# GSM & DTMF BASED HOME AND INDUSTRIAL AUTOMATION USING ARDUINO

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## ABSTRACT

*This paper presents an effective technique for the user to monitor and control the house/office appliances and other equipment's via the mobile phone. The automation improves the lifestyle of control of the device. This approach is based on embedded system. In this project, we propose a unique System for automation utilizing Dual Tone Multi Frequency (DTMF) that is paired with a wireless module to provide seamless wireless control over many devices in a house &Industry. This paper suggests a method for control using the DTMF tone generated when the user pushes mobile phone keypad buttons or when connected to a remote mobile system. The advantage of this system is that it can be operated from any distant or remote area.*

***Keyword:DTMF circuit, GSM modem, ARDUINO, Mobile phone, Controller circuit***

## I. INTRODUCTION

Just conceive that, how beneficial it will to be able switch on our air condition half hour before we reach our home on summer time. When we leave our home for some work without realizing that some appliances such as fans, air conditioners, and lights are on; then by using our mobile phone or internet, we are able to turn off power to those devices. It will be even more useful if the system detects unauthorized movement in the house and alerts us or sends messages on our mobile phones or we can know the status of our house anytime by Twitter. These are some features of home automation and there is no end to its application.

Actually, filthy automation systems are now being developed that can maintain an invoice of household items.The automation market is mainly guided by flourishing need for efficient solutions in various household applications such as lighting, safety and security and energy legislation. The development of smart cities and high-tech homes in the North America and Middle East region is make an impression about the growth of overall home automation market. The home automation market is initially driven by increasing the necessity of effective solutions in several household applications such as lighting, safety and security, energy management, audio and video entertainment. Smart homebased home automation has huge demand in market now-aday.Smart phone based home automation apps are alreadyrunning successfully in global market. Within 2020 year,home automation will run as expectations in Bangladesh aswell as in whole world. Now we can say that, user's

awarenessand attraction for new technology are increasing the growth ofhome automation in North America, Europe and Asia pacificzone.

Research for home automation will increase revenue andglobal development within 2015-2020. Advantages of homeautomation will explore soon and the effect of it will developthe growth of society. So, this project will create a goodopportunity at south Asian market.

## II. SYSTEM DESCRIPTION

Our designed home automation system is a flexible system that can control and make a communion between nearly all load appliances of the house. All appliances can control from indoor also Outdoor from any places. Our automated home can be called a smart home. If one forgets to switch off the lights or other appliances while going out, it allows you to turn off the appliance with your cell phone. By using GSM, you can get status of your home and also can control your home power devices. This is a simple automation system which contains remote mobile host controller and several home appliances.

We have five features in this thesis. We implement home automation usingGSM-SMS, GSM-DTMF, and anGSM module.

At first, we set up GSM then GSM-SMS then GSMDTMF (Dual-Tone Multi-Frequency) then PIR and the last part is the internet module using twitter.

The main features of this system are:

- Control through mobiles.
- Control by SMS where device is capable of recognizing the user.
- Through GSM modem, appliances can be controlled by DTMF (Dual-Tone Multi-Frequency) tone. All devices can be controlled using phone calls.
- The user can control appliances through Twitter.
- Another feature is detecting humans or intruders by using motion detector or PIR sensor.

While the development of the first three features of this system has been completed, the last two features are still under development.

## III. METHODOLOGY

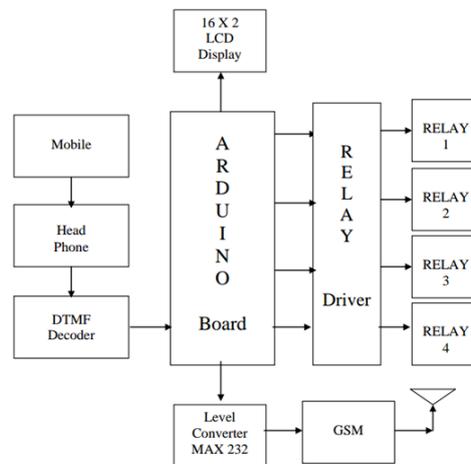We have combined the system with input processing and output that are shown in Fig.1

Fig.1 Block Diagram of Industrial Automation System

## GSM AND DTMF SYSTEM

### 1.1GSM Modem

GSM MODEM: A GSM modem is a wireless modem that works with a GSM wireless network.A wireless modem behaves like a dial-up modem. The main difference between them is that a dial-up modem sends and receives data through a fixed telephone line while a wireless modem sends and receives data through radio waves. Like a GSM mobile phone, a GSM modem requires a SIM card from a wireless carrier in order to operate.

A GSM modem can be an external unit or a PCMCIA card (also called PC Card). An external GSM modem is connected to a PC through a serial cable,USBcable,Bluetooth or Infrared. Like a GSM mobile phone,a GSM modem requires a SIM card from a wireless carrier in order to operate.PC's use AT commands to control a GSM modems.we can use a GSM modem just like a compatible modem. GSM modems support an extended set of AT commands. These extended AT commands are defined in the GSM standards.

**GSM** (**Global System for Mobile Communications)**, originally is a standard developed by the European Telecommunications Standards Institute (ETSI) to describe the protocols for second-generation digital cellular networks used by mobile devices GSM is a cellular network, which means that cell phones connect to it by searching for cells in the immediate vicinity. There are five different cell sizes in a GSM network— macro, micro, pico, femto, and umbrella cells. The coverage area of each cell varies according to the implementation environment. Macro cells can be regarded as cells where the base station antenna is installed on a mast or a building above average rooftop level. Micro cells are cells whose antenna height is under average rooftop level; they are typically used in urban areas. Picocells are small cells whose coverage diameter is a few dozen meters; they are mainly used indoors. Femtocells are cells designed for use in residential or small business environments and connect to the service provider's network via a broadband internet connection. Umbrella cells are used to cover shadowed regions of smaller cells and fill in gaps in coverage between those cells.

Cell horizontal radius varies depending on antenna height, antenna gain, and propagation conditions from a couple of hundred meters to several tens of kilometers. The longest distance the GSM specification

supports in practical use is 35 kilometers (22 mi). There are also several implementations of the concept of an extended cell,where the cell radius could be double or even more, depending on the antenna system, the type of terrain, and the timing advance.
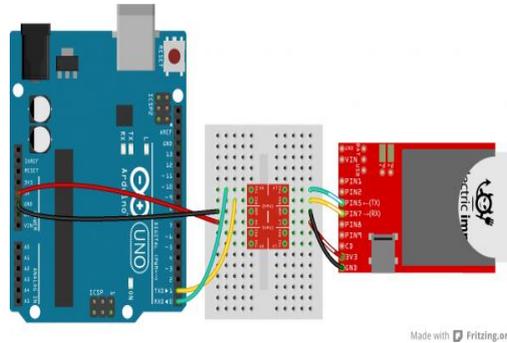


Fig.2Arduino's UNO Board



Fig.3 GSM Technology

1.1.1Subscriber Identity Module (SIM)

One of the key features of GSM is the Subscriber Identity Module, commonly known as a **SIM card**. The SIM is a detachable smart card containing the user's subscription information and phone book. This allows the user to retain his or her information after switching handsets. Alternatively, the user can also change operators while retaining the handset simply by changing the SIM. Some operators will block this by allowing the phone to use only a single SIM, or only a SIM issued by them; this practice is known as SIM locking. A **subscriber identity module** or **subscriber identification module** (**SIM**) is an integrated circuit that is intended to securely store the international mobile subscriber identity (IMSI) number and its related key, which are used to identify and authenticate subscribers on mobile telephony devices (such as mobile phones and computers). It is also possible to store contact information on many SIM cards. SIM cards are always used on GSM phones; for CDMA phones.The SIM circuit is part of the function of universal integrated circuit card(UICC) physical smart card, which is usually made of PVC with embedded contacts and semiconductors. "SIM cards" are transferable between different mobile devices. The first UICC smart cards were the size of credit and bank cards; sizes were reduced several times over the years, usually keeping electrical contacts the same, so that a larger card could be cut down to a smaller size.

1.1.2. SMS messages and contacts

Most SIM cards will orthogonally store a number of SMS messages and phone book contacts. The contacts are stored in simple "name and number" pairs: entries containing multiple phone numbers and additional phone numbers will usually not be stored on the SIM card.

**1.2DTMF Decoder**

In earlier days, our telephone systems were operated by manually in a telephone exchange room. The callers will pick up the phone and giving instruction to the operator to connect their destination line. The DTMF technology provides ultimate solutions for the telephone industries which is used to switch two lines automatically. The DTMF stands for 'Dual Tone Multi-frequency' which is one of the techniques for converting the analogue signal to digital using DTMF decoder. The DTMF decoder circuit mostly used in mobile communications system which recognizes the sequence of DTMF tones from the standard keypad of the mobile



Fig.4 DTMF Technology

**1.3LCD Display**

In this thesis we are using 16 X 2 intelligent LCD display to display the temperature, humidity, light etc. In our project to monitor the temperature, humidity, and status we require LCD display. The disadvantage of LCD is it will not emit the light. Therefore to remove this disadvantage we have to select the LCD, which has backlight LED.Two lines are sufficient for our project. Therefore we can select 2 line 16 character LCD displays.

We come across LCD displays everywhere around us. Computers, calculators, television sets, mobile phones, digital watches use some kind of display to display the time. An LCD is an electronic display module which uses liquid crystal to produce a visible image. The 16×2 LCD display is a very basic module commonly used in DIYs and circuits. The 16×2 translates o a display 16 characters per line in 2 such lines. In this LCD each character is displayed in a 5×7 pixel matrix.
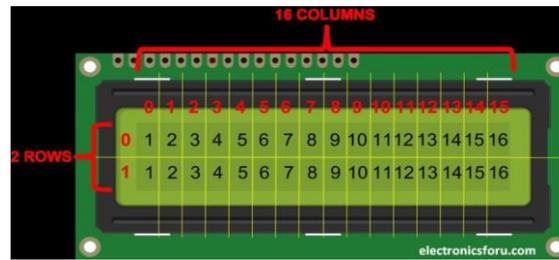
Fig.5 16*2 LCD Display

A **liquid-crystal display** (**LCD**) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in colour or monochrome.LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden, such as preset words, digits, and 7-segment displays, as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements.

**1.4 RELAY Driver**

Relays driver is used to switch ON or OFF the relay. Arduino will send data to the base of transistor. If base of transistor is at zero volts then transistor is off and relay is in de-energized condition. Therefore NO contact remains NO. If base of transistor is at +5 volts then transistor is ON and current flows through transistor as well as relay. Therefore relay is in energized condition. Therefore NO contact will become NC. We are using IC ULN2804 as relay driver. This has 08 transistors in it. A Relay driver IC is an electro-magnetic switch that will be used whenever we want to use a low voltage circuit to switch a light bulb ON and OFF which is connected to 220V mains supply. The required current to run the relay coil is more than can be supplied by various integrated circuits like Op-Amp, etc. Relays have unique properties and are replaced with solid state switches that are strong than solid-state devices. High current capacities, capability to stand ESD and drive circuit isolation are the unique properties of Relays. There are various ways to drive relays.Some of the Relay Driver ICs are as below.

- High side toggle switch driver
- Low side toggle switch driver
- Bipolar NPN transistor driver
- N-Channel MOSFET driver and
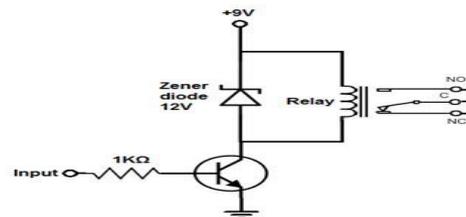- Darlington transistor driver
- ULN2003 driver

Fig.6 Circuit Diagram of Relay

A typical digital logic output pin supplies only tens of MA of current. External devices such as high-power LEDs, motors, speakers, light bulbs, buzzers, solenoids and relays can require hundreds of MA and they need same voltages. In order to control small devices which use DC, a transistor-based driver circuit is used to amplify current to the required levels. If the voltage and current levels are in perfect range, the transistor acts like a high-current switch controlled by the lower current digital logic signal. A discrete BJT is used at times in place of MOSFET transistor especially on older or low voltage circuits as shown
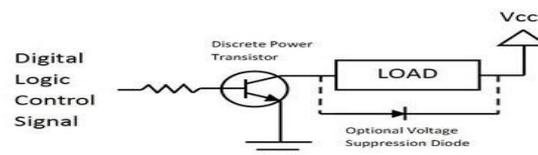


Fig.7 Relay Driver

### 1.5. AC Adapter

An AC adapter, AC/DC adapter, or AC/DC converter is a type of external power supply, often enclosed in a case similar to an AC plug. Other common names include plug pack, plug-in adapter, adapter block, domestic mains adapter, line power adapter, wall wart, power brick, and power adapter. Adapters for battery-powered equipment may be described as chargers or rechargers (see also battery charger). AC adapters are used with electrical devices that require power but do not contain internal components to derive the required voltage and power from mains power. The internal circuitry of an external power supply is very similar to the design that would be used for a built-in or internal supply.



Fig.8 AC Adapter

External power supplies are used both with equipment with no other source of power and with battery-powered equipment, where the supply, when plugged in, can sometimes charge the battery in addition to powering the equipment.

Use of an external power supply allows portability of equipment powered either by mains or battery without the added bulk of internal power components, and makes it unnecessary to produce equipment for use only with a specified power source; the same device can be powered from 120 VAC or 230 VAC mains, vehicle or aircraft battery by using different adapter.

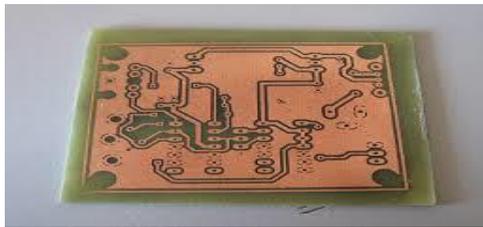## V. PCB DESIGNING



Fig.9 Copper Clad Lamination Plate



Fig.10 Drilling



Fig.11 Component Mounting



Fig.12 Circuit Testing

## VI.CONCLUSION

This paper describes the design and implementation of a home automation system using various modern communication technologies. The system also provides a security system. The project uses GSM and Arduino platforms, both of which are FOSS (Free Open Source Software). Therefore the overall implementation cost and affordability is very inexpensive.

## VII. ACKNOWLEDGMENT

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