# Home Automation and Smart Home Control

Gargi Saraf, Akash Jakkan

**Abstract**— This paper presents "Home Automation and Smart Home Control System".This system is a low cost and flexible, but yet secures cell phone based home automation system. This system controls physical devices using an Arduino and Bluetooth module controller that connects to your cell phone and lets you switch things on and off using Bluetooth. The heart of this project is the Arduino Mega 2560 board. Home appliances are connected to the input and output ports of Arduino while the cell phone and Arduino are connected wirelessly through Bluetooth. The other aspect of this project is home security. This module with the help of sensors and LCD helps to heighten home security. Password security is applied to secure authorized users to get into the home. This system is a combination of luxury and safety, which provides surveillance for intelligent home safety with high availability and reliability.

**Index Terms**— Arduino Mega 2560, Bluetooth Module, Automation, LCD, Cell Phone.

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## 1. INTRODUCTION

Home automation was a fantasy for many years, but after the introduction and widespread of electricity and information technology in 20thcentury the concept of home automation evolved and bloomed. In 1930s World's Fairs the idea of a modern home automation system originated. Automated homes were portrayed in Fairs in Chicago (1934), New York (1939) and (1964–65). In 1966home automation system called "ECHO IV was developed by Jim Sutherland, an engineer working for Westinghouse Electric; but this was an exclusive project and was never marketed. During the 1960s American hobbyists developed "wired homes", but there were certain limitations because technology was not much developed at that fourth dimension. By the close of the 1990s, even though people were interested in home automation, but it was not taken up by a great number of the great unwashed, the only brought this system were either hobbyists or rich people. The customers were deterred by high cost, complex protocol of the arrangement.

This condition changed considerably with the conception of the microcontroller. With the invention of microcontroller the cost of electronic control components reduced to a large extent. These control technologies were employed to further develop the home automation system. Today, according to ABI research, in USA in 2012 about 1.5 million home automation systems were installed and the number is increasing rapidly day by day.

### 1.1 Literature survey

Home automation can be used at different stages ranging from few buttons on a remote control to switch ON/Off lights to a complex scheme which includes fix of complex operations such as manipulating the atmosphere of the room. The system in uses robotic[1] programming environment RIDE to develop a central control system and has Modbus protocol to run applications, the system easily accommodated popular interface like X10 along with many other new devices. The devices in this system are connected through internet adapter using Arduino1 with Ethernet[2]. The second system which is described earlier3 consist of two wireless sensor nodes, which are controlled by Zigbee and the information which is collected from this node is turned over to centralized coordinator, which is linked to a PC. The PC stores the data and central coordinator performs statistical analysis. The sensor data obtained can be displayed on LCD[3]. E. Yavuz et al. reported4 an intelligent house which is operated by remote controller using a PIC control system. In this arrangement we can safely control electrically operated devices with the aid of mobile telephone sets from anywhere over the Earth. The suggested scheme is dissimilar from the co-existing[4] home automation in several ways. Firstly, the architecture is developed using Bluetooth module, it takes less physical connection which brings down the wire chaos. This scheme operates over phone's Bluetooth connection rather then the net. Second, this home automation system provides user to enter house by applying a password unlike of the traditional method of lock and key and also the house is comfortably protected from thieves and burglars. Furthermore, the project takes into consideration all the three aspects: luxury, security and comfort. [2],[3],[4],[5].

### 1.2 Feature Of Proposed System

Home Automation can be summarized as home automation is a system that can be reformed and made more sophisticated with many years of development. It can include everything that you ever thought of controlling or automating at your home. The most widely spread example, are the lighting system of your home. Motion detectors, contact sensors, and the central device that orchestrates your alarm system are generally the primary elements of any home automation system. The features included in this home automation system are:

#### 1. Lighting, cooling and home entertainment system:

Lights, fans, television and music system can be controlled using cell phones. The Arduino and the mobile phones connect via Bluetooth module Hc-05.Thus cell phone and Arduino is wirelessly connected reducing the cable networking. This also reduces the human effort.

## 2. Intelligent weather monitor:

The rain sensor connected to Arduino helps keep check on the rain. When it starts raining, the rain sensor triggers the Arduino. Arduino sends signal to the motor, which in turn draws shutter over the drying cloths.

## 3. Security system:

Security can be automated like other devices. Locks are upgraded to keypad that opens with code. If someone tries to enter forcefully, then the buzzers are triggered. The basic diagram of house automation is as pictured below in Fig. 1.
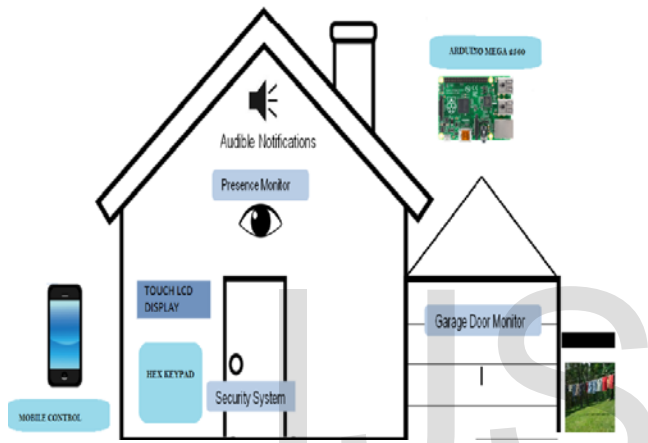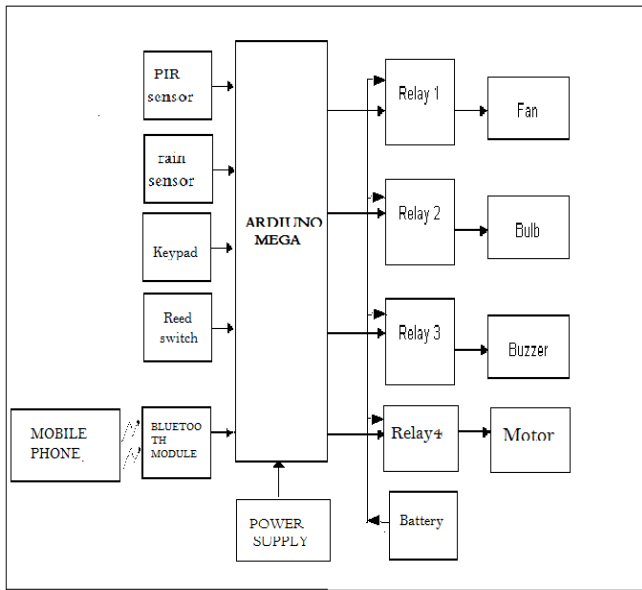


Fig. 1: Basic Diagram of Home Automation



Fig. 2: Block Diagram of Home Automation.

## 2. HARDWARE ARCHITECTURE

This automation system consists of two primary hardware components: Arduino Mega 2560 Board and Cell phone. The cell phone's Bluetooth communicates with the Bluetooth module HC-05. This Bluetooth enables the user the access the home appliance and also controls commands for applications.

### 2.1 Why ARDUINO MEGA?

There are many commercial solutions in a market on which one can build a home automation system such as PLC, Microcontroller and Arduino. There are few advantages of using PLC as the heart of home automation system. PLCs are digital computer used for automation of industrial operations and a single PLC can replace 1000 of the relays. But the advantages are overcast by the fact that the cost of PLC is high and that they are designed by semiconductors. The second option is using Microcontroller but it has its pros and cons. Microcontrollers more cheaper, easy to use and program are easy to build, but the biggest disadvantage is speed and once programmed cannot be reprogrammed. The best option is using the Arduino as the basic building block of home automation system. Arduino is easy to program, inexpensive, low power consumption, easy to use combination of hardware and software, can run on Widows, Linux, Mac operating system and is open source hardware and software. Because of these advantages we are using Arduino software and hardware in our project.

Arduino ranges from Arduino UNO to Raspberry pie. Arduino MEGA 2560 is best suited for home automation system because the Arduino Mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins, 4 UARTs, 16 analog inputs, reset button, 16 MHz crystal oscillator, power jack, ICSP header and USB connection. It contains everything on-board that is needed to support the micro controller, only the power supply demanded for the board is supplied externally which can be given through an AC-to-DC adapter or by connecting it to a computer by USB cable.[6],[7]

## 3. WORKING

The working of home automation system is split into three phases mainly:

**Phase I:** Luxury

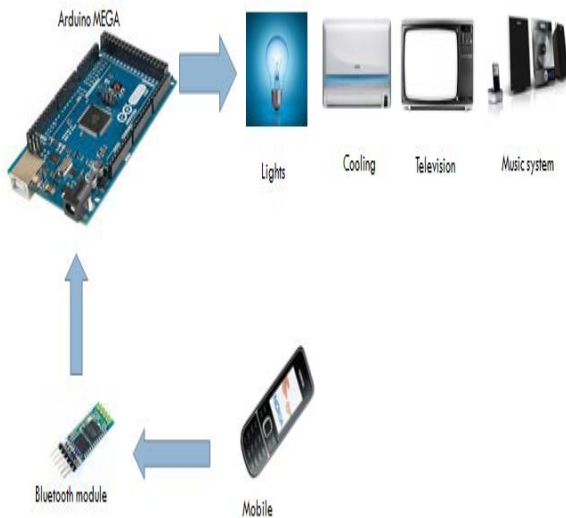**Phase II:** Security

**Phase III:** Comfort

Fig 3. Phase I of Home Automation.

Phase I is luxury. In this phase the manual shifts are replaced by mobile phone dominance, thus saving human energy. In this phase we can switch the lights, fans, music system and the television with one touch of mobile by sitting at one place. This phase is designed using Bluetooth module. The Bluetooth module picks up the packet send from the cell phone. These packets contain application status command, which are pipelined through Arduino. The output home appliances are linked up to the digital pins of the Arduino through a relay to pass sufficient power supply. The battery is connected to the relays to satisfy the additional power supply requirement.
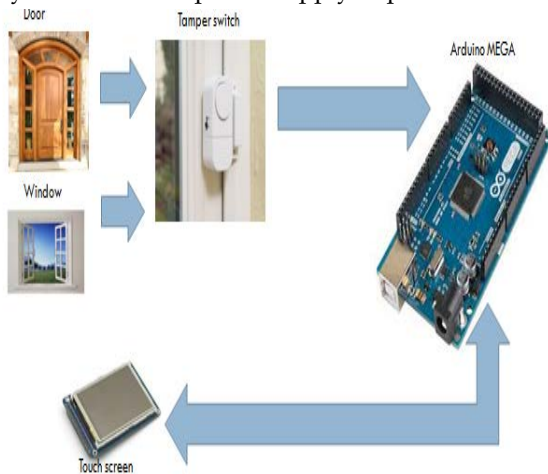


Fig. 4: Phase II of Home Automation.

The phase II of the project consists of home security. The traditional method of lock and key is replaced by password lock. The password is entered through a hex-keypad. The Arduino checks the password and allows access if the password is correct. If the password is incorrect and someone tries to enter forcefully, the sensors are triggered Sensors act as input to Arduino. The garage door and the front door are secured by using reed switch. The sensor consists of two main parts, a magnet and a switch with terminals to connect the signal wires. The magnet mounts to a doorway, and the switch is mounted along the chassis. While the door is shut, the two pieces should be within 1/2" of each other. When the door opens, the distance between the doorway and the frame increases, which eventually causing the switch to toggle. These signals are applied to the input pins of Arduino to know when the doorway is open. The output pins are connected to a buzzer and LCD, which is showing display and alarm is turned on when someone tries to enter forcefully. Motion sensors are used to sense the motion and are also used to detect trespassing. The output of the motion sensors is given to the Arduino and then to the buzzer through the Arduino.
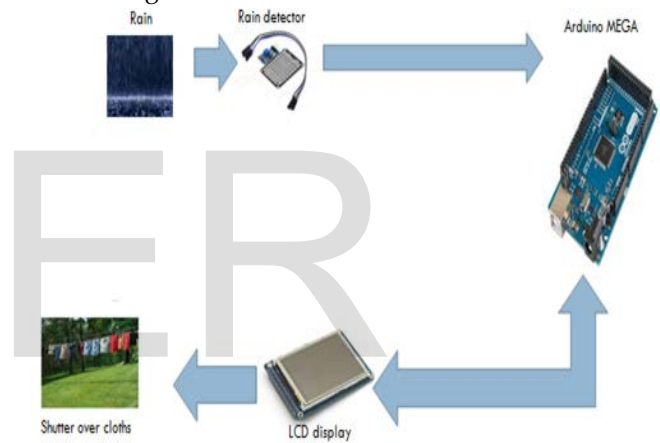


Fig. 5: Phase III Of Home Automation.

Phase III is comfort phase. This phase consists of a motor and rain sensor which monitors the rainfall. When it starts raining, the rain sensor sends signals to Arduino. The Arduino on getting this signal rotates the motor, thus shutter is drawn over drawing cloths. The rain sensor which is used to draw shutter on cloths to prevent them from getting wet is fast and accurate precipitation detection (ON/OFF) which is maintenance free and has a heating element for keeping sensor free of snow and condensed moisture, and for quick drying.

## 4. SOFTWARE

The Arduino software is employed to operate the various operations in the Arduino.cc or the Arduino language. Arduino platform performs on the Atmel microcontroller. This language is nothing but the simple form of C or C++ in which we use a set of comments, command and a set of library are used

for executive the programs in the Arduino Integrated development environment. The Arduino Integrated Development Environment (IDE) is an application written in Java language which helps in the performing the use of the Arduino board for multiple task. This Java written application helps in the driving the IDE for the Processing programming language software development. This Arduino board is too capable of composing the code and the uploading of code. This code can be uploaded with a help of a single click using the Arduino software. A program written in the Arduino is called a sketch.

Users just require to define two functions to make a run able cyclic executive program:

setup(): it used to initialize the function at the start of the program

loop (): it is used to run the operation in the program until the program is turned off.[5],[8]

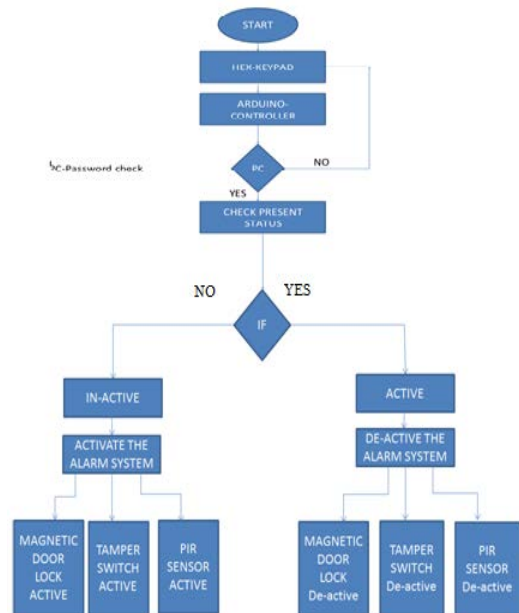The flow chart of the three phases proposed above is as follows
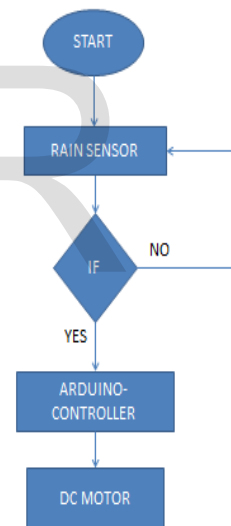
Fig. 7: Flowchart of Phase-II (Security)

Fig. 8: Flowchart of Phase-III (Comfort)

WIRELESS COMMUNICATION

Fig. 6: Flowchart of phase-I (Luxury)

## 5. RESULT

We have physically worked on this project and we gained a triumph in implementing the task. In this report, we projected the role of home automation as an efficient way to cut consumption of energy and other resources. To simplify the working of the project we had split the task into multiple phases. Each phase has its own importance.

Phase 1 is the luxury in which we had used a Bluetooth module. In this phase the Bluetooth of the Phone can also be used to control the entire electronic appliance which is connected

through the Arduino-just with a touch we can control the appliances. In the second phase we have the security. In security, we have a manual way using the hex-key pad to enter the password. The password is used to activate and de-activate the alarm system in the house. For the security we have magnetic door switches, tamper switches for the windows and the PIR sensors for the sensing of the movement. In phase three we have used the rain sensor and a DC motor, which is used to draw shutter above the drying clothes in case of rain, the rain-sensor activates when rain drops fell on it and sends the signal to the Arduino. Then through Arduino, supply is provided to the DC motor which is employed to actuate the shutter over the drying cloth. This is how we have successfully carried out the project.

## 6. ACKNOWLEDGEMENT

## 7. CONCLUSION

In this paper, we proposed the use of home automation as an effective means to reduce consumption of energy and other resources. This system provides effective, low cost, flexible and wireless home automation. The system is secured from unauthorized person, and we do not need to carry keys. User needs to insert the saved password in Arduino to enter the home. This protects our home from any interlopers. Even if a person enters forcefully, then the reed switches and the PIR sensor detect the presence and rings the alarm buzzer.

This system provides a wireless access to the user to switch On/off home appliances. The users are expected to pair with the Bluetooth module to gain admittance to switch home appliances. The wireless communication was found to be limited to <50m and maximum of 100m of operable range. The operating system of cell phone has never been a barrier, it can be Android, Mac OS, Symbian. The scheme was proven to be fully operational.

## REFERENCES

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