CSE-190019

A GSM BASED FIRE ALARM WITH AUTOMATIC SAFETY SYSTEM

A THESIS BOOK

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (CSE)

OF

SONARGAON UNIVERSITY (SU)

BY

SAMIKKHA KUMAR SAHA - ID CSE-1601007053

TAPASH CHANDRA PAUL - ID CSE1601007047

MD. SOHAL RANA -ID CSE1601007042

MD. TANVIR HOSSAIN -ID CSE1601007052

MAHADI HASAN SHUVO -ID CSE1601007087

SUPERVISED BY

MD. RAFIQUL ISLAM (RAFIQ)

LECTURER - DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

SONARGAON UNIVERSITY (SU)

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

BACHELOR OF COMPUTER SCIENCE & ENGINEERING

BATCH-7B

SONARGAON UNIVERSITY, DHAKA

September-2019

Declaration

We hereby declare that research work titled **"A Gsm Based Fire Alarm With Automatic Safety System'** is our own work. The work has not been presented elsewhere for assessment. We develop the new method where material has been used from other sources it has been properly referred.

Signature of Supervisor

12.09.2019

Md. Rafiqul Islam (Rafiq)
Lecturer Department of
Computer Science & Engineering

Signature Writer
12/09/19 Samikkha Kumar Saha ID-CSE 1601007053
Tapash Chandra Paul ID-CSE 160100747
Sohal Rana Md. Sohal Rana ID-CSE 1601007042
Tanvir Md. Tanvir Hossain ID-CSE 1601007052
12.09.19 Mahadi Hasan Shuvo ID-CSE1601007087

Approval

This is to certify that the project "**A Gsm Based Fire Alarm With Automatic Safety System**' has been submitted to the respective members of the Board of Examiners of the Faculty of Engineering department to fulfill the requirement for the degree of B.Sc. in Computer science & Engineering under complete supervision of the undersigned.

12.03.2019

Md. Rafiqul Islam (Rafiq)

Lecturer (Sonargaon University)

ACKNOWLEDGEMENT

Firstly, we would like to Thank **Md. Rafiqul Islam (Rafiq)** Lecturer Department of Computer Science & Engineering (Sonargaon University) for his guideline and feedback. Secondly we pledge our gratitude towards Sonargaon University for providing necessary resources.

We would like to express our gratitude to our parents for their continuous support and encouragement. We are grateful to all the respected teachers and officials of faculty of science and engineering of Sonargaon University (SU) as well for helping us in many different ways.finally, we would like thanks to almighty allah for enabling us to the successful completion of our undergraduate project.

Aim of The Project

The aim of this work is to use the risk management methodology to identify possible risk scenarios that might be at hand with current work procedures regarding the monitoring of Automatic Fire Alarm Systems, aiming at buildings considered to be vulnerable from a societal point of view.

To evaluate the level of risk, various strategies currently employed by the Fire Rescue Services (FRS) with regards to response procedures to automatic fire alarm systems are analyzed as well as various timelines regarding the alarm call-out time, the size of constructed facilities and other fire protection systems that are present.

Also controlling/reducing the risk factors if necessary, by building a model that categorizes buildings with regards to the FRS response to fire alarms, i.e. when and when not should there be a delay in the fire brigades response to fire alarms.

The model is built on this research on current working procedures regarding AFAS, fire protection measures, statistical analysis on empirical data from a PMS and the CDFRS as well as on a consequence model of a hospital ward and a new building regulation being introduced in Bangladesh.

Method

Firstly the methodology for reaching the aim of the project is determined. Risk analysis methods used will be qualitative as well as quantitative.

Probabilistic methods will be used to evaluate fire risk including simple statistical analysis, logic tree analysis and probability distributions.

Various data regarding CDFRS and PMS response times as well as floor area of facilities are analyzed in order to investigate the inter-dependence of these variables and to perform an analysis regarding optimal work procedures for the PMS and the FRS in order to reduce risks.

Data from different databases will be utilized in this study. Data and Databases are listed below: The Fire and Accident database, where every emergency call that the Fire and Rescue Service attend to relating fire is registered, including various time data.

Data on all fire alarms registered with a Private Monitoring Station over a one year period and the associated response timelines. Data from the Bangladesh Property registry where the floor area of buildings and facilities is registered as well as data from insurance companies on fire losses.

Evacuation calculations and computational fluid dynamic simulations will be carried out for a hospital building being planned in Reykjavik Bangladesh as an illustrative project as hospitals are considered vulnerable from a societal point of view.

A building classification model is introduced in this work which classifies buildings/activities with regards to the response of the PMS and the FRS following an alarm from an automatic fire alarm system.

The classification model focuses on vulnerable buildings/activities but also builds a base for other buildings and activities.

Table of contents

Chapter 1 **Page No**

1.1 Overview ---------- 10

Keywords ---------- 10

Introduction ---------- 10-11

Motivation of The Work and Background ---------- 11

Chapter 2

2.1 Fire Detectors Review ---------- 12

2.2 Heat or Thermal Type Detectors ---------- 12

2.3 Smoke or Gas Detectors ---------- 12-13

Chapter 3

3.1 Flame Type Detectors ---------- 14

3.2 semiconductor gas or smoke detectors ---------- 14

Chapter 4

4.1 Design of fire-Alarm system ---------- 15

4.2 Hardware design ---------- 16

4.3 Sensor Section ---------- 16

4.3.1 Control unit ---------- 17

4.3.2 Network Module* ---------- 18

Chapter 5

5.1 Power Supply ---------- 19

5.2 Software Design ---------- 19

Chapter 6

6.1 Results And Discussion ---------- 20-21

Chapter 7

7.1 Micro Controller---------- 22

7.2 Pic Micro Controller---------- 22

7.2.1 The Pic Architecture Is Characterized By Its Multiple Attributes---------- 22

7.2.2 Advantages Of Pic---------- 23

7.2.3 The Pic Architectures Have These Limitations ---------- 23

Chapter 8

8.1 Introduction To Pic16f73---------- 24

8.1.1 These Functions Include ---------- 24

8.2 Cmos Technology ---------- 25

8.3 Pin Configuration ---------- 25

Chapter 9

9.1 Dc Gear Motor ---------- 26

9.2 External Structure---------- 26

9.3 Working Of The Dc Geared Motor---------- 26

9.3.1 Motor Driver l293d---------- 27

9.3.2 Working Of l293d ---------- 27

9.3.3 l293d Logic 28

Chapter 10

10.1 Arduino Nano---------- 29

10.2 Specification of Aruino Nano ---------- 30

10.3 Input And Output ---------- 31

10.4 Lm7805 Voltage Regulator ---------- 31

10.5 Pin Description---------- 32

10.4.2 Advantages of 7805 Voltage Regulator---------- 33

10.4.3 Disadvantages Of 7805 Voltage Regulator ---------- 33

10.5 Pindescription ---------- 34

10.6 Advantages of 7805 Voltage Regulator ---------- 34

10.6.1 Disadvantages of 7805 Voltage Regulator---------- 35

10.7 Push Button Switch ---------- 36

10.8 Crystal Oscillator ---------- 37

10.9 Led---------- 37

11.00 Circuit Breakers---------- 38

Program Code---------- 38-40

References ---------- 41-43

Chapter 1

Overview, Keywords & Introduction

1.1 Overview

In this work a review of existing fire-detector types has been carried out along with the development of a low cost, portable, and reliable microcontroller based automated fire alarm system for remotely alerting any fire incidents in household or industrial premises. The aim of the system designed is to alert the distant property-owner efficiently and quickly by sending short message (sms) via gsm network. A linear integrated temperature sensor detects temperature beyond preset value whereas semiconductor type sensor detects presence of smoke or gas from fire hazards. The sensor units are connected via common data line to atmega8l avr microcontroller. A sim300cz gsm kit based network module, capable of operating in standard gsm bands, has been used to send alert messages. The system is implemented on printed circuit board (pcb) and tested under different experimental conditions to evaluate its performances.

1.2 keywords

Fire-detector, micro controller, fire alarm, temperature sensor, sms, gsm network,DC Motor, Autometic Circuit Breaker.

1.3 Introduction

With the advancement of human civilization, fire-safety has been a prime concern. Fire hazards can be fatal and denigrating for industrial and household security, also minatory for human life. The best way to reduce these losses is to respond to the emergency situation as quick as possible. So, there comes the necessity of standalone autonomous fire detection systems. These systems render the works of quick detection, alarm notification, and sometimes initiation of fire extinguishing. The systems, equipped with smoke, temperature, pyro-electric sensors can detect unfavorable accidental situations, as it happens, and with the help of a processing unit can alert in- scantly for undertaking cautious measures. In these fatal situations, early detection and faster alert will yield lesser losses of property and life.

A fire or smoke alarm system can be monitored locally in the premises, or remotely at a distant place as per requirement. Remote alarm system provides the owner of the premise with the advantage of monitoring from distant location and taking immediate actions when an emergency message is received, unlike a manual system. Remote monitoring systems can be designed in various ways-using wireless sensor networks, ethernet, image processing and other digital

communication technologies although the systems are reliable and have a wide range of pros, they are accompanied by concerns about being complex, uncompact, non-standalone, ex- pensive and having redundant appurtenances. Therefore, there is necessity for a system which would be reliable and swift responsive as well as simple, easy implementable and cost effective.

1.4 Motivation of The Work and Background

Fire has been a danger to assets and population through ages. In very recent times there have been multiple cases of fire throughout Dhaka city damaging properties worth millions and moreover taking away lives of innocent people.

Locations like factories, slums and other open areas are most vulnerable to such disastrous events.

Offices and other workplaces are also exposed to such events which may cause loss of important confidential documents and treasuries.

From January to February, incidents of 1,845 fires were recorded by Fire Service and Civil Defense all over Bangladesh.

Table:

Year	Countrywide fire	Financial loss	Casualty/Injury
2016	16,858	240 crore 43 lakh	152/247
2017	1,845	35 crore 81 lakh	14/41
Year	Dhaka city fire	Financial loss	Casualty/Injury
2016	3,020	100 crore 63 lakh	15/81

- A total of 25 deaths have been confirmed in a deadly fire that broke out at a building in Dhaka's Banani area
- Firefighters work to douse a fire that broke out inside the warehouse of an RMG factory in Ashulia, Dhaka on Monday, March 4, 2019
- February 21, 2019 Syed Zakir Hossain/Dhaka Tribune
- This slum in Chaktai area of Chittagong caught fire on Sunday, February 17, 2019
- A building ravaged in a fire on Wednesday night, February 20, 2019, in Chawkbazar of Old Dhaka

Chapter 2
Fire Detectors Review

2.1 Fire Detectors Review

Fire detectors can be of different types with various specific features depending upon different scenarios and demands. More or less these detectors can be categorized as heat or thermal detectors, smoke or gas detectors, semiconductor gas detectors, and flame detectors .

2.2 Heat or thermal type detectors

Heat or thermal type detectors are the most primitive types of autonomous fire detectors, dating back to mid- 1800' s. Most of these detectors are fixed temperature ones, which activates upon reaching a predefined tem- premature. Others include types, which activate whenever there is an abnormal rise in temperature in the premises. Thermal detectors are reliable, inexpensive, easy to maintain, and have lower false alarm rate. But these detect- tors are slow, and by the time they reach predefined detection point, damage could already been underway. Therefore these detectors are of limited use.

2.3 Smoke or gas detectors

Smoke or gas detectors, a relatively newer invention, became widespread during 1970' s and 1980' s.these detectors usually detect fire in early flaming or smoldering stages. These detectors can be of different types having different operation principles, namely—optical or photoelectric detectors, ionization detectors, air sampling detectors etc. Each of these types has specific applications in specific circumstances.

Photoelectric or optical smoke detectors include various components, mainly, a light source (usually an infra- red led), and a lens to converge light rays into a beam, and a photo-diode . In normal condition, the light beam passes straight. But whenever smoke interrupts the path of light, scatters fraction of light into the photo- diode, the smoke detector is activated. This method of detection can detect fires that begin with long duration of smoldering aptly. Ionization smoke detectors are based on ionization from radioactive elements like americium-241. This radioactive isotope emits alpha particles into an ionization chamber, which comprises of electrodes. The alpha particles ionize the air inside the chamber, resulting current flow between the electrodes. Now, whenever smoke particles from a nearby fire passes through the chamber, the ions get attached to smoke particles, and thereby interrupts the current flow between the electrodes, and activates the detector . This type of detectors is more suited to rapid flaming fire outbursts, unlike

the photoelectric detectors, which responds better to smoldering stages. Ionization detectors might perform better where there is risk of fast flaming fire, whereas photoelectric detectors react better to cases of slow smoldering, like electrical or furnishing fire. Ionization devices are weaker in scenarios where air-flow is high. Although ionization type detectors are cheaper than photoelectric ones, they have more chance of false alarm than the photoelectric detectors . However, ionization based detectors have safety issues and possess threats to environment, because of americium-241. Therefore, on the basis of performance and safety concern some countries have banned ionization based alarms, and different fire authorities and associations have reports not recommending use of these detectors . Air sampling detectors have applications in very sensitive areas, as they can detect very fine smoke particles. These detectors are mostly air aspirating type systems. Generally they comprise a control unit, and a network of sampling tubes or pipes. The control unit consists of detection chamber, an aspiration fan, and necessary operation circuitry. Since this type of detectors are very sensitive and fast responding, they have applications in high-value and critical areas, such as, aesthetic galleries, archives, vaults, server rooms, high-tech organizations etc. However, these detection systems are complex and expensive. moreover, some combination smoke alarms include both ionization and photoelectric technologies in a single device. Some smoke alarms use a carbon dioxide sensor or carbon monoxide sensor for detection as well.

Chapter 3
Flame Type-detectors

3.1 Flame Type-detectors

Flame type detectors are sophisticated equipment to detect the flame phenomena of a fire. These detectors have various types depending on the light wavelength they use. Such as, ultraviolet, near infrared, infrared, and combination of uv/ir type detectors.uv detectors generally work with wavelengths shorter than 300 nm. This type of detectors can detect fires and explosions situations within 3 - 4 milliseconds from the uv radiation emitted from the incident. However, to reduce false alarm triggered by uv sources such as lightning, arc welding etc. A time delay is often included in the uv flame detector. The near infrared sensor or visual flame detectors work with wavelengths between 0.7 to 1.1 μm. One of the most reliable technologies available for fire detection, namely multiple channel or pixel array sensors, monitors flames in the near ir band. The infrared (ir) flame detectors work within the infrared spectral band (700 nm - 1 mm). Usual response time of these detectors is 3 - 5 seconds. Also, there is uv and ir combined flame detectors, which compare the threshold signal in two ranges to detect fire and minimize false alarms. Flame detectors are expensive and complex, though they provide very reliable and accurate response. They can operate in highly sensitive environment where other detectors can't be used. Aircraft maintenance facilities, fuel loading platforms, mines, refineries, high-tech industries etc. Use these flame detectors for safety.

3.2 Semiconductor Gas or Smoke Detectors

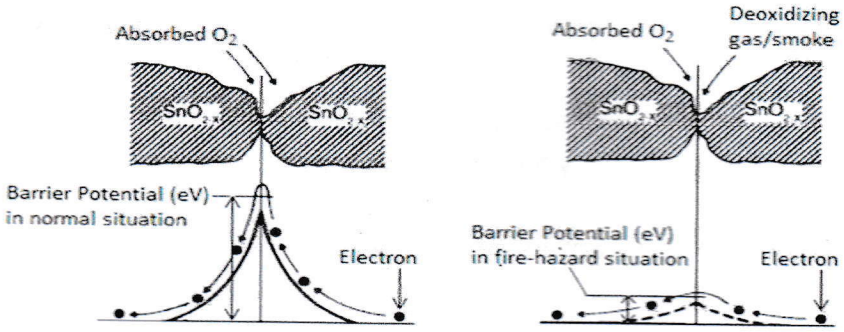
These work by the principle of chemical reaction taking place between gas from fire incident and semiconductor material present inside the sensor. The semiconductor material used in these sensors is metal oxides, generally tin dioxide (sno_2), tungsten oxide (wo_3), etc. Under normal circumstances, the surface potential acts as a potential barrier to restrict electron flow within the sensor circuitry. However, the deoxidizing gases from fire incidents diminish the oxygen surface density, and thereby reduce barrier potential to permit electron flow. The associated electrical circuitry detects the rise in conductivity due to electron flow, and activates alarm to undertake necessary measures.

These semiconductor sensors have wide range of applications for their advantageous features. They are small, compact, inexpensive, easy to install and maintain. These metal oxide type detectors are aptly used to detect fire incidents involving combustible gas, lp gas, methane, propane, alcohol, carbon monoxide etc. For their reliability. These features make this detector best suited for our purpose and hence we opted for it in our system.

Chapter 4
Design of Fire-Alarm System

4.1 Design of Fire-Alarm System

Depicts the proposed fire alarm system where multiple sensor units (each comprising smoke/gas and temperature detectors) are placed inside the arena which has fire safety concerns. All the sensors are connected.



(a) (b)

Figure 1. Overview of the system

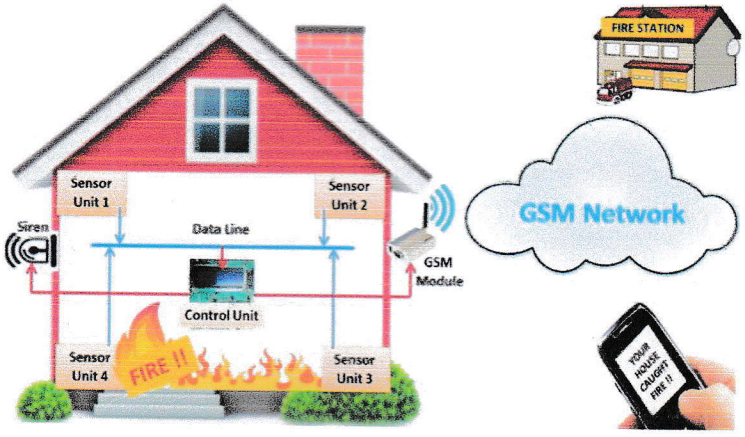


Figure 2: Working principle

Via a data input line to the control unit. So whenever any of the sensors detects any anomaly, the control unit starts its action. It activates the local siren and the gsm module. Thereby, an alarm message in the format of short message service (sms) will be rendered at the same time through the gsm network to the authority and the fire station nearby.

4.2 Hardware-Design

The hardware of the system mainly comprises sensor section, control unit, network module, and power supply.

4.3 Sensor section

It comprises of a smoke/gas, temperature sensors, comparators and variable resistors. Mq2 is a semiconductor type sensor, which can aptly sense presence of smoke, lpg, methane, butane, propane and other hydrocarbon combustible gases. The sensitive material in this sensor is tin dioxide (sno_2). When comes in contact with the gas to be monitored, the electrical resistance of the sensor decreases, enabling the Micro controller to respond to the situation. The analog voltage from the sensor is applied to the input of the comparator ic lt1013 while its reference input voltage comes from a variable resistor to adjust the sensing intensity . The output of comparator has been connected to the mcu via single data line. In case of detection of smoke or gas, the output will be high, and the indicator led will glow.the lm35 temperature sensor is an integrated circuit sensor. Here the output voltage is linearly proportional

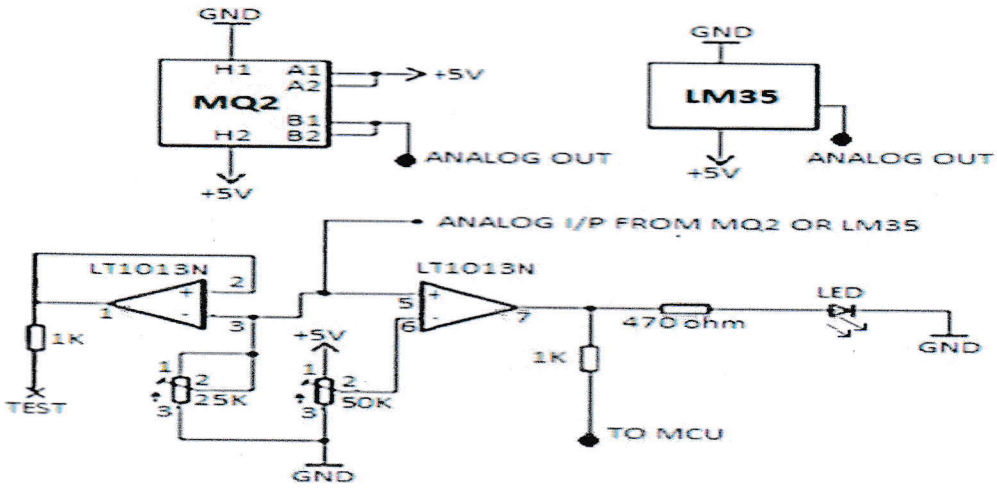


Figure 3: Circuit diagram of the sensor module

To temperature in centigrade, making the sensor perfectly suitable for our purpose. The sensor is precise up to ±1/4° c at room temperature with operation range from −55° c to 150° c, and is very low self-heating as it draws very small amount of current. The output of lm35 module is also an analog voltage. The circuit operation of this module is similar to the smoke detection process described above. The reference voltage of the comparator is adjusted to 500 mv using a variable resistor same as the one used in smoke sensor circuitry. The lm35 increases its output by 10 mv/c at the non-inverting pin of the op-amp. So when the temperature is greater than the pre-set temperature (50° c), the module will make its output high.

For quick and efficient fire detection, multiple sensor units (each unit having a mq2 smoke/gas and a lm35 temperature detector) have been placed in different fire vulnerable places in the premise. All sensor units are connected to a single i/o digital pin of the control unit via a single data line. A signal diode has been used in each sensor unit to protect other un-triggered sensor units from reverse current. This type of connection has the advantage of providing multiple sensor connection compatibility covering a considerably large area; only using a single microcontroller and avoiding the necessity of multi-channel adc chip, also saving i/o pins for additional features. Any mq2 and/or lm35 sensor unit will trigger the data bus to logic high state (5 v) if any smoke or gas is present in the location, or if room temperature surpasses the preset value due to fire or any other accidental situation.

4.3.1 Control-Unit

The heart of the control unit is atmega8l, a low power atmel 8-bit avr rise-based general purpose computer. Optimized power consumption, good processing speed, small physical dimensions, and lower costs make this micro controller a perfect fit for our purpose. Only one of the digital i/o pins has been used to acquire the status of the sensor units via common data line. A liquid crystal display (lcd) has been interfaced to the controller to show the status of the system. The controller also operates a peso type siren via a 12 v relay to alert the local authority about fire-hazard. Rs 232 serial communication protocol has been used to control the gsm module using at commands. A db9 serial port has also been connected to the microcontroller for firmware update.

At status

At+ creg? Network registration

At+cimi request international mobile subscriber identity at+cpbf find honebook entries

At+cmgf select sms message format at+cmgs send smsmessage

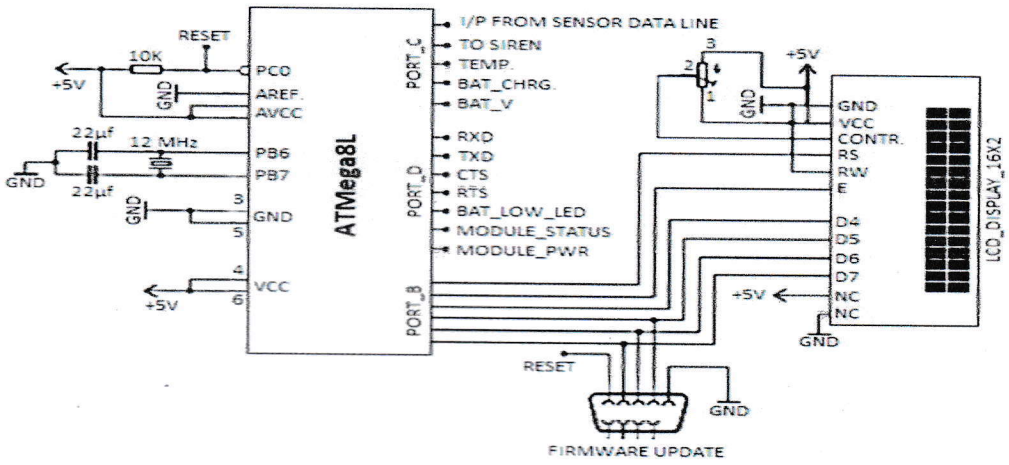


Figure 5: Sensors connection scheme to the controller

In the present work, a sim300cz gsm kit has been used . The network module has been shown in the. It operates on the 850/1900 mhz and 900/1900 mhz frequency bands, which is available throughout the globe. Sim interface to the gsm kit have been designed and implemented in printed circuit board. This type of design offers low power consumption as the network module operates at 5 v and reduces cost of the system as there are no communication interface circuitries (*i.e.* Rs 232 leveltranslator).

4.3.2 Network Module

The alert message can be sent to distant remote locations using various means like: Wireless networks (rf tx/rx pair), wireless sensor network, Ethernet, GSM network etc. Among these, gsm based mobile network is most feasible for its availability all over the globe effectiveness. GSM (global system for mobile communications) is the technology that underpins most of the world's mobile phone networks gsm operates in the 900mhz and 1.8ghz bands gsm supports data transfer speeds of up to 9.6 kbps, allowing the transmission of basic data services such as sms.

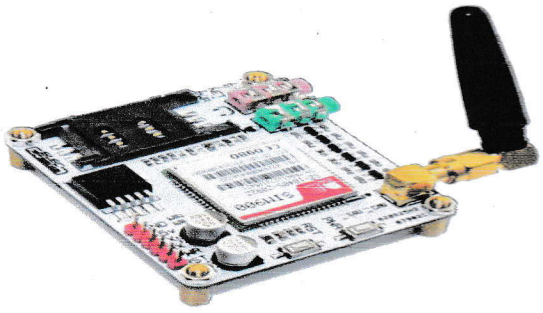


Figure 4: Gsm

Chapter 5
Power supply

5.1 Power supply

A 12 volt li-ion rechargeable battery ensures uninterrupted power supply to the entire system. A lm7805 voltage regulator regulates the voltage at 5 v to power up the microcontroller and sensor units. The battery is charged by ac power, under the control of a charger controller. Battery charge level is monitored by applying a reference voltage to an adc channel of the mcu. A voltage divider and a zengerdiode are used to keep the reference voltage level between 0 - 5 v. A pair of green and red leds indicates the charging and battery low status of the system respectively. If the battery voltage is less than 10.5 v, the red led flashes. So, the battery would have to be charged, flashing the green led.

5.2 Software Design

The whole system is controlled by a firmware which is implemented in embedded c and built in micro compiler . Then the program is downloaded to the 8-bit atmega8l microcontroller. Figure 6 shows the program flowchart. It includes developing algorithm for the system, allocating memory blocks as per functionality, writing the separate routines for different interfacing devices, and finally testing them on the developed hard- ware.

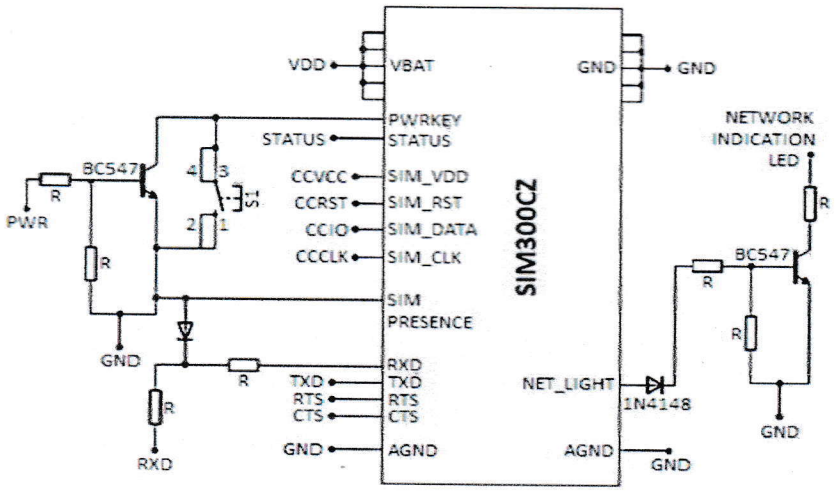


Figure 6: Software design

Chapter 6
Results and Discussion

6.1 Results and Discussion

To observe the performance and response of the system to adverse fire situations, 10 individual simulation tests were performed with varying smoke, gas, and temperature conditions. The result of the tests suggests the system renders desired alert responses under different test conditions reliably. The experimental set-up of the tests is shown in figure 8. And the system responses under varying situations of fire or smoke or gas or temperature are shown in figure 9.

During the tests, the time taken from fire detection to alert message (sms) delivery via gsm network by the system has been noted down as well. These time responses have been plotted in figure 10. The maximum time taken by the system to deliver alert sms was 10.5 seconds (test no. 9), and the minimum time was 7 seconds (test no. 1 and 6) approximately. As it is seen, on an average, the developed system takes 7 - 10 seconds to de- liver alert sms to the concerned authority, which is quick enough to undertake necessary measures to avert the fire hazard.

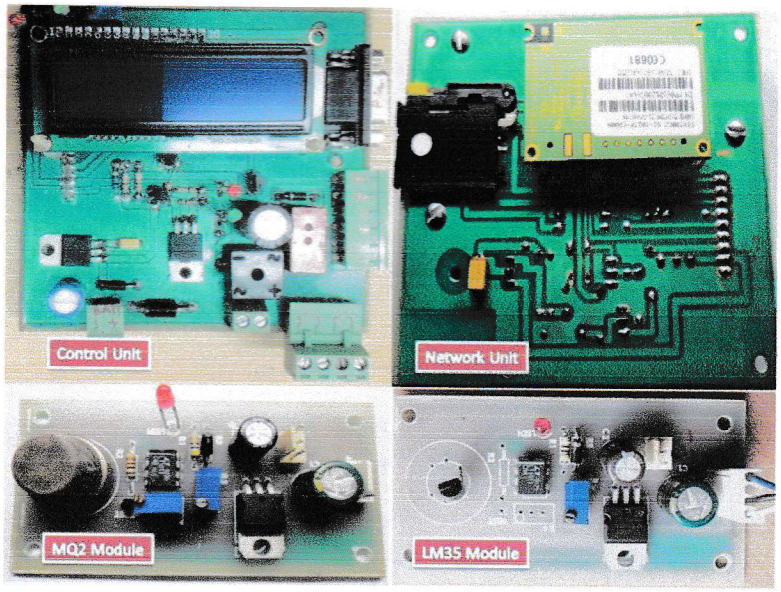
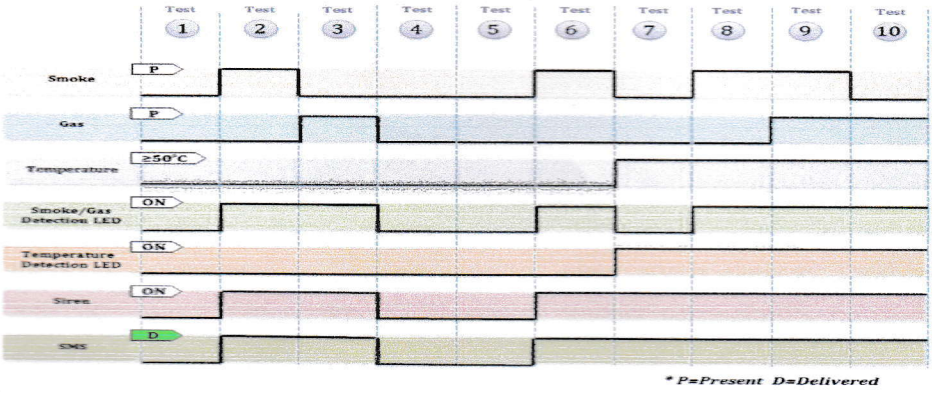


Figure 7. Snapshot of the hardware



Figure 8: Testing of developed system



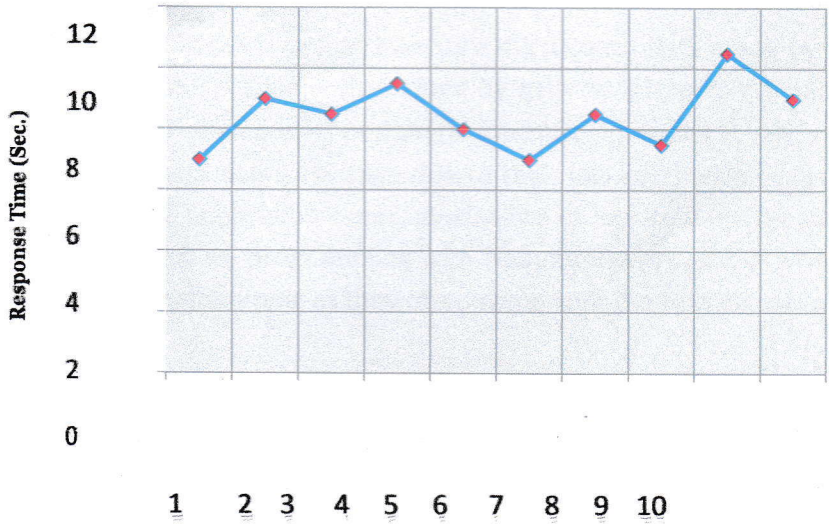


Figure 9: System response time

Chapter 7
Microcontroller

7.1 Microcontroller

A microcontroller is a small computer on a single integrated circuit containing a processor core, memory, and programmable input/output peripherals. Program memory in the form of nor flash or otp rom is also often included on chip, as well as a typically small amount of ram. Microcontrollers are designed for embedded applications, in contrast to the microprocessors used in personal computers or other general purposeapplications.

Microcontrollers are used in automatically controlled products and devices, such as automobile engine control systems, implantable medical devices, remote controls, office machines, appliances, power tools, toys and other embedded systems. By reducing the size and cost compared to a design that uses a separate microprocessor, memory, and input/output devices, microcontrollers make it economical to digitally control even more devices and processes. Mixed signal microcontrollers are common, integrating analog components needed to control non-digital electronic systems [2].

7.2 Pic Micro Controller

Pic is a family of modified harvard architecture microcontrollers made by microchip technology, derived from the pic1650originally developed by general instrument's microelectronics division. The name pic initially referred to "peripheral interface controller". Pic s are popular with both industrial developers and hobbyists alike due to their low cost, wide availability, large user base, extensive collection of application notes, availability of low cost or free development tools, and serial programming (and re- programming with flash memory) capability. They are also commonly used in educational programming as they often come with the easy to use 'pic locator' software[2].

7.2.1 the pic architecture is characterized by its multiple attributes:

I. Separate code and data space (harvard architecture).
II. A small number of fixed length instructions.
III. Most instructions are single cycle execution (2 clock cycles, or 4 clock cycles in 8-bit models), with one delay cycle on branches and skips.
IV. One accumulator (w0), the use of which (as source operand) is implied (i.e. Is not encoded in theopcode).
V. All ram locations function as registers as both source and/or destination of math and other

functions.

VI. A hardware stack for storing return addresses
VII. A small amount of addressable data space (32, 128, or 256 bytes, depending on the family), extended through banking.
VIII. Data space mapped cpu, port, and peripheral registers.
IX. Alu status flags are mapped into the data space.

The program counter is also mapped into the data space and writable (this is used to implement indirect jumps).

There is no distinction between memory space and register space because the ram serves the job of both memory and registers, and the ram is usually just referred to as the register file or simply as the registers.

7.2.2 Advantages of pic

The pic architectures have these advantages:

Small instruction set tolearn.

Risc architecture.

Built in oscillator with select table speeds.

Low cost.

Index pensive micro controllers.

Wide range of interfaces including i^2 c, spi, usb, usart, a/d, programmable comparators, pwm, lin, can, psp, and ethernet.

Availability of processors in dil package makes them easy to handle for hobby use[2].

Limitations ofpic

7.2.3 The pic architectures have these limitations:

A. Oneaccumulator.
B. Register-bank switching is required to access the entire ram of manydevices
C. Operations and registers are not orthogonal; some instructions can address ram and/or immediate constants, while others can only use the accumulator.

Chapter 8
Introduction Topic

8.1 Introduction Topic 16f73

The pic16f73 belongs to the mid-range family of the pic devices. The program memory contains 2k words, which trans-late to 2048 instructions, since each 14-bit program memory word is the same width as each device instruction. The data memory (ram) contains 128 bytes. There are 22 i/o pins that are user configurable on a pin to pin basis. Some pins are multiplexed with other device functions [3].

8.1.1 These Functions Include:

Externalinterrupt

Change on portbinterrupt

Timer0 clockinput

Timer1clock/oscillator

Capture/compare/pwm

A/dconverter

Spi/ i^2 c[3]

Features ofpic16f73

High performance risccpu

Only 35 single word instruction tolearn

All instruction are 1 μ s (4mhz) except for programbranches.

Operating speed: Dc -20mhz clock input[3].

Peripheral features

Two 8-bit timer/counter (tmr0,tmr1) with 8-bit programmable presale.

One 16-bittimer/counter.

High source/sink current:25ma.

12.5 nsresolution.

Capture/compare pwm (ccp) module.

Special microcontrollerfeatures

1,000 erase/write cycle flash programmemory typical.

Power-on reset (por), power-up timer (pwrt)and oscillator start-up timer(ost).

Watchdog timer (wdt) with its own on-chiprc oscillator for reliableoperation.

Programmable codeprotection.

Power saving sleepmode.

Selectable oscillatoroptions.

In-circuit serial programming™ (icsp™) via 2pins.

Processor read access to program memory[3].

8.2 Cmos Technology

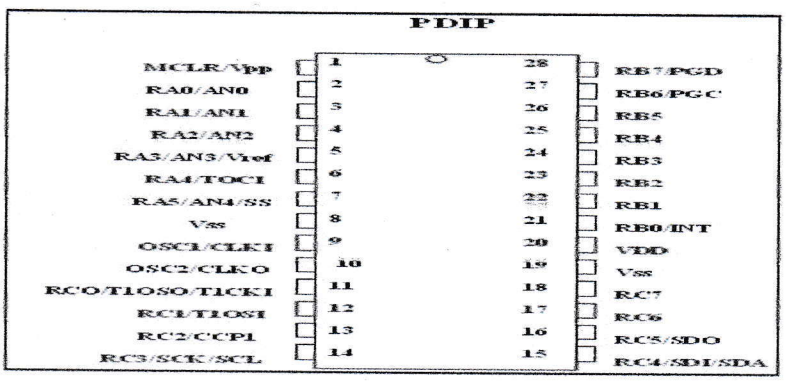
Fully staticdesign

Low power, high speed cmos flashtechnology

Wide operating voltage range: 2.0v to5.5v.

< 0.6 ma typical 3v, 4mhz[3].

8.3 Pin Configuration



Chapter 9
DC Motor

9.1 DC gear motor

Geared dc motors can be defined as an extension of dc motor which already had its insight details demystified here. A geared dc motor has a gear assembly attached to the motor. The speed of motor is counted in terms of rotations of the shaft per minute and is termed as rpm .the gear assembly helps in increasing the torque and reducing the speed. Using the correct combination of gears in a gear motor, its speed can be reduced to any desirable figure. This concept where gears reduce the speed of the vehicle but increase its torque is known as gear reduction[4].

9.2 External Structure

At the first sight, the external structure of a dc geared motor looks as a straight expansion over the simple dc ones.

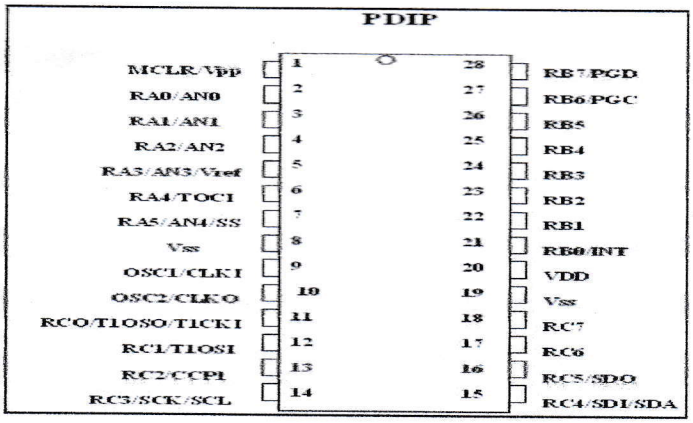


Figure 11: External structure

The lateral view of the motor shows the outer protrudes of the gear head. A nut is placed near the shaft which helps in mounting the motor to the other parts of the assembly.

9.3 Working of The Dc Geared Motor

The dc motor works over a fair range of voltage. The higher the input voltage more is the rpm (rotations per minute) of the motor. For example, if the motor works in the range of 6-12v, it will have the least rpm at 6v and maximum at 12 v.

In terms of voltage, we can put the equation as: Rpm= k1 * v, where,

K1= induced voltage constant=voltage applied

The working of the gears is very interesting to know. It can be explained by the principle of conservation of angular momentum. The gear having smaller radius will cover more rpm than the one with larger radius. However, the larger gear will give more torque to the smaller gear than vice versa. The comparison of angular velocity between input gear (the one that transfers energy) to output gear gives the gear ratio. When multiple gears are connected together, conservation of energy is also followed. The direction in which the other gear rotates is always the opposite of the gear adjacent toit.

In any dc motor, rpm and torque are inversely proportional. Hence the gear having more torque will provide a lesser rpm and converse. In a geared dc motor, the concept of pulse width modulation is applied. The equations detailing the working and torque transfer of gears are shown below:

Tinin = toutout

Where, tin = input torque by the drivergearin = angular speed of the driver gear tout = output torque by the driven gearout= angularspeed ofthe drivengear

In a geared dc motor, the gear connecting the motor and the gear head is quite small, hence it transfers more speed to the larger teeth part of the gear head and makes it rotate. The larger part of the gear further turns the smaller duplex part. The small duplex part receives the torque but not the speed from its predecessor which it transfers to larger part of other gear and so on. The third gear' s duplex part has more teeth than others and hence it transfers more torque to the gear that is connected to the shaft[4].

9.3.1 Motor Driver L293d

L293d is a motor driver integrated circuit which is used to drive dc motors rotating in either direction. It is a 16-pin ic which can control a set of two dc motors simultaneously. The l293d uses 5v for its own power and external power source is needed to drive the motors, which can be up to 36v and draw up to 600ma.the l293d works on the concept of typical h-bridge, a circuit which allows the high voltage to be flown in either direction. In a single l293d ic there are two h-bridge

circuits which can rotate two dc motors independently. Due to its size and voltage requirement, it is frequently used in robotics. Applications for controlling dc motors, including in arduino projects. The l293d is also a key component in larger 'motor driver' boards available premade for hobbyists.

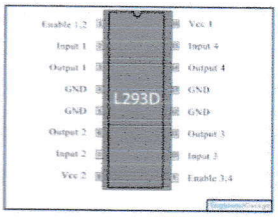


Figure 12: L293d motor driver.

9.3.2 Working of l293d

There are two drive pins on l293d. Pin 1 (left h-bridge) and pin 9 (right h-bridge). To turn on the corresponding motor, pin 1 or 9 need to be set to high. If either pin 1 or pin 9 goes low then the motor in the corresponding section will go off (high impedance). These inputs (1 and 9) are the ones that should be used to control motor start/stop and motor speed under pwm, since there would be high impedance output during low semi-period of pwm, it would not provoke overload of the l293d when the motor is turning. Thus, pwm or motor on/off control should never be input to pins 2, 7, 15, 10, which should only be used to control direction (clockwise-counter clockwise). The direction defining four input pins for the l293d are pin 2 and 7 on the left and pin 15 and 10 on the right as shown on the pin diagram. Left input pins will determine the rotation of motor connected on the left side and right input for motor on the right hand side.

9.3.3 l 293d logic

Assuming a motor connected on left side output pins (pin 3,6). Pin 2 = logic 1 and pin 7 = logic 0 | clockwise direction

Pin 2 = logic 0 and pin 7 = logic 1 | anticlockwise direction

Pin 2 = logic 0 and pin 7 = logic 0 | brake (this is not high impedance) (force stop rotation using electric brake = same voltage both

Pins of the motor = overload while the motor is still running)

Pin 2 = logic 1 and pin 7 = logic 1 | brake (this is not high impedance) (force stop rotation using electric brake = same voltage both pins of the motor = overload while the motor is still running)

In a similar way, the motor can be operated across input pins 15 and 10 to control the directionofthemotorattachedtotheh-bridge'srightside.usingpins2and7(15and 10) to determine motor start/stop or pwm duties it's dangerous, since there.

Chapter 10
Arduino Nano

10.1 Arduino Nano

Arduino is an open-source microcontroller development board. In plain english, we can use the arduino to read sensors and control things like motors and lights. This allows us to upload programs to this board which can then interact with things in the real world.

The arduino nano is a small, complete, and breadboard-friendly board based on the atmega328 (arduino nano 3.x). It has more or less the same functionality of the arduino duemilanove, but in a different package. It lacks only a dc power jack, and works with a mini-b usb cable instead of a standard one .

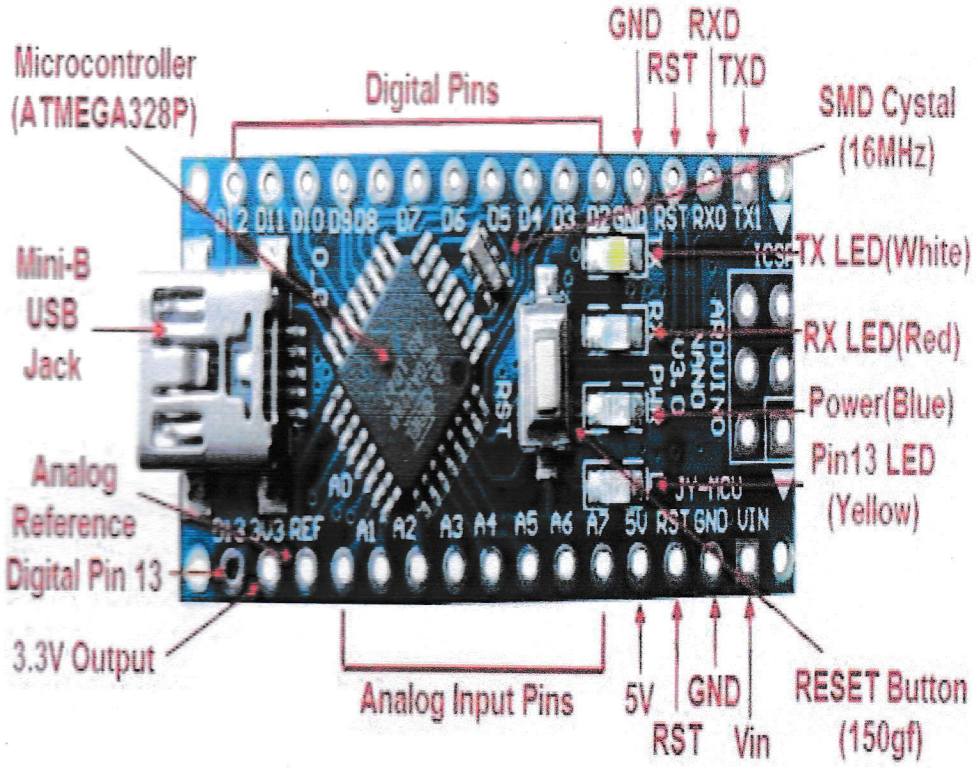


Figure 13: Arduino nano

10.2 Specification of Arduinonano

Microcontroller	Atmel atmega328
Operating voltage (logic level)	5 v
Input voltage (recommended)	7-12 v
Input voltage (limits)	6-20 v
Digital i/o pins	14 (of which 6 provide pwm output)
Analog input pins	8
Dc current per i/o pin	40 ma
Flash memory	32 kb of which 2kb used by boot-loader
Sram	2 kb
Eeprom	1 kb
Clock speed	16 mhz
Dimensions	0.73" X 1.70"

Table 1: Specification of arduino nano

10.3 Input and output

Each of the 14 digital pins on the nano can be used as an input or output, using pin mode, digital-write, and digital-read functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40 ma and has an internal pull-up resistor (disconnected by default) of 20-50 kohms. In addition, some pins have specialized functions:

Serial: 0 (rx) and 1 (tx). Used to receive (rx) and transmit (tx) ttl serial data. These pins are connected to the corresponding pins of the ftdi usb-to-ttl serialchip.

External interrupts: 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attach- interrupt function fordetails.

Pwm: 3, 5, 6, 9, 10, and 11. Provide 8-bit pwm output with the analog-write function.

Spi: 10 (ss), 11 (mosi), 12 (miso), 13 (sck). These pins support spi communication, which, although provided by the underlying hardware, is not currently included in the arduinolanguage.

Led: 13. There is a built-in led connected to digital pin 13. When the pin is high value, the led is on, when the pin is low, it'soff.

The nano has 8 analog inputs, each of which provides 10 bits of resolution (i.e. 1024 different values). By default they measure from ground to 5 volts, though is it possible to change the upper end of their range using the analog-reference function. Analog pins 6 and 7 cannot be used as digital pins. Additionally, some pins have specialized functionality:

I^2c: A4 (sda) and a5 (scl). Support i^2c (twi) communication using the wire library (documentation on the wiringwebsite).

There are a couple of other pins on the board:

Aref.reference voltage for the analog inputs. Used withanalog-reference

Reset. Bring this line low to reset the microcontroller. Typically used to add a reset button to shields which block the one on the board.

10.4 lm7805 voltage regulator

The l7805 is a family of self-contained fixed linear voltage regulator integrated circuits. The 7805 family is commonly used in electronic circuits requiring a regulated power supply due to their ease-of-use and low cost. For ics within the family, the *05* is replaced with two digits, indicating the output voltage (for example, the 7805 has a 5 volt output, while the 7812 produces 12 volts). The 7805 line are positive voltage regulators, they produce a voltage that is positive relative to a common ground. There is a related line of 79xx devices which are complementary negative

voltage regulators. 78xx and 79xx ics can be used in combination to provide positive and negative supply voltages in the same circuit.

78xx ics have three terminals and are commonly found in the to220 form factor, although smaller surface-mount and larger to3 packages are available. These devices support an input voltage anywhere from a couple of volts over the intended output voltage, up to a maximum of 35 or 40

Volts, and typically provide 1 or 1.5 amperes ofcurrent (though smaller or larger packages may have a lower or higher current rating).

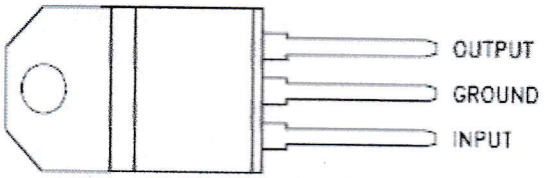


Figure 14: Voltage regulator

10.5pindescription

Pin no	Function	Name
1	Input voltage (5v-18v)	Input
2	Ground (0v)	Ground
3	Regulated output; 5v (4.8v-5.2v)	Output

Table 2: Pin description of ic7805

10.6 Advantages of 7805 Voltage Regulator

7805 series ics do not require additional components to provide a constant, regulated source of power, making them easy to use, as well as economical and efficient uses of space. Other voltage regulators may require additional components to set the output voltage level, or to assist in the regulation process. Some other designs (such as a switched-mode power supply) may need substantial engineering expertise to implement.

7805 series ics have built-in protection against a circuit drawing too much power. They have protection against overheating and short-circuits, making them quite robust in most applications. In some cases, the current-limiting features of the7805devicescanprovideprotectionnotonlyforthe7805itself,butalsofor other parts of the circuit. 7805 ics are easy to use and handle but these cannot give a altering voltage required so lm317 series of ics are available to obtain a voltage output from 1.25 volts to 37 volts [12].

10.6.1 Disadvantages of 7805 voltage Regulator

The input voltage must always be higher than the output voltage by some minimum amount (typically 2 volts). This can make these devices unsuitable for powering some devices from certain types of power sources (for example, powering a circuit that requires 5 volts using 6-volt batteries will not work using a7805).

As they are based on a linear regulator design, the input current required is always the same as the output current. As the input voltage must always be higher than the output voltage, this means that the total power (voltage multiplied by current) going into the 7805 will be more than the output power provided. The extra input power is dissipated as heat. This means both that for some applications an adequate heat sink must be provided, and also that a (often substantial) portion of the input power is wasted during the process, rendering them less efficient than some other types of power supplies. When the input voltage is significantly higher than the regulated output voltage (for example, powering a 7805 using a 24 volt power source), this inefficiency can be a significantissue.

Even in larger packages, 7805 integrated circuits cannot supply as much power a many designs which use discrete components, and are generally inappropriate for applications requiring more than a few amperes of current.

10.7push Button switch

A push button switch is a momentary or non-latching switch which causes a temporary change in the state of an electrical circuit only while the switch is physically actuated. An automatic mechanism (i.e. A spring) returns the switch to its default position immediately afterwards, restoring the initial circuitcondition.

There are two types:

A push to make switch allows electricity to flow between its two contacts when held in. When the button is released, the circuit isbroken.

A push to break switch does the opposite, i.e. When the button is not pressed, electricity can flow, but when it is pressed the circuit is broken.

10.8 Crystal oscillator

A crystal oscillator is an electronic oscillator circuit that uses the mechanical resonance of a vibrating crystal of piezoelectric material to create an electrical signal with a very precise frequency. This frequency is commonly used to keep track of time (as in quartz wristwatches), to provide a stable clock signal for digital integrated circuits, and to stabilize frequencies for radio transmitters and receivers. The most common type of piezoelectric resonator used is the quartz crystal, so oscillator circuits designed around them became known as "Crystal oscillators." It is very useful to provide the clock frequency of a pic micro controller[13].

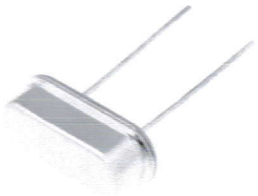


Figure15 : Crystal oscillator

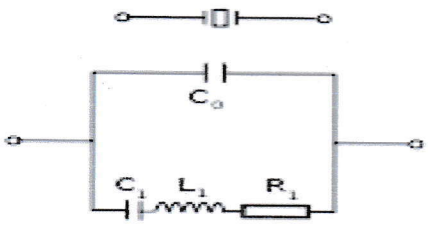


Figure 16: Schematic symbol & equivalent circuit

The crystal oscillator circuit sustains oscillation by taking a voltage signal from the quartz resonator, amplifying it, and feeding it back to the resonator. The rate of expansion and contraction of the quartz is the resonant frequency, and is determined by the cut and size of the crystal. When the energy of the generated output frequencies matches the losses in the circuit, an oscillation can besustained.

An oscillator crystal has two electrically conductive plates, with a slice or tuning fork of quartz crystal sandwiched between them. During startup, the controlling circuit places the crystal into an unstable equilibrium, and due to the positive feedback in the system, any tiny fraction of noise will start to get amplified, ramping up the oscillation. The crystal resonator can also be seen as a highly frequency-selective filter in this system: It will only pass a very narrow sub band of frequencies around the resonant one, attenuating everything else. Eventually, only the resonant frequency will be active. As the oscillator amplifies the signals coming out of the crystal, the signals in the crystal's frequency band will become stronger, eventually dominating the output of the oscillator. The narrow resonance band of the quartz crystal filters out all the unwanted frequencies .

10.9 LED

A light-emitting diode (led) is a two-lead semiconductor light source that resembles a basic pn-junction diode, except that an led also emits light. When an leds anode lead has a voltage that is more positive than its cathode lead by approximately 0.6 to 2.2 volts, current often flows and light is often emitted. On the other hand, when an leds anode lead has a voltage that is less positive than its cathode lead by approximately 0.6 to 2.2 volts, current often does not flow and light is often not emitted.

When a light-emitting diode is switched on, electrons are able to recombine with holes within the device, releasing energy in the form of photons. This effect is called electro luminescence, and the color of the light (corresponding to the energy of the photon) is determined by the energy band gap of the semiconductor. An led is often small in area (less than 1 mm^2), and integrated optical components may be used to shape its radiation pattern.

List of Components and Cost Analysis

Sl. No:	Name of components	Quantity	Price (tk)
1.	Micro-controller 16 f 73	1	100
2.	Crystal 20mhz	1	20
3.	Dc gear motor	1	1500
4.	Motor driver(l293d)	1	120
5.	Circuit backer	1	1000
6.	Stepper motor driver(uln2003d)	1	200
7.	Gas sensor(tcs3200)	1	1400
8.	Arduino nano	1	800
9.	Belt & extensions	1	2500
10.	Transformer(220v/12v)	1	550

11.	Lm7805	1	20
12.	Rectifier & filter		50
13.	Others		500
	Total		Tk.8760

Table 3: Cost calculation

11.0 Circuit Breakers

A new fire protection circuit breaker from Siemens prevents electrical fires from developing. The device registers dangerous arcing in an electrical installation and breaks the circuit automatically. Arcing can happen as a consequence of voltage flashovers in electrical circuits, for example, or occur due to a loose contact.

In the past, some disturbances threw the breaker but others went unchecked. The new fire protection circuit breaker detects all kinds of arcing, effectively closing that gap



Programe Code

```
// code


#include <liquidcrystal.h>

Liquidcrystallcd(a0,a1,a2,a3,a4,a5);

Intbuttonstate =1;


Void setup()

{

Lcd.begin(16,2);


Lcd.setcursor(0,0);

Lcd.print("  Gsm based ");

Lcd.setcursor(0,1);

Lcd.print(" Gas detector ");

Delay(5000);

Lcd.clear();

Pinmode(7, input);

Pinmode(10, output);

Pinmode(11, output);

Pinmode(12, output);

Serial.begin(9600);   // setting the baud rate of serial monitor (arduino)

Delay(100);

}

Void loop()
```

```
{
Buttonstate = digitalread(7);
If (buttonstate == low) {
Digitalwrite(11, high);  // turn the led on (high is the voltage level)
Digitalwrite(12, high);
Digitalwrite(10, high);
Lcd.clear();
Lcd.setcursor(0,0);
Lcd.print("  Gas detect");
Lcd.setcursor(0,1);
Lcd.print("  Calling..");

Makecall();

 }
If (buttonstate == high) {
Digitalwrite(11, low);   // turn the led off by making the voltage low
Digitalwrite(12, low);
Digitalwrite(10, low);

Lcd.clear();
Lcd.setcursor(0,0);
Lcd.print(" No gas detect");

  Delay(200);
```

```
 }

Voidmakecall()

{

Serial.println("Atd+8801756795129;"); // atdxxxxxxxxxx; -- watch out here for semicolon at the end!!

Serial.println("Calling  "); // print response over serial port

Delay(10000);
```

References

- Kwon, o.h., cho, s.m. And hwang, s.m. (2008) design and implementation of fire detection system. Advanced software engineering and its applications, hainan island, 13-15 december 2008,233-236.
- Li, j.h., zou, x.h. And lu, w. (2012) the design and implementation of fire smoke detection system based on fpga. Proceedings of the 24th control and decision conference, taiyuan, 23-25 may 2012,3919-3922.
- Bbc news asia (25 november 2012) dhaka bangladesh clothes factory fire kills more than 100.http://www.bbc.com/news/world-asia-20482273
- The guardian (4 june 2010) dhaka fire kills up to 150 in bangladesh.http://www.theguardian.com/world/2010/jun/04/dhaka-fire-bangladesh
- Cote, a. And bugbee, p. (1988) ionization smoke detectors. Principles of fire protection. National fire protection association, quincy,249.
- Northeast document conservation center, nick artim, an introduction to fire detection, alarm, and automatic fire sprinklers.
- Http://www.nedcc.org/free-resources/preservation-leaflets/3.-emergency-management/3.2-an-introduction-to-fire-detection,-alarm,-and-automatic-fire-sprinklers
- E.d. (2007) performance of home smoke alarms analysis of the response of several available technologies in residential fire settings. Nist tn 1455-1; nist technical note 1455-1; p. 396. Http://fire.nist.gov/bfrlpubs/fire07/art063.html
- Mikroelektronika (2014) mikroc pro for avr.http://www.mikroe.com/mikroc/avr/
- Cadsoft computer (2014) cadsoft eagle pcb design software. Http://www.cadsoftusa.com/eagle-pcb-design-software/
- Michel Mouly and Marie-Bernadette Pautet: GSM System for Mobile Communications, published by the authors 1992, ISBN 2-9507190-0-7
- Fried helm Hillenbrand (editor): GSM and UMTS, the creation of Global Mobile Communication, Wiley 2001
- GSM Switching, Services, and Protocols by Jorge Eberspaecher, Hans-Joerg Voegel, Christian Bettstetter

- GSM, GPRS and EDGE Performance: Evolution Towards 3G/UMTS by Timo Halonen (Editor), Javier Romero (Editor), Juan Melero (Editor)
- Intelligent Networks for the GSM, GPRS and UMTS Network by Rogier Noldus
-
- Fundamentals of Cellular Network Planning and Optimisatio by Ajay R. Mishra
-
- The GSM System for Mobile Communications by Michel Mouly, Marie-Bernadette Pautet
- GSM Networks: Protocols, Terminology and Implementation (Artech House Mobile Communications) by Gunnar Heine
- An Introduction to GSM (Artech House Mobile Communication Series) 0th Edition by Siegmund M. Redl
- GSM System Engineering Series)by Asha K. Mehrotra

- Arduino -Software. 2013. Arduino-Software.[ONLINE] Available at: http://arduino.cc/en/Main/Software
- http://arduino.cc/
-
- http://www.wikipedia.com
- http://arduino.cc/en/Tutorial/Blink
- http://blog.circuits4you.com/2015/06/gsm-based-fire-alarm-system.html
- http://www.instructables.com/id/GSM-Based-Fire-Alarm-System/
- http://ieeexplore.ieee.org/xpl/login.jsp?tp=&arnumber=6013128&url=http%3A%2F%2Fieeexplore.ieee.org%2Fxpls%2Fabs_all.jsp%3Farnumber%3D6013128

- 18. http://link.springer.com/chapter/10.1007%2F978-3-642-31968-6_28
- http://www.instructables.com/id/Fire-Alarm-System-GSM-based-using-Arduino/
- http://duino4projects.com/gsm-based-sms-alert-fire-alarm-system-using-arduino/
- http://www.electronicslovers.com/2015/04/sms-alert-fire-alarm-system-gsm- based.html
- https://securitysnobs.com/LA-Mobeye-Portable-Quad-Band-Alarm_H2.html
- https://www.youtube.com/watch?v=pxacoNbfLX0
- http://www.compoundsecurity.co.uk/security-equipment-smoke-alarms-mobeye-gsm-stand-alone-smoke-detector
- http://www.instructables.com/id/Square-Smoke-GSM-Smoke-Detector/
- http://www.instructables.com/id/Sending-sms-if-smoke-is-detected-ArduinoGSM- SIM900/
- https://www.isocketworld.com/en/Kit-2-ISKIT2/
- https://makerfeed.net/article/gsm-based-sms-alert-fire-alarm-system-using-arduino
- http://www.ijert.org/view-pdf/3166/design-of-gsm-based-smoke-detection-and-temperature-monitoring-system