at home and guests with varying technical knowledge and different intentions compounds security issues at home.

Related Work

Central Controller-based Home Automation System A central controller based home security system can be implemented by combining many homes into a security network with a control node dedicated to each locality depending on the number of users. There are few central or chief control nodes with high processing power which controls these nodes. Central Controller-based Home Automation System Challenges: There must be a considerable number of homes in the locality to implement this system. So that it will be cost effective and maintainable

A person having central control and its data will be able to know about a home's intimate and private information from the data at its disposal, like if a home's room AC is off or on, or if a person in a home is taking a shower. This may cause serious privacy concerns. A home automation Security System called SmartEye using GPRS also uses a central controller, to which many individual home controllers are connected. This system proposes a real-time monitoring system and home automation. The system notifies the homeowner by mobile phone using GPRS. SmartEye uses video cameras for security. This proposed system is also not suitable for securing single homes, but suits for a group of homes. This central controller-based security system is difficult to implement and can cause some very serious privacy concerns. Bluetooth-based Home Automation System The work of N. Srisanthan shows the implementation of a home automation system using Bluetooth. They use a host controller, which is implemented on a PC, is connected to a micro-controller based sensor and device controllers. Home Automation Protocol (HAP) is proposed to make the communication between devices possible. The paper discusses controlling and updating home devices along

with fault detection and diagnostics remotely. It also considers about providing an electronics user manual on the phone using Bluetooth and Internet.

Issues of using Bluetooth Bluetooth has a maximum communication range of 100m in ideal conditions. More may be needed in a home environment. Bluetooth communication has high power consumption, so the batteries of devices need to be frequently recharged or replaced. Bluetooth technology has advanced and improved, which provides the same range of communication.

Bluetooth is an attractive communication technology for creating smart homes. Bluetooth is cheap, easy, and quick to set up. People are already familiar with the technology. The hardware required for establishing Bluetooth communication is available and the technology provides the necessary bandwidth for the operation in a home. GSM or Mobile-based Home Automation System is attractive to researchers because of the popularity of mobile phones and GSM technology. We mainly consider three options for communication in GSM, namely SMS-based home automation, GPRSbased home automation, and Dual Tone Multi Frequency System

There are many of home automation systems implemented using GPRS. Researchers M. Danaher and D. Nguyen proposed a home security system using GPRS. The project uses a webcam to stream video (DTMF)-based home automation. It shows the logical diagram of how a home's sensors, electrical, and mechanical devices interact with the home network and communicate through the GSM module using a Subscriber Identity Module (SIM). The system converts the machine functions into electrical signals through a transducer, which goes into a micro-controller. A transducer converts physical quantities like sound, temperature, and humidity into some other quantity like voltage, a sensor does that function. For electronic devices, the reading goes directly into the microcontroller. The micro-controller analyses these signals and converts them into commands that can be understood by the GSM module. Based on the received commands, the GSM module selects the communication method.

GPRS-based Home Automation and images of the house to its owner's mobile through GPRS.

The webcam detects movement by comparing frames and also light intensity. Video streaming of the proposed work is done using the home Internet connection, not the GSM modem. U. Ali proposes another home and office automation system using GPRS in mobile phones. The user interacts with the home via a client/server architecture implemented at home using a PC and a micro Java application. Home devices are controlled by a controller, which is connected to the computers parallel port. The proposed system allows users to remotely control and inquire the status of the devices that are connected to the device controller. The researchers J. Jin discuss a home

automation system based on WSNs and GPRS. It allows users, to control equipment in their home, and collect data about weather conditions and status of device at home through their mobile devices. Different from other GPRS-based home automation, the proposed system uses an system-based central controller. Researchers S.R. Das developed an iOS-based home automation security system using GPRS. The proposed system uses the client/server model for communication. The authors develop an iOS application that runs on a user's mobile phone and acts as the client and the cloud to which the home devices are connected acts as the server. The authors use cameras of video and motion sensors for providing security at home. When a motion sensor is triggered, the video cameras in the start to record. A user can view these live motion on a mobile device through GPRS.

Security concerns in GPRS-based home security systems:

1. The works of M. Danaher and D. Nguyen, S.R. Das both implement cameras at home. Moreover, people do not like to be watched; it affects their normal behaviour and makes them uncomfortable.

2 Video feeds could be looped by skilled attackers if the cameras and the system are not installed and maintained properly.

3. In a GPRS-based intrusion detection system, the user will have to monitor his or her phone constantly to successfully defend against intrusion. Researchers S.R. Das provide users access to the home using a web browser, which opens the home to a different set of browsing-related security issues like session hijacking, cookie stealing, and cross-site scripting.

3. SYSTEM ARCHITECTURE

It is one of the project is one of the important Arduino Projects. Arduino based home automation using Bluetooth project helps the user to control any home appliances using Device Control application on their Smartphone. The android application sends commands to the controller which is Arduino, through the wireless communication Bluetooth. These relays can be connected to different home appliances. When the user presses on the 'On' button displayed on the application for the device 1, the Buzzer is switched on. This Buzzer can be switched off, by pressing the same button once again. Similarly, when the user presses on the 'On' button displayed on the application for the device 2, the fan is switched on and so on. The fan can be switched off, by pressing the same button again and so on. The project of home automation using Bluetooth and Arduino can be used for controlling and adjusting any AC or DC devices. We have used DC Fan and also DC Bulb. In this system there are 2 main part Hardware and Software. Hardware part consist of smartphone, Arduino board, bluetooth module, PIR sensor and Ultrasonic sensor. Software part consist of arduino integrated development environment (IDE) and bluetooth

terminal, mobile application. It is used for wireless communication with smartphone and arduino board. Ultrasonic sensor is used in this method to provide more easy and facilities to the user.in this fig:1 describe block diagram of smart home automation sytem using mobile application and flowchart is represented fig:2

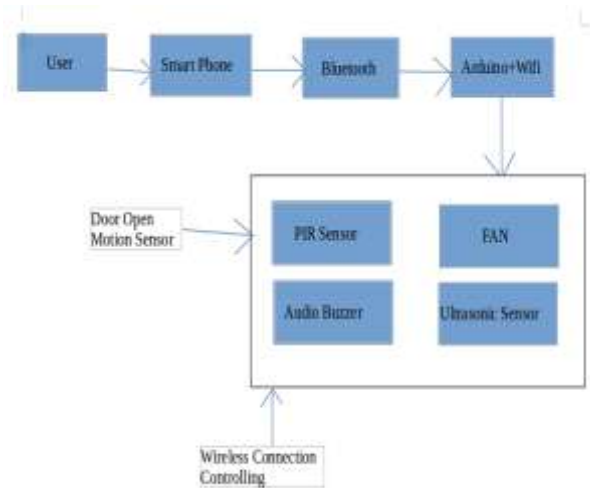


Fig 1: Block diagram of System Architecture

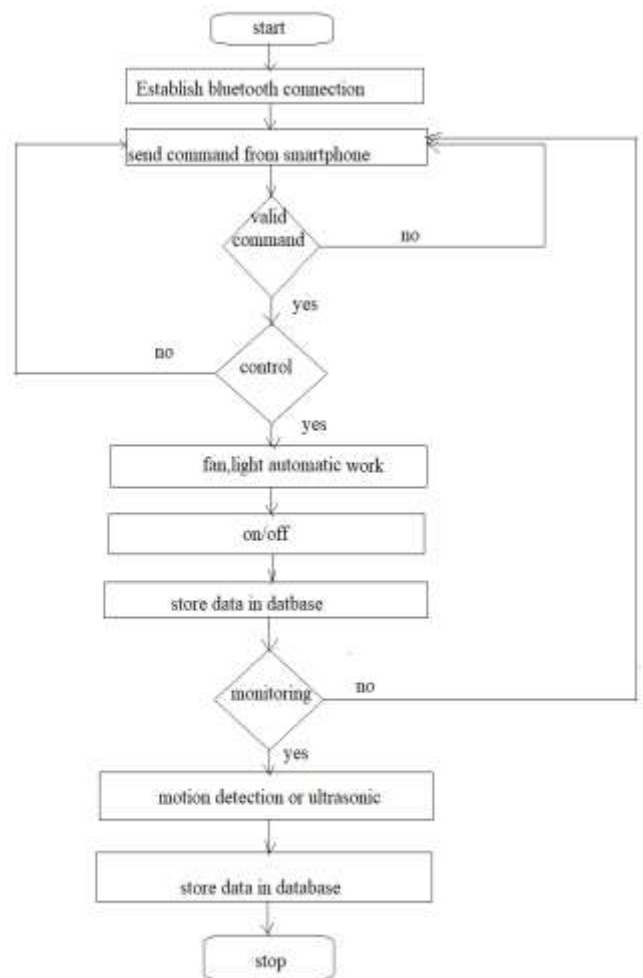


Fig 2 : Flow chart of System Architecture home automation system

Hardware Architecture

Smart home automation system contain Hardware component that is smartphone, arduino board, bluetooth module, PIR sensor(passive infrared sensor), ultrasonic sensor.

Smartphone is used communication with arduino board by using mobile application and bluetooth technology. Research works bluetooth module HC – 06 and arduino uno are use for hardware implementation

A. Arduino uno

It is open source and The Arduino UNO is a widely used open-source microcontroller board based on the Microchip ATmega328p microcontroller.



Fig : Arduino uno

The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards and other circuits. The board features 14 Digital pins and 6 Analog pins. Operating Voltage at 5 Volts, Input Voltage at 7 to 20 Volts, Clock Speedn at 16 Mhz, in that 32 kb flash memory, 2 kb SRAM and 1 kb EEPROM.

B.HC-05 Bluetooth Module

HC-05 module is very easy to use Bluetooth SPP (Serial Port Protocol) module, which is designed for transparent wireless serial connection setup. Serial port Bluetooth module is a Bluetooth module which is qualified V2.0+EDR (Enhanced Data Rate) it has 3Mbps Modulation and complete 2.4GHz radio transceiver and baseband. It has the footprint as small as 12.7mmx27mm.

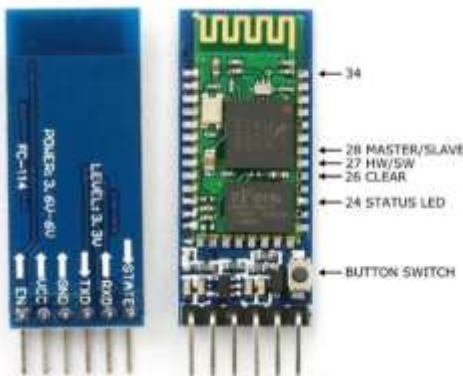


Fig : HC-05 Bluetooth Module

HC-05 Bluetooth Module Interfacing with Arduino UNO

HC-05 is a Bluetooth device which is used for wireless communication with the help Bluetooth enabled devices (like smartphone). It interfaces with microcontrollers using serial communication (USART).

Default settings of HC-05 Bluetooth module can be altered using certain commands like AT.

The HC-05 Bluetooth module has 3.3 V level for RX/TX also having microcontroller which can detect 3.3 V level.

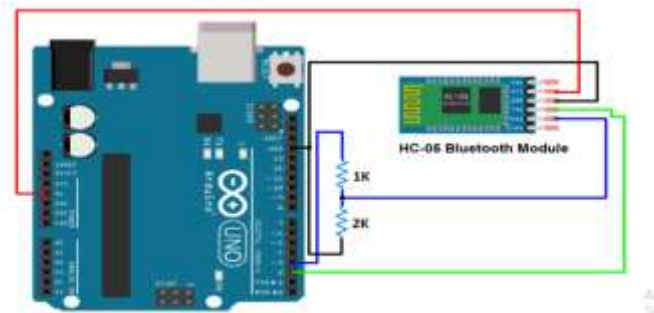


Fig : HC-05 Bluetooth Module Interfacing with Arduino UNO

C. Ultrasonic Range Sensor HC-SR04

Ultrasonic sensors is base on the measurement of the properties of acoustic waves with frequency above the human audible range often at roughly 40 kHz. They typically operate by generating a high-frequency pulse of sound, and then receiving and evaluating the properties of the echo pulse. It is use sonar to calculate the distance from a physical objects. Ultrasonic sensor module SRF-04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The module includes ultrasonic sensor has transmitters, receiver and transreceiver.

Working Voltage at DC 5V, Working Current at 15mA ,Working Frequency at 40Hz, Max Range at 4m ,Min Range at 2cm ,Measuring Angle at 15 degree ,Trigger Input Signal at 10uS TTL pulse Echo Output Signal at Input TTL lever signal and the range in proportion.

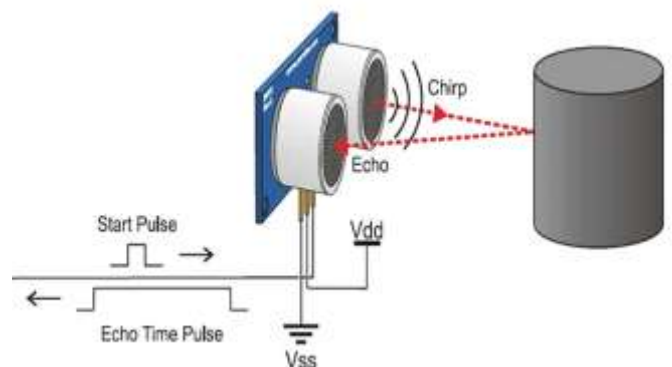


Fig : Ultrasonic Range Sensor HC-SR04

- 9 V Power supply.
- Smartphone or tablet (Bluetooth enabled).

SOFTWARE ARCHITECTURE

In this exploration work two software Arduino Integrated Development Environment (IDE) and Bluetooth terminal application are use.

A. Arduino IDE

Arduino consists of both a physical programmable circuit board and a piece of software or IDE (integrated development environment) that runs on your computer, use to write and upload computer code to the physical board. This is a screenshot of the Arduino IDE Arduino language is only a set of C/C++ function that can be called from your code.

Bluetooth terminal application

Bluetooth is am wireless technology standard for exchanging data over short distance from fixed and mobile device and building personal area network (PAN). Invented by dutch electrical engineer jaap haartsen, working for telecommunication vendor ericsson in 1994. Web bluetooth terminal is a website that can connect with the remote devices which support bluetooth low energy and exchange data bidirectionally.it can be installed on homescreen as an application and offline.

Table 2. ASCII data with equated operations

ASCII Data	Operation
0	ON light 1
1	OFF light 1
2	ON light 2
3	OFF light 2
4	ON FAN
5	OFF FAN
s	Check status of all appliances &sensors
w	Check status of water level indicator

Hardware Requirement

- Arduino Uno with Atmega 328P microcontroller.
- HC – 05 Bluetooth Module.
- 10 KΩ Resistor.
- 1 KΩ Resistor X 4.
- BC547 NPN Transistor X 4.
- 1N4007 Diode X 4.
- 5 V Relay X 4
- Prototyping board (Bread board).
- Connecting wires.

Software Requirement

- Arduino 1.6.9 compiler
- Proteus 7
- Android application

4. CONCLUSION

The home automation system has been proven to work by connecting sample appliances to it and the appliances were successfully controlled from a wireless mobile device. We learned skills such as soldering, wiring the circuit and other **tools** that The Bluetooth client was successfully tested on different mobile phones from different manufacturers, thus proving its portability and wide compatibility. Thus a low-cost home automation system was designed, implemented and tested.

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