

GSM Based Home Automation System using Arduino

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These wastages are very detrimental to industrial development. Consequently, available technologies need to be widened to eliminate or reduce these wastages in electricity usage. Negligence with regards to leaving lights and other electrical appliances on can lead to outrageous electricity bills, wastage of much needed power (electrical energy) and shorter life span of electrical devices or appliances. This thesis presents the design and implementation of a centralized remote lighting and appliances control system for smart home applications using GSM technology that generally reduces the cost of power consumption appreciably. Therefore, the remote controlling takes the control of the home beyond the home and directly to the hands of the home owners. Basically, if a simple mobile phone takes on the added responsibility to control the electrical appliances of any home, then the control has no geographical boundaries. Nowadays the mobile services, so developing a system which can control home appliances and lighting from anywhere should appeal to a very large population.

2. Hardware Requirements

Arduino Uno, GSM module, L298 motor driver, LCD display, Mobile phone and Relay are mainly contained in this research.

2.1 Arduino Uno

The Uno is a huge option for initial Arduino. It consists of 14-digital I/O pins, where 6-pins can be used as PWM (pulse width modulation outputs), 6-analog inputs, a reset button, a power jack, a USB connection and more. It includes everything required to hold up the microcontroller; simply

ABSTRACT

Home Automation System is used to control home appliances. With the use of computers and electronics technology electrical appliances can be controlled from any part of the world. Consequently, greater amount of energy will be saved and hence the natural resources. This can be achieved by using the mobile phone. This system is designed using Arduino UNO and GSM module. The electrical appliances are controlled by sending a text message from any mobile located in any part provided it has GSM connectivity. There are many existing Home Automation Systems on the world. But every system has its pros and cons. The proposed system is easy to implement and understand.

KEYWORDS: Arduino Uno, GSM module, L298 motor driver, LCD display, Mobile phone, Relay

1. INTRODUCTION

The development of digital information has led to the rapid change in human life -style. The use of electricity is very important as one of the main source of energy that is vital in modern lives today. As the years go by, technology has been ever evolving, and as a result, new means are being developed for easier and safer control of electrical devices for more efficient power management at homes and work places. Most people inevitably tend to leave their lights, fans and other appliances on when leaving their homes resulting in energy wastages and inefficiencies. It is not environment but whatever be the case much should be done to moderate energy wastage.

attach it to a PC with the help of a USB cable and give the supply to get started with a AC-to-DC adapter or battery. Arduino Uno is shown in figure 1. [17 Ano]



Figure1. Arduino Uno

2.2 GSM module

GSM module is used in many communication devices which are based on GSM (Global System for Mobile Communications) technology. Figure 2 describes an example of GSM module.



Figure2. GSM module

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 a 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. RESULT: As per the requirement the activation /deactivation of the device is done through wireless medium. [14Bha]

2.3 LCD Display

LCD1602, or 1602 character-type liquid crystal display, is a kind of dot matrix module to show letters, numbers, characters and so on. The model 1602 means it displays two lines of sixteen characters. LCD1602 has parallel ports, that is, it would control several pins at the same time. LCD1602 can be categorized into eight-port and four-port connections. If the eight-port connection is used, then all the digital ports of the Sun Founder Uno board are almost completely occupied. An example of LCD Display is as shown in figure 3. [06Ano]



Figure3. LCD Display

2.4 L298 Motor Driver

The L298 is an integrated monolithic circuit in a 15-lead Multiwatt and PowerSO20 packages. It is a high voltage, high current dual full-bridge driver designed to accept standard TTL logic levels and drive inductive loads such as relays, solenoids, DC and stepping motors. A motor driver is a little current amplifier; the function of motor drivers is to take a low-current control signal and then turn it into a higher-current signal that can drive a motor. L-298. Figure 4. shows L298 Motor Driver. [15 Ano]



Figure4. L298 Motor Driver

3. Hardware Implementation

Mobile phone is a revolutionary invention of the century. It was primarily designed for making and receiving calls & text messages, but it has become the whole world after the Smart phone comes into the picture. In this thesis, one can control the home appliances, using the simple **GSM based phone**, just by sending SMS through his phone. In this thesis, no Smart phone is needed, just the old GSM phone will work to switch ON and OFF any home electronic appliances, from anywhere. In proposed system overcome the all the unsupported things in existing system. This system is designed for secured wireless communication, our system is based on the WSN system user can access the system from android mobile using GSM module. This contain the two section one is transmitter section and another section is

receiver. Transmitter section is contain the android mobile and Receiver section is the actual controlling electronic system for home automation which is designed using the Arduino circuit containing the GSM module for wireless communication. GSM module is used to access wireless communication between android mobile as well as the Arduino controlled circuit. The system block diagram describes the following figure 5.

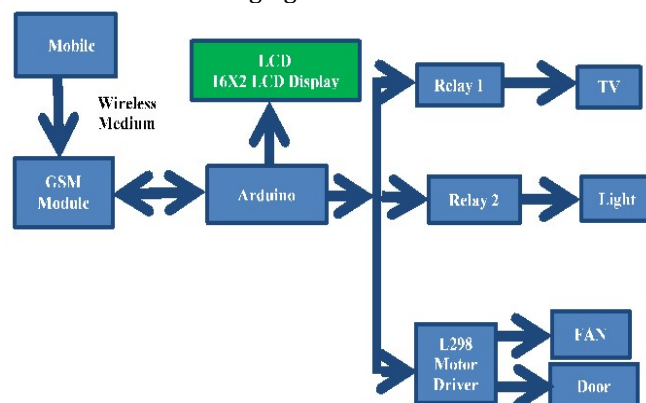


Figure5. Block Diagram of GSM Base Home Automation

4. System Circuit Diagram

Connection of this GSM automation circuit is simple, a LCD is used for displaying the status of home appliances which is directly connected to A4, A5 of Arduino. Rx and Tx pin of GSM module is directly connected at Tx and Rx pin of Arduino respectively. System Circuit Diagram is expressed in figure 6.

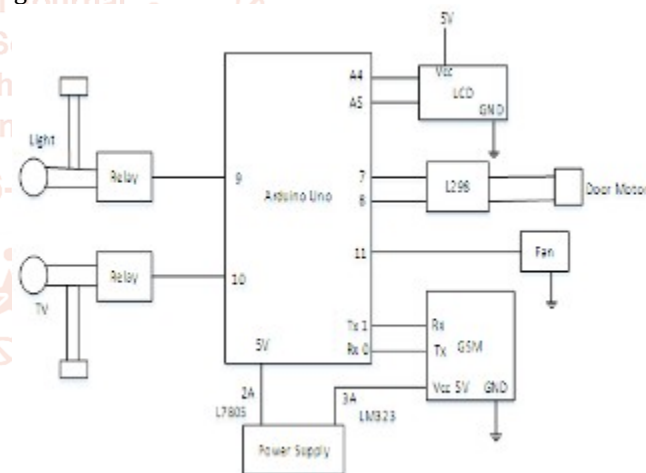
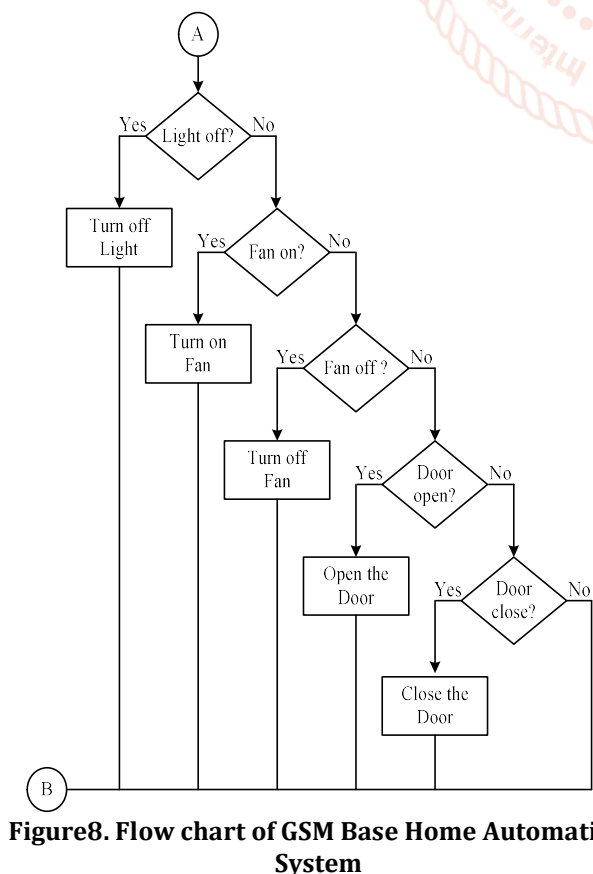
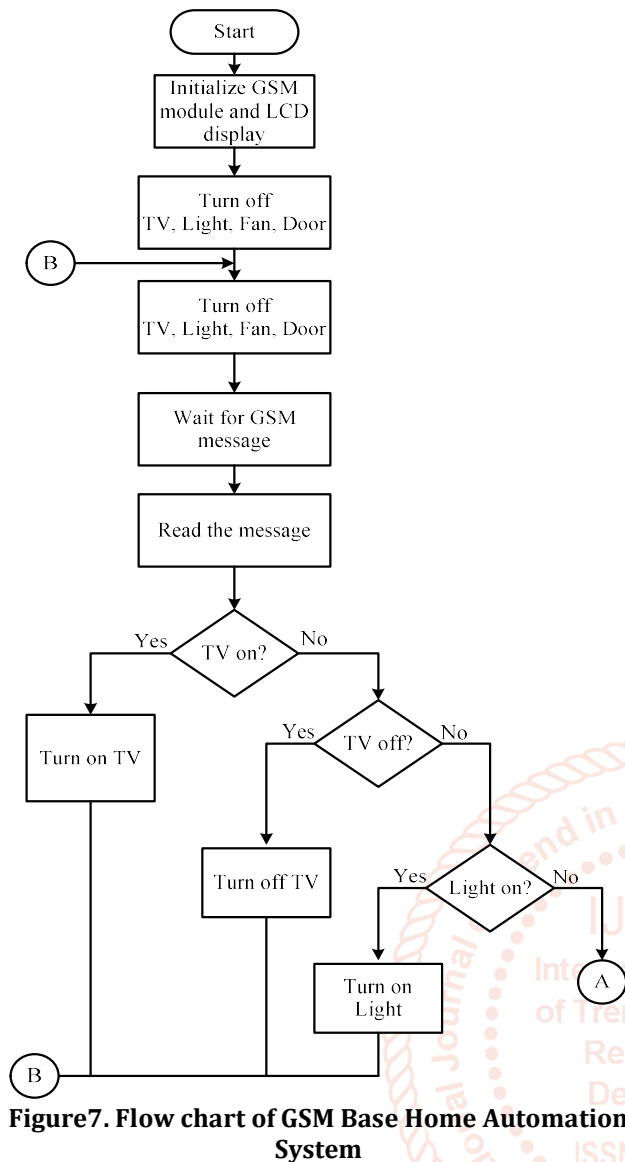


Figure6. Circuit Diagram of GSM Base Home Automation

GSM module is powered by using a 12V Power supply and 5 volt relays is used for controlling LIGHT, and TV. And relays are connected to Arduino pin number 9, 10. Fan is connected to pin 11 of Arduino. L298IC is used for controlling the door motor.

5. Flow chart of GSM Base Home Automation System

In this Thesis, 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. Flow chart of GSM Base Home Automation System is shown in figure 7 and figure 8.

6. Tests and Result

The experimental output results can be proved in this section. It consists of Arduino Uno which controlling the whole process, GSM Module which accept the message from mobile, LCD display which express ON,OFF of the home appliances. After the connections are made and checked properly the system is now ready for use. The system works by sending a predefined text string from a mobile phone which can be present in any part of the world. The string is then received by the Arduino which decodes it and checks if it matches with the already stored string in command. If it matches the Arduino drives the relay which further switches ON and OFF the electrical appliances. The sending and receiving of the strings from/ to the Arduino can be achieved by AT commands. AT commands for TV can be studied at the following piece of code. The code shows how Arduino reads commands and drives the relays.

```

#define TV 10 if(!strcmp(str,"tv on",5)))
{
  digitalWrite(TV, LOW);
  lcd.setCursor(9,1);
  lcd.print("ON ");
  delay(200);
}
  
```

In this piece of code value '5' is given to tv in the macro defined at the starting of the code. The command checks the condition that if the received string and predefined string matches then It sets the pin 10 of Arduino to low which is further connected to relay and drives it. Figure 9 shows the TV ON when the mobile send message #A.tv on*, the GSM Module initialized, the LCD display initialized and then the LCD display shows TV ON and the TV is ON.



Figure9. Photo of TV ON

Figure 10 shows fan ON when the mobile send message #A.fan on*, the GSM Module initialized, the LCD display initialized and then the LCD display shows fan ON and the fan is ON.



Figure10. Photo of Fan ON

Figure 11 shows light ON when the mobile send message #A.light on*, the GSM Module initialized, the LCD display initialized and then the LCD display shows light ON and the light is ON.



Figure11. Photo of light ON

Figure 12 shows door motor Open when the mobile send message #A.door open*, the GSM Module initialized, the LCD display initialized and then the LCD display shows door Open and the door is Open. Although figure 9, figure 10, figure 11 and figure 12 are the same program procedure, Arduino pins, lcd pins and input variable name are different.

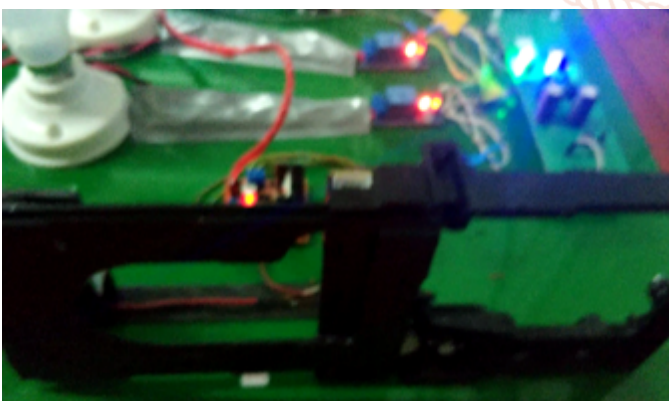


Figure12. Photo of Door open

7. Discussions

With the increase in the consumption of energy and population, there is a great need to conserve energy in every way possible. The inability to access and control the appliances from remote locations is one of the major reasons for energy wastage. This thesis presents the development and implementation of a Global System for Mobile Communication (GSM) based remote control system for electrical appliances and lighting that enables complete control of the interface on which it is based. GSM Shield was used for receiving short message service (SMS) from the homeowner as mobile phone that automatically enables an Arduino microcontroller to take the necessary actions like switching OFF and ON electrical appliances such as fan, light, air-conditioner, supply mains and so on. Basically, it reads the SMS and acts according to the message. Similar products commercially available are Internet dependent and so lack the true sense of real mobility and security. However, the present GSM based remote control system allows the homeowner to control household appliances from anywhere using the mobile phone and also prevents unauthorized access to these appliances. Crucial to the present system is the provision of security on detection of intrusion via SMS using GSM technology.

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