Home Automation Using Digital Control

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I. Introduction

The aim of this project is to develop a Home Automation System that can be controlled remotely using digital controllers over desktops, laptops, tablets and phones. The home automation is one of the most emerging trends in modernization of home appliance control. Presently, conventional wall switches are located in different parts of the house and one has to physically go near them and press them to turn the loads on/off. It becomes very difficult for the elderly or physically handicapped people to do so.There many home automation systems made using modules like Bluetooth,IR Sensor,etc.

But our system is designed to provide control of home appliances through mobile phone by sending SMS to the designated number. The system is designed engaging a programmable micro controller with GSM Modem which receives the command through the SMS and changes the status (turn ON or turn OFF) of the connected devices like light,fan,TV etc.This proposed system gives a new direction to the development of home automation.

***Index Terms*—Automation,Arduino UNO,GSM Modem,Liquid Crystal Display(LCD),DC Motor,LEDs**

II. Literature Survey

There are many different types of communication in control applications to control home appliances.In general two types are used - one is wired and other one is wireless. In wireless communication signals are transmitted wirelessly, like using radio frequency (RF) and in wired communication wires like copper wire are used.

In DTMF based Home Automation System[1] with out using any micro controller in it we can control the home appliances.When one upper and one lower frequencies mixed then a tone called Dual Tone Multiple Frequency is created.A DTMF decoder MT8890 IC is used which converts dial pad tone of the mobile phone into the four bit digital output. Loads like LIGHT, FAN and TV are connected to DTMF decoder IC through a relay.One of the limitations is that number of devices which we can connect to the circuit is limited.

In RF based Home Automation System,using an RF remote that is interfaced to the micro controller on transmitter side, which sends On/OFF commands to the receiver where the loads are connected.By operating a particular remote switch from the transmitter, the loads can be turned ON/OFF remotely through wireless technology.

In Arduino based Home Automation System[2],using a Blue tooth module which is interfaced to the Arduino board at the end of the receiver. At the transmitter end, a GUI (Graphical User Interface) application on the cell phone sends ON/OFF commands to the receiver. By touching the particular location on the GUI, the loads at the receiver end can be turned ON/OFF remotely.The Blue tooth security depends largely on the length and randomness of the password/PIN used during pairing.

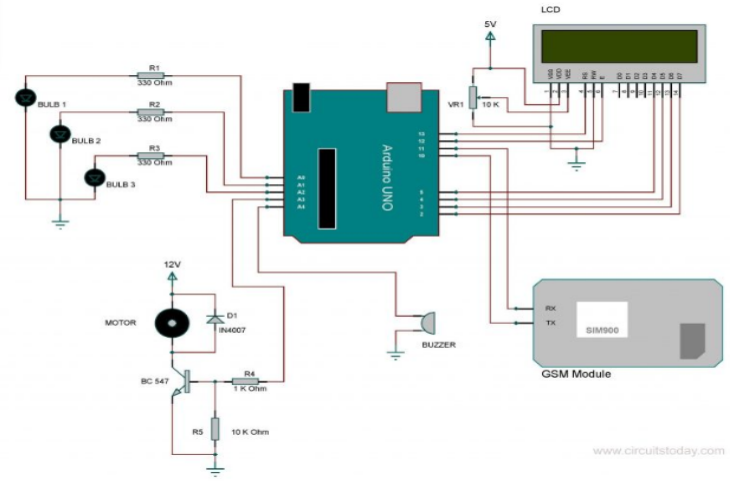

Fig. 1: Circuit Diagram

In this DTMF based system the user has to make a call to the mobile phone connected on the other end of the system. Once the call is received by the mobile phone connected to the system, the user can now send commands to operate the home appliances.

GSM technology[3] has been matured since long and hence GSM mobile phones and modems are widely available across the world.Advanced versions of GSM with higher number of antennas will provide high speed download and upload of data and these are easy to maintain integrate with other wireless technology based devices such as CDMA,LTE.

In our project, we have used GSM for the wireless communication between transmitter and receiver.LCD,DC Motor and LEDs are connected to the Arduino UNO[4] as shown in the above Fig.1.LCD is used for displaying the current status of an appliance[5].DC Motor resembles Fan with the option for speed control[6].And finally LEDs representing some devices like Tube Light and Television.

Fig. 2: Arduino UNO

Fig. 3: GSM SIM 900A

III. Methodology

The GSM based home automation using Arduino method we implemented is used to automate the certain function of home appliances.The main scope of this project is that we can control our home from anywhere in the world where GSM network is available.

The project consists of a 16×2 LCD module for displaying the status of the home appliances. The status (turn ON or turn OFF) of the connected devices can be changed by sending an SMS from your mobile phone. Upon receiving SMS commands through GSM module, Arduino will change the status (turn ON/OFF) of the connected device that is mentioned in the SMS.

A. Main Objective

(i) Send/Monitor the status of the connected devices to a specified mobile number using GSM.
(ii) Change the status of the device upon receiving commands through SMS.
(iii) Display status of the devices in an LCD using a 16×2 LCD module.

B. Explanation

The user sends a SMS requesting for a particular function like switching OFF the light to the other side.The GSM receives this message and send it to the Arduino through serial communication.

To the Arduino, 3 bulbs are connected representing light,TV,Fridge.And a DC Motor representing Fan whose speed can also be controlled.A buzzer is also attached so that when a particular device changes its state it alarms.The status of the appliance is displayed on the LCD every time when its state changes.

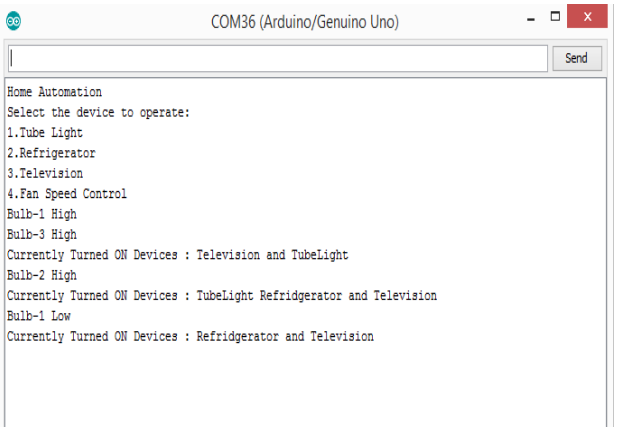

Fig. 4: Simulation of the Results Obtained

IV. Results

The user sends SMS mentioning about which device to be turned OFF/ON.In the receiver side, the device changes its state based on the SMS.The Fan speed can also be controlled just by sending SMS.For Tube Light,TV and Fridge we just need to send the device number.And for controlling speed of Fan we need to send the device number and the desired speed.If SMS received is "1", the Tube Light will be turned ON/OFF based on its previous state.If SMS received is "42", the Fan will turned ON with Speed 2.

To turn off fan we should send "40" as the message.Here 4 digit represents Fan and the next digit followed represents the speed of the fan.

V. Analysis

In this System, you can change the state of the device from anywhere in the World.This system also reduces the wastage of Electricity like when you accidentally forget to turn OFF some electric appliance.
To serve for many devices we have to use more than one Arduino as more power is required.

VI. Conclusion

The main purpose of this project is to provide a smart and efficient way to control our home appliances with the help of modern communication technology.With the combination of Arduino and GSM this project is not only a very friendly and easy to use system.This project will give our daily life a new dimension at the same time it will help us to save energy.

VII. Further Improvements

Now the number of devices that can be connected are very limited as we are using only one microcontroller(Arduino). So using more number of microcontrollers can increase the number of devices which can be controlled via this project. And making a SMS/Call may cost you.So using an Android Application for this project helps.And using IR sensor when home also saves the cost for an SMS.When in out station GSM can be used.

VIII. Future Scopes

The project "GSM BASED HOME CONTROL" is intended to automate the certain functions of home appliances.Smart home technologies have been around for about 30 years,mostly relying on some proprietary technologies and applications.With the recent expansion of communication networks,smart home applications can be further enhanced with new dimension of capabilities that were not available before.In particular,wireless technologies will soon enable exotic and economically feasible applications.

IX. Contributions

In the Hardware Part,
G.Aditya - LCD part , LEDs part , Integration
K.Sai Suma - DC Motor part, Buzzer part , GSM part, Designing
For the Literature Survey
G.Aditya - Home automation using DTMF and Bluetooth
K.Sai Suma - Home automation using GSM and IR Sensor

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