



Design and Implementation of GSM Based Home Automation System using Arduino Uno

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Abstract: This paper presentation is about implementation of a wireless real-time home automation system based on Arduino Uno microcontroller as main controller. Mobile phone is a revolutionary invention of the century. It was designed for making and receiving calls & text messages, but it has occupied the present generation through its trending applications. This project is about building a home automation system, where the user can control the home appliances by simple phone including a GSM module, just by sending SMS through the phone. In this project just a old GSM phone is enough to switch ON and OFF any home appliances from anywhere. The proposed system is shown to be a simple, cost effective which makes it suitable for the smart home future.

KEYWORDS: Wireless Home Automation, Arduino Uno, GSM.

I. INTRODUCTION

Recently man's work and life are increasingly complicated with the rapid growth in communication as well as information technology. Due to the rapid economic growth the living standard has kept raising everyday such that people have a higher requirement for dwelling functions. This information based society has changed the peoples way of life as well as challenged the customs. The intellectualized society brings diversified information where safety, economical, comfortable and convenient life has become the ideal for every modern family [1]. Now the trending concept of smart home has focused the attention of researchers, consumers and the lifestyle practitioners to be directed towards the usage of the recent technologies. Considerable efforts have been made for the development of remote control systems in home automation. This system uses the mobile phone as the input controlling device which cannot be connected through any other users interface.

II. SURVEY

- The previous works were done on such systems which was mainly based on the use of telephone line, i.e. using a phone-based system for home automation using a hardware-based remote controller in [2] and [3].

- The application was implemented by using personal computer approach in [4].
- Shepherd introduced the method of using Bluetooth wireless technology as a replacement of cables, which tells about the wireless connectivity using radio home automation system in [5].
- N.Sriskanthan developed an automated system based on Bluetooth wireless technology from which a user can control different appliances that are connected over a Bluetooth network based on a mobile host controller in [6].
- A.Z.Aikar developed an internet based wireless home automated system for multi functioning devices. This system has flexible and low cost solution to the wireless home automation systems but still has some limitations related to power failure and communication range of the wireless medium as explained in [7].
- Jawarkar developed monitoring system through mobile phone using spoken commands. These spoken commands were generated and sent to the control system through a microcontroller that was designed on the basis of text where a particular task was decided, this was explained in [8].
- Wael El-Medany developed a GSM based remote sensing to control the system using FPGA. This system worked as a remote sensing device for the electrical appliances to state whether the device was on or off. Similarly it allowed the user to control the electrical appliances at home based on SMS technique, this was explained in [9].
- Zhang developed a home automation system based on (PLC) electrical power communication which used the household connection wire for communication and internet control with logging facilities, this is explained in [10].
- System that used GSM Bluetooth based controller and remote based monitoring system which was scalable and be used by any number of appliances without any changes in its core was developed in [11].

- Carl developed a flexible and cost effective automation system that used FPGA controller and mobile Bluetooth network. This method provided a parallel implementation of hardware by algorithm execution method which was explained in [12].
- Automation system based on WiFi was developed where Wi-Fi technology and microcontroller was used for controlling the appliances, this was explained in [13].

It was proved that the point of view of the scalability and flexibility is the main criteria considered in home automation systems. Based on this information, a design concept for a wireless home automation system using Arduino Uno using GSM is proposed in this work. This work provides simple implementation of the system as compared to other types of microcontroller.

III. HARDWARE REQUIREMENTS

- Arduino UNO
- GSM Module
- ULN 2003
- Relay 5V
- Bulb with holder
- Cell phone
- LCD display
- Bread board
- Power supply
- Connecting wires

IV. BLOCK DIAGRAM

The block diagram consists of Wireless medium, Arduino, GSM module and LCD display as shown in the block diagram.

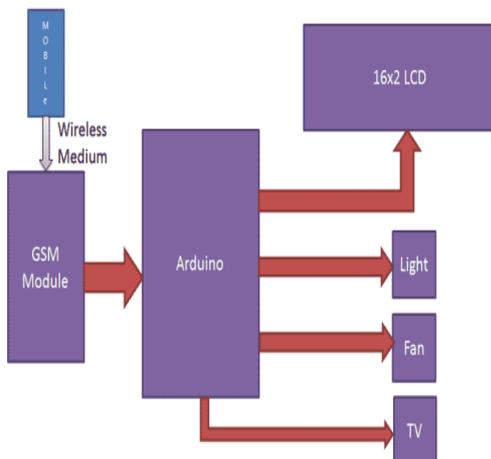


Figure.1 Block diagram

V. CIRCUIT REPRESENTATION

Model of circuit is as shown below:

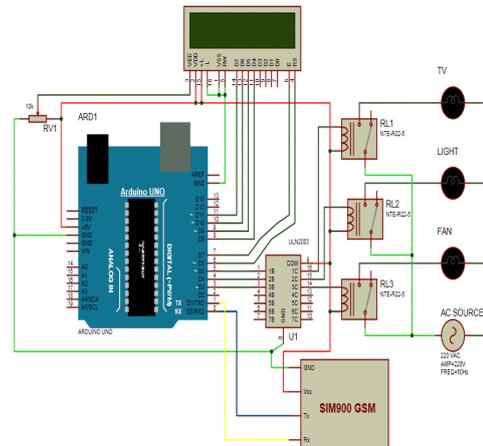


Figure.2 : Circuit Model

VI. METHODOLOGY

In this project, Arduino UNO is used for controlling the whole process. Here GSM module is used for wireless communication in controlling the home appliances. Commands such as “#A.Fan.on*”, “#A.Fan.off*” are used for controlling home appliances. Arduino receives the message through GSM, it sends the signal to relays to switch ON or OFF the home appliances using relay driver. A prefix in command “#A.” is used to identify that the main command is coming next to it and “*” at the end of command indicates that message has ended.

When the message is sent from GSM module of Mobile to GSM module in Arduino, the Arduino reads the message by extracting the main command from the received message and stores it in a variable. After this, Arduino compares the command with predefined command. If the command is matched then Arduino sends signal to relay through the relay driver for switching ON and OFF the home appliance and simultaneously result is displayed on LCD by using appropriate commands.

VII. GSM MODULE

GSM module is used in many communication devices which are based on GSM (Global System for Mobile Communications) technology. It is used to interact with GSM network using a computer or any other electronic devices with an interface. GSM module only understands Atmel commands and responds accordingly. The most basic command of this is “AT” if the GSM module responds OK then it is working good otherwise it responds saying an error has occurred like “ERROR”. There are various Atmel commands like ATA to answer a call, ATD to dial a call etc. Atmel commands should be followed by Carriage return exclusively.



Figure.3: GSM MODULE

7.1 CIRCUIT DESCRIPTION

Connection of this GSM automation circuit is simple, here a LCD is used for displaying the status of home appliances which is directly connected to Arduino in 4-bit mode. Data pins of LCD namely RS, EN, D4, D5, D6, D7 are connected to Arduino digital pin number 6, 7, 8, 9, 10, 11 respectively similarly Rx and Tx pin of GSM module is directly connected at Tx and Rx pin of Arduino respectively. And GSM module is powered by using a 12 volt adaptor and 5 volt SPDT 3 relays is used for controlling LIGHT, FAN and TV. And relays are connected to Arduino pin number 3, 4 and 5 through relay driver ULN2003 for controlling the devices.

VIII. SOFTWARE REQUIREMENTS

The Arduino project requires an integrated development environment (IDE), which is written in the programming language called Java, it is from the IDE for the languages Processing and Wiring. It was created for people with no exact knowledge of electronics. It consists of a code editor with features such as cutting-pasting the texts, highlighting, searching, automatic indentifying and replacing. Similarly it provided simple one-click mechanism to compile and upload programs.

Arduino programs can be written in any programming language with a compiler that generates the binary machine code. Atmel is suggested in this work for microcontrollers. AVR Studio and Atmel Studio are be used for programming Arduino in this project.

8.1 ALGORITHM

STEP 1: The device which is to be made ON or OFF is decided.

STEP 2: The command is sent through SMS from user mobile to GSM Module .

STEP 3: The command is verified; if the command is correct the operation is performed, or else an error is shown in display.

STEP 4: RESULT: As per the requirement the activation/deactivation of the device is done through wireless medium.

IX. APPLICATION:

- Security systems
- Burglar alarms
- Gas detection
- Smoke detection
- Control of door and window shutters
- Home entertainment system

X. ADVANTAGES:

- Simple and easy to access
- Accessed from remote areas
- Lower power consumption
- Takes measures for reducing electricity bills
- Portability

XI. CONCLUSION

This document presents a mobile controlled user-friendly approach to the home automation system. This system can easily be implemented because of its wireless communication standards. Till now it has used the literatures for all the topics that include GSM automation system using SMS. Then main control program, hardware and automation system is built and sent through the GSM network (with SMS).

A hardware implementation of the system was carried out to verify the reliability of the system.

The implemented system was simple, cost effective and flexible that can be expanded and scaled up.

XII. FURTHER ENHANCEMENT:

- Controlling speed of fan
- Controlling room temperature
- Control of water level

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