1. Introduction

In human day to day life, the LPG cylinder plays a major role. The main application of the LPG is that it is used in the place of chloroform carbon which causes great damage to the ozone layer. Though it's one in all the foremost normally used fuels, it's associate explosive vary of one.8%–9.5% the volume of gas in the air. It's packed into three classes per the burden of the LPG within the cylinder: social unit, business, and Industrial. The social unit class of the LPG cylinder contains 14.2 kilo LPG within the cylinder. Similarly, the business and Industrial classes of LPG cylinders contain nineteen and thirty-five kilo of LPG severally.

With the rising demand for LPG, users have to be compelled to pre-book their LPG cylinder a minimum of a month before the delivery of the new LPG cylinder. Most of the days, users find it difficult to figure out what quantity of LPG has left at intervals the cylinder and this causes tons of bothering to them. In such a state of affairs, associate degree efficient technique to watch the amount of LPG within the cylinder is needed, so the users have tuned in to the LPG level at intervals the cylinder. This paper deals with the detection of the gas leakage and the level of gas in the cylinder and automatic booking of the new LPG cylinder.

The sensor used in this has high sensitivity and fast response time. The gas sensor detects other gases including cigarette smoke. When the gas has detected the output of the sensor is sent to the microcontroller and the buzzer is turned on and when the weight measured using the load sensor becomes critically low, the alert is sent to the user and the new LPG cylinder is booked. The main application of this proposed system is to overcome the shortcomings such as delay and pre-booking of the LPG cylinder by the consumers.

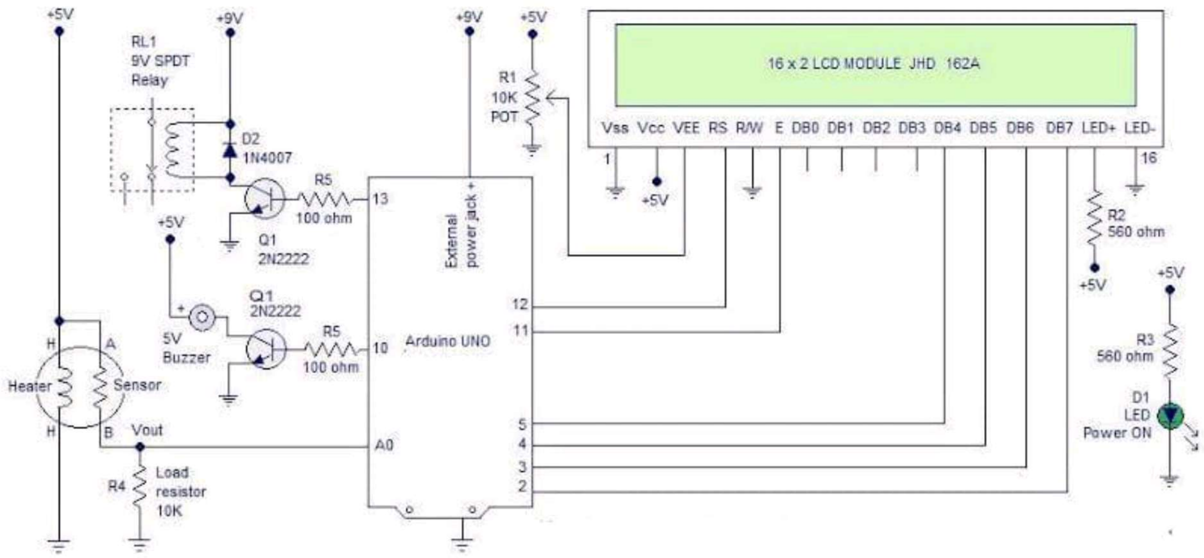
1.1Abstract

Nowadays peoples are busy in their so they do not have enough time for their security and safety that's why are working on this issue regarding home security. In Kitchen, Hotel, and Industry while using LPG cylinder it also create the problem with gas leakage. Our designed system can help for monitor and detect gas leakage by using the sensor as soon as gas leakage is detected an alert message send to user and it also stops the gas supply by automatically switching off the regulator with the help of solenoid valve and immediately turns on the exhaust fan and turn on buzzer which can help near people.

It ensures safety from accident occure due to gas leakage. This system has an additional purpose that is measuring the weight of gas about whether they are cheated by gas Agency company providing less amount of gas. The main benefit is automatically booking an LPG cylinder by sending SMS to the gas agency company and all so inform the user with the help of GSM module. It also helps aged and handicapped people by making them independent and provides security for them from any kitchen hazards.

2. OVER ALL CIRCUITDIAGRAM

2.1 Diagram:



3. SYSTEM ANALYSIS

3.1 Proposed System

Gas level detection and automatic booking are designed with various features that are implemented using Arduino and this device will be a single system with multiple applications for LPG consumers. The device monitors the load if the gas level and displays it within the alphanumeric display incessantly. It also detects the gas leakage by gas senor. This includes an additional feature of booking a new LPG cylinder when the gas level becomes critically low. Then it sends an alert to the registered mobile number by an SMS with the help of the GSM module and the alert database is displayed in the system monitor.

3.2 Hardware Tools

- Arduino Uno
- Gas Sensor
- LPG Cylinder
- GSM Module
- Load Cell

3.3 Software Tools

- Arduino IDE
- Embedded-C

4. ARDUINO

The number of embedded devices that can interact with environment are already con-nected to internet, and it is estimated that the number reaches 50 billion by 2020 (Kouhia, 2016). The growth of such interacting objects achieved this staggering pace with the development of microcontroller based easy-to-use designed system which are replacing old systems designed with complicated electronic circuits. Arduino is a microcontroller board which functions as a tiny computer; it is a platform where creation and development of interacting objects is possible with required program-ming software.

The Arduino software IDE (Integrated Development Environment) pro-vides space to write codes in the language (programming languages C, C++) that Ar-duino board understands and responds to. Inexpensiveness, easy-to-use design and flexibility for advance modifications are some features of the microcontroller based Ar-duino hardware and software that are making its range of use wider. One of the most important factor that affects its increasing range of use is its freedom of use. Both the Arduino hardware and the software are open source. Which means that one can easily use the ideas generated by others in their work and modify them without anyone's au-thorization. It can be used by anyone to do anything they want to do with it (Banzi, ei pvm). Arduino boards are designed in such a way that one without prior knowledge of electronics or previous experience of programming can use information from other peo-ple's work and build their own interactive object that can sense the environment and control it. It comes with a cheap price which is a crucial factor that makes Arduino ac-cessible to many students, hobbyists and teachers and ultimately a new revolution of innovation in electronics.

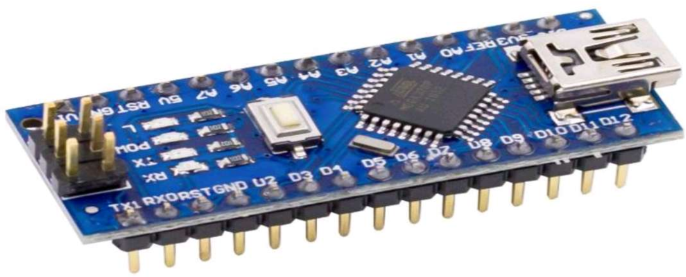


Figure 1: Arduino Uno (Nano board)

4.1 INTRODUCTION

Arduino is used for building different types of electronic circuits easily using of both a physical programmable circuit board usually microcontroller and piece of code running on computer with USB connection between the computer and Arduino. Programming language used in Arduino is just a simplified version of C++ that can easily replace thousands of wires with words.

4.2 ARDUINO UNO-R3 PHYSICAL COMPONENTS

ATMEGA328P-PU microcontroller

The most important element in Arduino Uno R3 is ATMEGA328P-PU is an 8-bit Microcontroller with flash memory reach to 32k bytes. It's features as follow:

• High Performance, Low Power AVR

• Advanced RISC Architecture

o 131 Powerful Instructions – Most Single Clock Cycle Execution

o 32 x 8 General Purpose Working Registers

o Up to 20 MIPS Throughput at 20 MHz

o On-chip 2-cycle Multiplier

• High Endurance Non-volatile Memory Segments

o 4/8/16/32K Bytes of In-System Self-Programmable Flash program memory

o 256/512/512/1K Bytes EEPROM

o 512/1K/1K/2K Bytes Internal SRAM

o Write/Erase Cycles: 10,000 Flash/100,000 EEPROM

o Data retention: 20 years at 85°C/100 years at 25°C

o Optional Boot Code Section with Independent Lock Bits

o In-System Programming by On-chip Boot Program

o True Read-While-Write Operation

o Programming Lock for Software Security

• Peripheral Features

o Two 8-bit Timer/Counters with Separate Prescaler and Compare Mode

o One 16-bit Timer/Counter with Separate Prescaler, Compare Mode, and Capture Mode

o Real Time Counter with Separate Oscillator

o Six PWM Channels

o 8-channel 10-bit ADC in TQFP and QFN/MLF package

o Temperature Measurement

o 6-channel 10-bit ADC in PDIP Package

o Temperature Measurement

o Programmable Serial USART

o Master/Slave SPI Serial Interface

o Byte-oriented 2-wire Serial Interface (Philips I2 C compatible)

o Programmable Watchdog Timer with Separate On-chip Oscillator

o On-chip Analog Comparator

o Interrupt and Wake-up on Pin Change

• Special Microcontroller Features

o Power-on Reset and Programmable Brown-out Detection

o Internal Calibrated Oscillator

o External and Internal Interrupt Sources

o Six Sleep Modes: Idle, ADC Noise Reduction, Power-save, Power-down, Standby, and Extended Standby

• I/O and Packages

o 23 Programmable I/O Lines

o 28-pin PDIP, 32-lead TQFP, 28-pad QFN/MLF and 32-pad QFN/MLF

• Operating Voltage:

o 1.8 - 5.5V

• Temperature Range:

o -40°C to 85°C

• Speed Grade:

o 0 - 4 MHz@1.8 - 5.5V, 0 - 10 MHz@2.7 - 5.5.V, 0 - 20 MHz @ 4.5 - 5.5V

• Power Consumption at 1 MHz, 1.8V, 25°C

o Active Mode: 0.2 mA

o Power-down Mode: 0.1 µA

o Power-save Mode: 0.75 µA (Including 32 kHz RTC)

4.3 Digital

An electronic signal transmitted as binary code that can be either the presence or absence of

current, high and low voltages or short pulses at a particular frequency. Humans perceive the world in analog, but robots, computers and circuits use Digital. A digital signal is a signal that has only two states. These states can vary depending on the signal, but simply defined the states are ON or OFF, never in between. In the world of Arduino, Digital signals are used for everything with the exception of Analog Input. Depending on the voltage of the Arduino the ON or HIGH of the Digital signal will be equal to the system voltage, while the OFF or LOW signal will always equal 0V. This is a fancy way of saying that on a 5V Arduino the HIGH signals will be a little under 5V and on a 3.3V Arduino the HIGH signals will be a little under 3.3V. To receive or send Digital signals the Arduino uses Digital pins # 0 - # 13. You may also setup your Analog In

pins to act as Digital pins. To set up Analog In pins as Digital pins use the

command: pinMode(pinNumber, value);

where pinNumber is an Analog pin (A0 – A5) and value is either INPUT or OUTPUT. To setup Digital pins use the same command but reference a Digital pin for pinNumber instead of an Analog In pin. Digital pins default as input, so really you only need to set them to OUTPUT in pinMode. To read these pins use the command: digitalRead(pinNumber); where pinNumber is the Digital pin to which the Digital component is connected. The digitalRead command will return either a HIGH or a LOW signal. To send a Digital signal to a pin use the command: digitalWrite(pinNumber, value); where pinNumber is the number of the pin sending the signal and value is either HIGH or LOW. The Arduino also has the capability to output a Digital signal that acts as an Analog signal, this signal is called Pulse Width Modulation (PWM). Digital Pins # 3, # 5, # 6, # 9, # 10 and #11 have PWM capabilities. To output a PWM signal use the command: analogWrite(pinNumber, value); where pinNumber is a Digital Pin with PWM capabilities and value is a number between 0 (0%) and 255 (100%). For more information on PWM see the PWM worksheets or S.I.K. circuit 12. Examples of Digital: Values: On/Off, Men's room/Women's room, pregnancy, consciousness, the list goes on.... Sensors/Interfaces: Buttons, Switches, Relays, CDs, etc.... Things to remember about Digital:

- Digital Input/Output uses the Digital pins, but Analog In pins can be used as Digital
- To receive a Digital signal use: digitalRead(pinNumber);
- To send a Digital signal use: digitalWrite(pinNumber, value);
- Digital Input and Output are always either HIGH or LOW

4.4 Analog

A continuous stream of information with values between and including 0% and 100%. Humans perceive the world in analog. Everything we see and hear is a continuous transmission of information to our senses. The temperatures we perceive are never 100% hot or 100% cold, they are constantly changing between our ranges of acceptable temperatures. This continuous stream is what defines analog data. Digital information, the complementary concept to Analog, estimates analog data using only ones and zeros. In the world of Arduino an Analog signal is simply a signal that can be HIGH (on), LOW (off) or anything in between these two states. This means an Analog signal has a voltage value that can be anything between 0V and 5V (unless you mess with the Analog Reference pin). Analog allows you to send output or receive input about devices that run at percentages as well as on and off. The Arduino does this by sampling the voltage signal sent to these pins and comparing it to a voltage reference signal (5V). Depending on the voltage of the Analog signal when compared to the Analog Reference signal the Arduino then assigns a numerical value to the signal somewhere between 0 (0%) and 1023 (100%). The digital system of the Arduino can then use this number in calculations and sketches. To receive Analog Input the Arduino uses Analog pins # 0 - # 5. These pins are designed for use with components that output Analog information and can be used for Analog Input. There is no setup necessary, and to read them use the command: analogRead(pinNumber); where pinNumber is the Analog In pin to which the the Analog component is connected. The analogRead command will return a number including or between 0 and 1023. The Arduino also has the capability to output a digital signal that acts as an Analog signal, this signal is called Pulse Width Modulation (PWM). Digital Pins # 3, # 5, # 6, # 9, # 10 and #11 have PWM capabilities. To output a PWM signal use the command: nalogWrite(pinNumber, value); where pinNumber is a Digital Pin with PWM capabilities and value is a number between 0 (0%) and 255 (100%). On the Arduino UNO PWM pins are signified by a ~ sign. For more information on PWM see the PWM worksheets or S.I.K. circuit 12.

Examples of Analog:

Values: Temperature, volume level, speed, time, light, tide level, spiciness, the list goes on.... Sensors: Temperature sensor, Photoresistor, Microphone, Turntable, Speedometer, etc....

Things to remember about Analog:

- Analog Input uses the Analog In pins, Analog Output uses the PWM pins
- To receive an Analog signal use: analogRead(pinNumber);
- To send a PWM signal use: analogWrite(pinNumber, value);
- Analog Input values range from 0 to 1023 (1024 values because it uses 10 bits, 210)
- PWM Output values range from 0 to 255 (256 values because it uses 8 bits, 28)

4.5 Output Signals

A signal exiting an electrical system, in this case a microcontroller. Output to the Arduino pins is always Digital, however there are two different types of Digital Output; regular Digital Output and Pulse Width Modulation Output (PWM). Output is only possible with Digital pins # 0 - # 13. The Digital pins are preset as Output pins, so unless the pin was used as an Input in the same sketch, there is no reason to use the pinMode command to set the pin as an Output. Should a situation arise where it is necessary to reset a Digital pin to Output from Input use the command: pinMode(pinNumber, OUTPUT); where pinNumber is the Digital pin number set as Output. To send a Digital Output signal use the command: digitalWrite(pinNumber, value); where pinNumber is the Digital pin that is outputting the signal and value is the signal. When outputting a Digital signal value can be either HIGH (On) or LOW (Off). Digital Pins # 3, # 5, # 6, # 9, # 10 and #11 have PWM capabilities. This means you can Output the Digital equivalent of an Analog signal using these pins. To Output a PWM signal use the command: analogWrite(pinNumber, value); where pinNumber is a Digital Pin with PWM capabilities and value is a number between 0 (0%) and 255 (100%). For more information on PWM see the PWM worksheets or S.I.K. circuit 12. Output can be sent to many different devices, but it is up to the user to figure out which kind of

Output signal is needed, hook up the hardware and then type the correct code to properly use these signals. Things to remember about Output:

- Output is always Digital
- There are two kinds of Output: regular Digital or PWM (Pulse Width Modulation)
- To send an Output signal use analogWrite(pinNumber, value); (for analog) or

digitalWrite(pinNumber, value); (for digital)

- Output pin mode is set using the pinMode command: pinMode(pinNumber, OUTPUT);
- Regular Digital Output is always either HIGH or LOW
- PWM Output varies from 0 to 255

5. GSM MODULE

GSM (Global System for Mobile Communications, originally Group Special Mobile), is a standard developed by the European Telecommunications Standards Institute (ETSI).It was created to describe the protocols for secondgeneration (2G) digital cellular networks used by mobile phones and is now the default global standard for mobile communications – with over 90% market share, operating in over 219 countries and territories.**GSM/GPRS module** is used to establish communication between a computer and a **GSM-GPRS system**.

Global System for Mobile communication (GSM) is an architecture used for mobile communication in most of the countries. **Global Packet Radio Service (GPRS)** is an extension of GSM that enables higher data transmission rate. **GSM/GPRS module consists of a GSM/GPRS modem assembled together with power supply circuit and communication interfaces** (like RS-232, USB, etc) for computer. GSM/GPRS MODEM is a class of wireless MODEM devices that are designed for communication of a computer with the GSM and GPRS network. It requires a **SIM (Subscriber Identity Module)** card just like mobile phones to activate communication with the network. Also they have **IMEI** (International Mobile Equipment Identity) number similar to mobile phones for their identification. A GSM/GPRS MODEM can perform the following operations:

- Receive, send or delete SMS messages in a SIM. Read, add, search phonebook entries of the SIM

- .Make, Receive, or reject a voice call.

The MODEM needs **AT commands**, for interacting with processor or controller, which are communicated through serial communication. These commands are sent by the controller/processor. The MODEM sends back a result after it receives a command. Different AT commands supported by the MODEM can be sent by the processor/controller/computer to interact with the **GSM and GPRS cellular network**.

5.1 Contents

- What is GSM/GPRS?
- What is GSM Module?
- Modems, Modules and Mobile
- Applications of GSM module
- Points to Consider
- Interface example

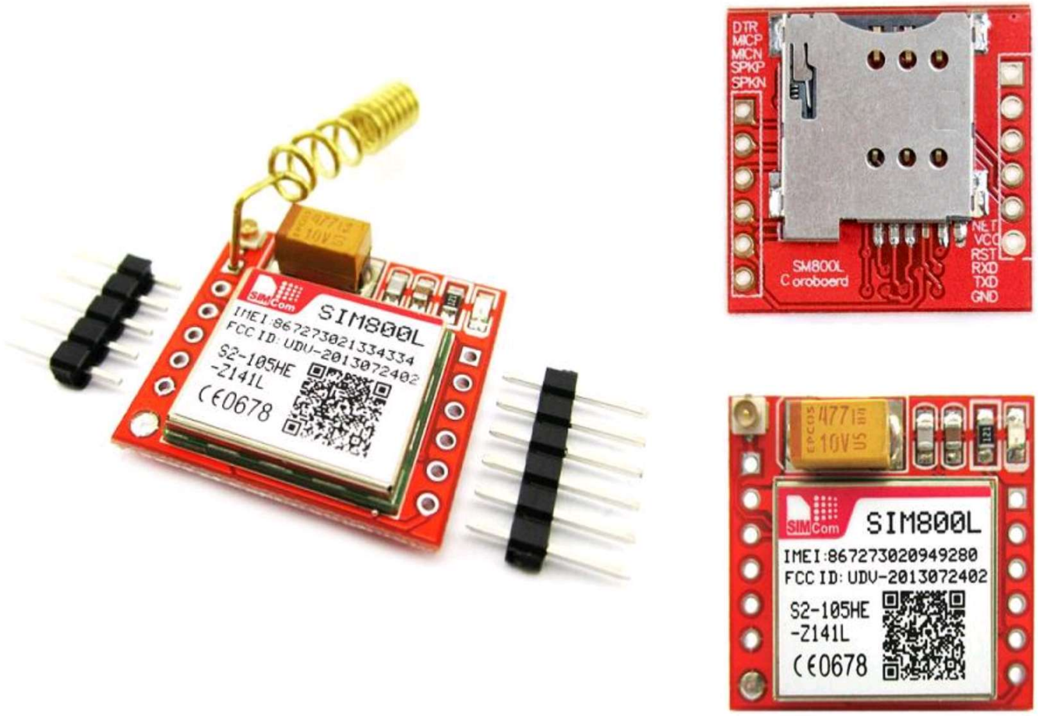


Figure 2 :GSM Model

5.2 Understanding Modems

Wireless modems generate, transmit or decode data from a cellular network, in order to establish communication.

A GSM/GPRS modem is a class of wireless modem, designed for communication over the GSM and GPRS network. It requires a SIM (Subscriber Identity Module) card just like mobile phones to activate communication with the network. Also they have IMEI (International Mobile Equipment Identity) number similar to mobile phones for their identification hardware Overview of SIM800L GSM/GPRS module At the heart of the module is a SIM800L GSM cellular chip from Simoom. The operating voltage of the chip is from **3.4V to 4.4V**, which makes it an ideal candidate for direct LiPo battery supply. This makes it a good choice for embedding into projects without a lot of space.

All the necessary data pins of SIM800L GSM chip are broken out to a 0.1″ pitch headers. This includes pins required for communication with a microcontroller over **UART**. The module supports baud rate from **1200bps** to **115200bps** with AutoBaud detection.

The module needs an external antenna to connect to a network. The module usually comes with a **Helical Antenna** and solders directly to NET pin on PCB. The board also has a U.FL connector facility in case you want to keep the antenna away from the board.There's a SIM socket on the back! Any activated, **2G micro SIM card** would work perfectly. Correct direction for inserting SIM card is normally engraved on the surface of the SIM socket.

6. LOAD CELL

load cell is a transducer that is used to convert a force into electrical signal.

Figure 3 :Load cell

This conversion is indirect and happens in two stages. Through a mechanical arrangement, the force being sensed deforms a strain gauge. The strain gauge measures the deformation (strain) as an electrical signal, because the strain changes the effective electrical resistance of the wire. A load cell usually consists of four strain gauges in a Wheatstone bridge configuration. Load cells of one strain gauge (quarter bridge) or two strain gauges (half bridge) are also available.[1] The electrical signal output is typically in the order of a few millivolts and requires amplification by an instrumentation amplifier before it can be used. The output of the transducer can be scaled to calculate the force applied to the transducer.

The various types of load cells that are present are: 1) Hydraulic Load cell 2) Pneumatic Load cell 3) Strain Gauge Load cell

Hydraulic Load Cell: the piston is placed in a thin elastic diaphragm. The piston doesnt actually come in contact with the load cell. Mechanical stops are placed to prevent over strain of the diaphragm when the loads exceed certain limit. The load cell is completely filled with oil. When the load is applied on the piston, the movement of the pistonand the diaphragm arrangement result in an increase of oil pressure which in turn produces a change in the pressure on a bourdon tube connected with the load cells

Pneumatic load cells : the load cell is designed to automatically regulate the balancing pressure. Air pressure is applied to one end of the diaphragm and it escapes through the nozzle placed at the bottom of the load cell. A pressure gauge is attached with the load cell to measure the pressure incide the cell. The deflection of the diaphragm affects the airflow through the nozzle as well as the pressure inside the chamber.

Although strain gauge load cells are the most common, there are other types of load cells as well. In industrial applications, hydraulic (or hydrostatic) is probably the second most common, and these are utilized to eliminate some problems with strain gauge load cell devices. As an example, a hydraulic load cell is immune to transient voltages (lightning) so might be a more effective device in outdoor environments.

Other types include piezoelectric load cells (useful for dynamic measurements of force), and vibrating wire load cells, which are useful in geomechanical applications due to low amounts of drift, and capacitive load cells where the capacitance of a capacitor changes as the load preses the two plates of a capacitor closer together.

Every load cell is subject to "ringing" when subjected to abrupt load changes. This stems from the spring-like behavior of load cells. In order to measure the loads, they have to deform. As such, a load cell of finite stiffness must have spring-like behavior, exhibiting vibrations at its natural frequency. An oscillating data pattern can be the result of ringing. Ringing can be suppressed in a limited fashion by passive means. Alternatively, a control system can use an actuator to actively damp out the ringing of a load cell. This method offers better performance at a cost of significant increase in complexity.

7. Temperature Sensor -LM35

The LM35 series are precision integrated circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in Kelvin as the user is not required to subtract a large constant voltage from its output to obtain convert centigrade scaling.

The LM35 does not require any external calibration or trimming to provide typical accuracy's of ±1/4 ºc at room temperature and ±3/4 ºc over a full -55 to +150 ºc temperature range. Trimming and calibration at the wafer level assure low cost.

The Lm35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. It can be used with single power supplies, or with pulse and minus supplies. As it draws only 60microamp from its supply, it has very low self-heating, less than 0.1c in still air. The LM35 is rated to operate over a-55 to 150-ºc-temperature range while the LM35cis rated for a -40 to +110 ºc (-10 with improved accuracy).

The LM35 series is available packaged in hermetic TO-46 transistor packages. While the LM35c, LM35CA and LM35D are also available in the plastic TO-92 transistor package. The LM35Dis also available in an 8-lead surface mount small outline package and a plastic TO-220 package.

7.1 Features

Calibrated directly in ºc Celsius(centigrade)

linear +10.0mV/ºc scale factor

0.5 c accuracy graranteeable (at+25c)

rated for full -55 to +150 ºc range

Suitable for remote applications

Low cost due to wafer level trimming

Operates from 4 to 30 volts

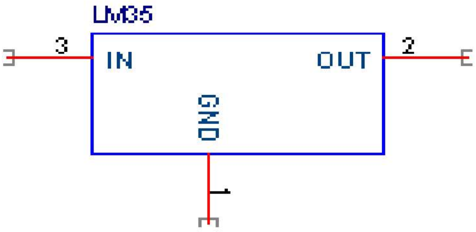
Less than 60 µA current drain]

Low self-heating, 0.08ºc in still air

Nonlinearly only ± 1/4ºc typical

Low impedance output 0.1Ω for 1mA load

Pin out Diagram



7.2 Applications

The LM35 can be applied easily in the same way as other integrated-circuit temperature sensors. It can be glued or cemented to a surface and its temperature will be within about 0.01˚C of the surface temperature. This presumes that the ambient air temperature is almost the same as the surface temperature; if the air temperature were

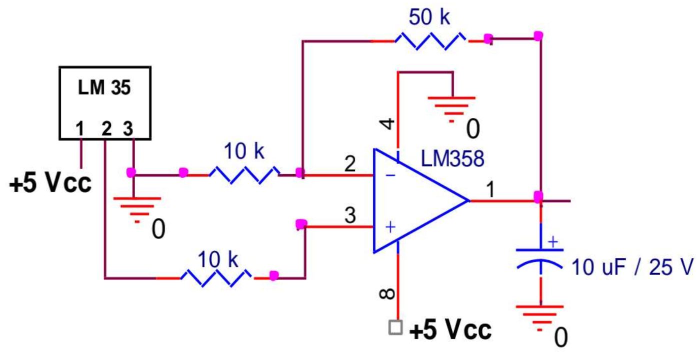
much higher or lower than the surface temperature, the actual temperature of the LM35 die would be at an intermediate temperature between the surface temperature and the air temperature. This is expecially true for the TO-92 plastic package, where the copper leads are the principal thermal path to carry heat into the device, so its temperature might be closer to the air temperature than to the surface temperature.

To minimize this problem, be sure that the wiring to the LM35, as it leaves the device, is held at the same temperature as the surface of interest. The easiest way to do this is to cover up these wires with a bead of epoxy which will insure that the leads and wires are all at the same temperature as the surface, and that the LM35 die’s temperature will not be affected by the air temperature.

The TO-46 metal package can also be soldered to a metal surface or pipe without damage. Of course, in that case the V− terminal of the circuit will be grounded to that metal. Alternatively, the LM35 can be mounted inside a sealed-end metal tube, and can then be dipped into a bath or screwed into a threaded hole in a tank. As with any IC, the LM35 and accompanying wiring and circuits must be kept insulated and dry, to avoid leakage and corrosion. This is especially true if the circuit may operate at cold temperatures where condensation can occur. Printed-circuit coatings and varnishes such as Humiseal and epoxy paints or dips are often used to insure that moisture cannot corrode the LM35 or its connections.

These devices are sometimes soldered to a small light-weight heat fin, to decrease the thermal time constant and speed up the response in slowly-moving air. On the other hand, a small thermal mass may be added to the sensor, to give the steadiest reading despite small deviations in the air temperature.

7.3 Temperature Sensor



8. MQ-4 Gas sensor

MQ4 GAS Sensor is suitable for sensing natural gas, Methane (CH_4). MQ4 gas sensor is composed of micro AL_2O_3 ceramic tube, Tin Dioxide (SnO_2) sensitive layer, measuring electrode and heater are fixed into a crust made by plastic and stainless steel net. The heater provides necessary work conditions for work of sensitive components. The enveloped MQ - 4 has 6 pin, 4 of them are used to fetch signals, and other 2 are used for providing heating current. This MQ4 Gas sensor is suitable for detecting Natural Gas concentration. It has a high sensitivity and fast response time. Sensor provides an analog resistive output based on Natural Gas concentration.

Figure 4 :MQ4 GAS Sensor.

817.1 Features of MQ4 GAS Sensor:-

High sensitivity to Methane (CH_4), Natural Gas.

Fast response and High sensitivity

Stable and long life.

Simple drive circuit.

9. LCD DIPLAY

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 combined with polarizer's. 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 seven segment displays, as in a digital clock.

They use the same basic technology, except that arbitrary images are made from a matrix of small pixels, while other displays have larger elements. LCDs can either be normally on (positive) or off (negative), depending on the polarizer arrangement. For example, a character positive LCD with a backlight will have black lettering on a background that is the colour of the backlight, and a character negative LCD will have a black background with the letters being of the same colour as the backlight. Optical filters are added to white on blue LCDs to give them their characteristic appearance.LCDs are used in a wide range of applications, including LCD televisions, Computer monitors, instrument panels, aircraft cockpit displays, and indoor and outdoor signage.

Small LCD screens are common in portable consumer devices such as digital cameras, watches, calculators, and mobile telephones, including smart phones. LCD screens are also used on consumer electronics products such as DVD players, video game devices and clocks. LCD screens have replaced heavy, bulky cathode ray tube (CRT) displays in nearly all applications LCD screens are available in a wider range of screen sizes than CRT and plasma displays, with LCD screens available in sizes ranging from tiny digital watches to very large television receivers.

LCDs are slowly being replaced by OLEDs, which can be easily made into different shapes, and have a lower response time, wider colour gamut, virtually infinite colour contrast and viewing angles, lower weight for a given display size and a slimmer profile (because OLEDs use a single glass or plastic panel whereas LCDs use two glass panels; the thickness of the panels increases with size but the increase is more noticeable on LCDs) and potentially lower power consumption (as the display is only "on" where needed and there is no backlight).

10. Solenoid valve

A solenoid valve is an electromechanically-operated valve.

10.1 Solenoid valves.

Solenoid valves differ in the characteristics of the electric current they use, the strength of the magnetic field they generate, the mechanism they use to regulate the fluid, and the type and characteristics of fluid they control. The mechanism varies from linear action, plunger-type actuators to pivoted-armature actuators and rocker actuators. The valve can use a two-port design to regulate a flow or use a three or more port design to switch flows between ports. Multiple solenoid valves can be placed together on a manifold.

Solenoid valves are the most frequently used control elements in fluidics. Their tasks are to shut off, release, dose, distribute or mix fluids. They are found in many application areas. Solenoids offer fast and safe switching, high-reliability, long service life, good medium compatibility of the materials used, low control power and compact design.

10.2 Operation

There are many valve design variations. Ordinary valves can have many ports and fluid paths. A 2-way valve, for example, has 2 ports; if the valve is open, then the two ports are connected and fluid may flow between the ports; if the valve is closed, then ports are isolated. If the valve is open when the solenoid is not energized, then the valve is termed normally open (N.O.). Similarly, if the valve is closed when the solenoid is not energized, then the valve is termed normally closed.[1] There are also 3-way and more complicated designs.[2] A 3-way valve has 3 ports; it connects one port to either of the two other ports (typically a supply port and an exhaust port).

Solenoid valves are also characterized by how they operate. A small solenoid can generate a limited force. If that force is sufficient to open and close the valve, then a direct acting solenoid valve is possible. An approximate relationship between the required solenoid force F_s, the fluid pressure P, and the orifice area A for a direct acting solenoid valve is:[3]

$$F_s = PA = P\pi d^2/4$$

Where d is the orifice diameter. A typical solenoid force might be 15 N (3.4 lb_f) . An application might be a low pressure (e.g., 10 psi (69 kPa)) gas with a small orifice diameter (e.g., ⅜ in (9.5 mm) for an orifice area of 0.11 in^2 (7.1×10^{-5} m^2) and approximate force of 1.1 lbf (4.9 N)).

The solenoid valve (small black box at the top of the photo) with input air line (small green tube) used to actuate a larger rack and pinion actuator (gray box) which controls the water pipe valve.

When high pressures and large orifices are encountered, then high forces are required. To generate those forces, an internally piloted solenoid valve design may be possible.[1] In such a design, the line pressure is used to generate the high valve forces; a small solenoid controls how the line pressure is used. Internally piloted valves are used in dishwashers and irrigation systems where the fluid is water, the pressure might be 80 psi (550 kPa) and the orifice diameter might be ¾ in (19 mm).

In some solenoid valves the solenoid acts directly on the main valve. Others use a small, complete solenoid valve, known as a pilot, to actuate a larger valve. While the second type is actually a solenoid valve combined with a pneumatically actuated valve, they are sold and packaged as a single unit referred to as a solenoid valve.

Piloted valves require much less power to control, but they are noticeably slower. Piloted solenoids usually need full power at all times to open and stay open, where a direct acting solenoid may only need full power for a short period of time to open it, and only low power to hold it.

A direct acting solenoid valve typically operates in 5 to 10 milliseconds. The operation time of a piloted valve depends on its size; typical values are 15 to 150 milliseconds.[2]

Power consumption and supply requirements of the solenoid vary with application, being primarily determined by fluid pressure and line diameter. For example, a popular 3/4" 150 psi sprinkler valve, intended for 24 VAC (50 – 60 Hz) residential systems, has a momentary inrush of 7.2 VA, and a holding power requirement of 4.6 VA.[4] Comparatively, an industrial 1/2" 10000 psi valve, intended for 12, 24, or 120 VAC systems in high pressure fluid and cryogenic applications, has an inrush of 300 VA and a holding power of 22 VA.[5] Neither valve lists a minimum pressure required to remain closed in the un-powered state.

Internally piloted ...

While there are multiple design variants, the following is a detailed breakdown of a typical solenoid valve design.

A solenoid valve has two main parts: the solenoid and the valve. The solenoid converts electrical energy into mechanical energy which, in turn, opens or closes the valve mechanically. A direct acting valve has only a small flow circuit, shown within section E of this diagram (this section is mentioned below as a pilot valve). In this example, a diaphragm piloted valve multiplies this small pilot flow, by using it to control the flow through a much larger orifice.

Solenoid valves may use metal seals or rubber seals, and may also have electrical interfaces to allow for easy control. A spring may be used to hold the valve opened (normally open) or closed (normally closed) while the valve is not activated.

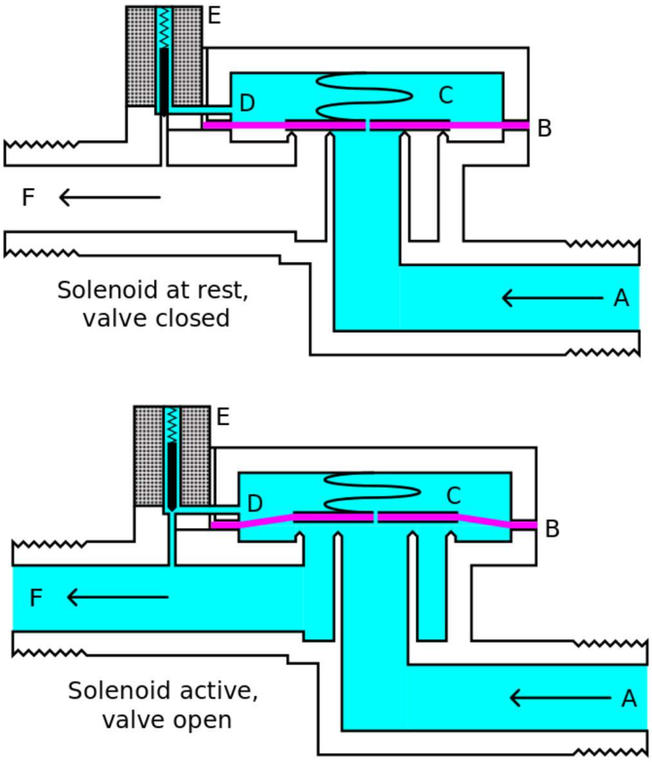


Figure 5: Solenoid Valve

Input side

Diaphragm

Pressure chamber

Pressure relief passage

Electro Mechanical Solenoid

Output side

The diagram to the right shows the design of a basic valve, controlling the flow of water in this example. At the top figure is the valve in its closed state. The water under pressure enters at A. B is an elastic diaphragm and above it is a weak spring pushing it down. The diaphragm has a pinhole through its center which allows a very small amount of water to flow through it. This water fills the cavity C on the other side of the diaphragm so that pressure is equal on both sides of the diaphragm, however the compressed spring supplies a net downward force. The spring is weak and is only able to close the inlet because water pressure is equalized on both sides of the diaphragm.

Once the diaphragm closes the valve, the pressure on the outlet side of its bottom is reduced, and the greater pressure above holds it even more firmly closed. Thus, the spring is irrelevant to holding the valve closed.

The above all works because the small drain passage D was blocked by a pin which is the armature of the solenoid E and which is pushed down by a spring. If current is passed through the solenoid, the pin is withdrawn via magnetic force, and the water in chamber *C* drains out the passage *D* faster than the pinhole can refill it. The pressure in chamber C drops and the incoming pressure lifts the diaphragm, thus opening the main valve. Water now flows directly from A to F.

When the solenoid is again deactivated and the passage D is closed again, the spring needs very little force to push the diaphragm down again and the main valve closes. In practice there is often no separate spring; the elastomer diaphragm is molded so that it functions as its own spring, preferring to be in the closed shape.

From this explanation it can be seen that this type of valve relies on a differential of pressure between input and output as the pressure at the input must always be greater than the pressure at the output for it to work. Should the pressure at the output, for any reason, rise above that of the input then the valve would open regardless of the state of the solenoid and pilot valve.

10.3 Components

Figure 6 :Components

Example core tubes. Non-magnetic core tubes are used to isolate the fluid from the coil. The core tube encloses the plugnut the core spring and the core encloses the plugnut, the core spring, and the core. The coil slips over the core tube; a retaining clip engages the depression near the closed end of the core tube and holds the coil on the core tube.

Solenoid valve designs have many variations and challenges.

Common components of a solenoid

valve:[6][7][8][9]

●Solenoid subassembly

○Retaining clip (a.k.a. coil clip)

○Solenoid coil (with magnetic return path)

○Core tube (a.k.a. armature tube, plunger tube, solenoid valve tube, sleeve, guide assembly) ○ Plugnut (a.k.a. fixed core)

○Shading coil (a.k.a. shading ring)

○Core spring (a.k.a. counter spring)

- ○Core (a.k.a. plunger, armature)

Core tube–bonnet seal

- Bonnet (a.k.a. cover)

Bonnet–diaphragm–body seal

- Hanger spring

Backup washer

- Diaphragm

○Bleed hole

- Disk

Valve body

- ○Seat

The core or plunger is the magnetic component that moves when the solenoid is energized. The core is coaxial with the solenoid. The core's movement will make or break the seals that control the movement of the fluid. When the coil is not energized, springs will hold the core in its normal position.

The plugnut is also coaxial.

The core tube contains and guides the core. It also retains the plugnut and may seal the fluid. To optimize the movement of the core, the core tube needs to be nonmagnetic. If the core tube were magnetic, then it would offer a shunt path for the field lines.[10] In some designs, the core tube is an enclosed metal shell produced by deep drawing. Such a design simplifies the sealing problems because the fluid cannot escape from the enclosure, but the design also increases the magnetic path resistance because the magnetic path must traverse the thickness of the core tube twice: once near the plugnut and once near the core. In some other designs, the core tube is not closed but rather an open tube that slips over one end of the plugnut. To retain the plugnut, the tube might be crimped to the plugnut.

An O-ring seal between the tube and the plugnut will prevent the fluid from escaping.

The solenoid coil consists of many turns of copper wire that surround the core tube and induce the movement of the core. The coil is often encapsulated in epoxy. The coil also has an iron frame that provides a low magnetic path resistance.

Materials ...

The valve body must be compatible with the fluid; common materials are brass, stainless steel, aluminum, and plastic.[11] The seals must be compatible with the fluid.

To simplify the sealing issues, the plugnut, core, springs, shading ring, and other components are often exposed to the fluid, so they must be compatible as well. The requirements present some special problems. The core tube needs to be nonmagnetic to pass the solenoid's field through to the plugnut and the core. The plugnut and core need a material with good magnetic properties such as iron, but iron is prone to corrosion. Stainless steels can be used because they come in both magnetic and non-magnetic varieties.[12] For example, a solenoid valve might use 304 stainless steel for the body, 305 stainless steel for the core tube, 302 stainless steel for the springs, and 430 F stainless steel (a magnetic stainless steel[13]) for the core and plugnut.[1]

10.4 Types

Many variations are possible on the basic, one-way, one-solenoid valve described above:

●one- or two-solenoid valves; ●direct current or alternating current powered;

●different number of ways and positions;

10.5 Common uses

Solenoid valves are used in fluid power pneumatic and hydraulic systems, to control cylinders, fluid power motors or larger industrial valves. Automatic irrigation sprinkler systems also use solenoid valves with an automatic controller. Domestic washin g machines and dishwashers use solenoid valves to control water entry into the machine. They are also often used in paintball gun triggers to actuate the CO_2 hammer valve. Solenoid valves are usually referred to simply as "solenoids."

Solenoid valves can be used for a wide array of industrial applications, including general on-off control, calibration and test stands, pilot plant control loops, process control systems, and various original equipment manufacturer applications.[14]

10.6 History and commercial development

In 1910, ASCO Numatics became the first company to develop and manufacture the

solenoid valve.[15][16]

See also

●Air-operated valve

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11. RELAY

11.1 What is a relay?

We know that most of the high end industrial application devices have relays for their effective working. Relays are simple switches which are operated both electrically and mechanically. Relays consist of a n electromagnet and also a set of contacts. The switching mechanism is carried out with the help of the electromagnet. There are also other operating principles for its working. But they differ according to their applications. Most of the devices have the application of relays.

11.2 Why is a relay used?

The main operation of a relay comes in places where only a low-power signal can be used to control a circuit. It is also used in places where only one signal can be used to control a lot of circuits. The application of relays started during the invention of telephones. They played an important role in switching calls in telephone exchanges. They were also used in long distance telegraphy. They were used to switch the signal coming from one source to another destination. The high end applications of relays require high power to be driven by electric motors and so on.

Such relays are called contactors.

11.3 Relay Design

There are only four main parts in a relay. They are

- Electromagnet
- Movable Armature

- Switch point contacts
- Spring

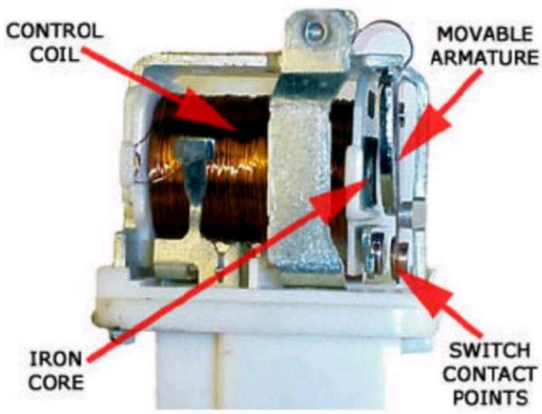

Fig no 7: RELAY CONFIGURATION

Relay construction It is an electro-magnetic relay with a wire coil, surrounded by an iron core. A path of very low reluctance for the magnetic flux is provided for the movable armature and also the switch point contacts. The movable armature is connected to the yoke which is mechanically connected to the switch point contacts. These parts are safely held with the help of a spring. The spring is used so as to produce an air gap in the circuit when the relay becomes de-energized.

Relay design the diagram shows an inner section diagram of a relay. An iron core is surrounded by a control coil. As shown, the power source is given to the electromagnet through a control switch and through contacts to the load. When current starts flowing through the control coil, the electromagnet starts energizing and thus intensifies the magnetic field. Thus the upper contact arm starts to be attracted to the lower fixed arm and thus closes the contacts causing a short circuit for the power to the load.

On the other hand, if the relay was already de-energized when the contacts were closed, then the contact move oppositely and make an open circuit. As soon as the coil current is off, the movable armature will be returned by a force back to its initial position. This force will be almost equal to half the strength of the magnetic force. This force is mainly provided by two factors. They are the spring and also gravity.

12. BUZZER

Fig 8: Buzzer

A buzzer or beeper is a signalling device, usually electronic, typically used in automobiles, household appliances such as a microwave oven, or shows. It most commonly consists of a number of switches or sensors connected to a control unit that determines if and which button was pushed or a preset time has lapsed, and usually illuminates a light on the appropriate button or control panel, and sounds a warning in the form of a continuous or intermittent buzzing or beeping sound. Initially this device was based on an electromechanical system which was identical to an electric bell without the metal gong (which makes the ringing noise).

. Another implementation with some AC-connected devices was to implement a circuit to make the AC current into a noise loud enough to drive a loudspeaker and hook this circuit up to a cheap 8-ohm speaker. Nowadays, it is more popular to use a ceramic-based piezoelectric sounder like a Son alert which makes a high-pitched tone. Usually these were hooked up to "driver" circuits which varied the pitch of the sound or pulsed the sound on and off. In game shows it is also known as a "lockout system," because when one person signals ("buzzes in"), all others are locked out from signalling. Several game shows have large buzzer buttons which are identified as "plungers". This may take the form of a separation of electric charge across the crystal lattice. If the material is not short-circuited, the applied charge induces a voltage across the material. The word is derived from the Greekpiezein, which means to squeeze or press.

The piezoelectric effect is reversible in that materials exhibiting the direct piezoelectric effect (the production of electricity when stress is applied) also exhibit the converse piezoelectric effect (the production of stress and/or strain when an electric field is applied). For example, lead zirconatetitanate crystals will exhibit a maximum shape change of about 0.1% of the original dimension.

The effect finds useful applications such as the production and detection of sound, generation of high voltages, electronic frequency generation, microbalances, and ultra fine focusing of optical assemblies. It is also the basis of a number of scientific instrumental techniques with atomic resolution, the scanning probe micros copies such as STM, AFM, MTA, SNOM etc.

13. POWER SUPPLY

Available power source is an Ac voltage arrives at 230V.Since our electronic circuits require only very minimum voltage and current. One can use step down power transformer. Step down transformer is designed in such a way that the input is 230V and output of 12V. Another thing is, that electronic circuits operate in DC where as available output of transformer is Ac of 12V. So rectifier circuit is used to convert AC to DC. Rectifier circuit consists of four diodes formed in bridge fashion so as to convert incoming AC to DC.

Even though output of rectifier circuit is DC it is not smooth or fixed DC. So filter circuits are used to convert rippling DC to smooth DC. The filter circuit is a capacitor, connected parallel to the output of rectifier circuit. This smooth DC voltage will be in the range of 12+volt. But they require only 5V supply for the operation of micro controllers and it's supporting components. Here again regulator ICs such as 7805 is used to regulate the incoming 12VDC to fixed regulated 5V as output. This DC regulated 5V is applied to the circuits. Even though the circuit is functioning with 5V, the relays are driven by 6V or 12V. For this purpose 7806/7812 regulator IC is additionally connected to the rectifier filter circuit. Thus 12V regulated is used for driving 12V relays.

13.1 THREE-TERMINAL REGULATORS

For most no critical applications the best choice for a voltage regulator is the simple –terminal type. It has only three connections and is factory-trimmed to provide a fixed output. Typical of this type is the 78xx. The voltage is specified by the last two digits of the part number and can be any of the following: 05, 08, 10, 12, 15, 18, or 24. It is to make a +5 volt regulator, for instance, with one of these regulators.

The capacitor across the output improves transient response and keeps the impedance low at high frequencies (an input capacitor of at least 0.33F should be used in addition if the regulator is located a considerable distance from the filter capacitors). The 7800 series is available in plastic or metal power packages (same as power transistors). A low-power version, the 78Lxx, comes in the same plastic and metal packages as small-signal transistors. The 7900 series of negative regulators works the same way (with negative input voltage, of course). The 7800 series can provide up to 1 amp load current and has on-chip circuitry to prevent damage in the event of overheating or excessive load current; the chip simply shuts down, rather than blowing out. In addition, on-chip circuitry prevents operation outside the Transistor safe operating area by reducing available output current for large input-output voltage differential. These regulators are in-expensive and easy to use, and they make it practical to design a system with many printed-circuit boards in which the unregulated dc is brought to each board and regulation is done locally on each circuit card.

Three - terminal fixed regulators come in some highly useful variants. The LP 2950 works just like a 7805, but draws only 75A of quiescent current (compared with the 7805's 5mA or the 78L05's 3mA); it also regulates with as little as a 0.4 volt drop from unregulated input to regulated output (called the "drop out voltage"), compared with 2 volts drop out for the classic 7805. The LM291 is also low-dropout, but they might call it milli power (0.4mA quiescent current), compared with the “micro power” LP 2950. Low-dropout regulators also come in high – current versions for example, the LT 1085/4/3 series from LTC (A, 5A, and 7.5A, respectively, with both + 5V and + 12V available in each type). Regulators like the LM 2984 are basically three-terminal fixed regulators, but with extra outputs to signal a microprocessor that power has failed, or resumed. Finally, regulators like the 4195 contain a pair of 3-terminal 15-volt regulators, one positive and one negative.

14. Battery (electricity)

Various batteries (clockwise from bottom left): two 9-voltPP3, two AA, one D, one handheld ham radio battery, onecordless phone battery, one camcorder battery, one C, twoAAA.

In electronics, a battery or voltaic cell is a combination of one or moreelectrochemical Galvanic cells which store chemical energy that can be converted intoelectric potential energy, creating electricity. Since the invention of the first Voltaic pilein 1800 by Alessandro Volta, the battery has become a common power source for many household and industrial applications, and is now a multi-billion dollar industry.

The name "battery" was coined by Benjamin Franklin for an arrangement of multipleLeyden jars (an early type of capacitor) after a battery of cannon.[1] Common usage has evolved to (inaccurately) include a single electrical cell in the definition.[2][3]

14.2 History

Main article: History of the battery

The modern development of batteries started with the Voltaic pile, invented by the Italian physicist Alessandro Volta in 1800.[4] (An early form of electrochemical battery called the Baghdad Battery may have been used in antiquity.[5])

In 1791, Luigi Galvani published a report on "animal electricity."[6] He created an electric circuit consisting of two different metals, with one touching a frog's leg and the other touching both the leg and the first metal, thus closing the circuit. In modern terms, the frog's leg served as both the electrolyte and the sensor, and the metals served as electrodes. He noticed that even though the frog was dead, its legs would twitch when he touched them with the metals.

Within a year, Volta realized the frog's moist tissues could be replaced by cardboard soaked in salt water, and the frog's muscular response could be replaced by another form of electrical detection. He already had studied the electrostatic phenomenon of capacitance, which required measurements of electric charge and of electrical potential ("tension"). Building on this experience, Volta was able to detect electric current through his system, also called a Galvanic cell. The terminal voltage of a cell that is not discharging is called its electromotive force (emf), and has the same unit as electrical potential, named (voltage) and measured in volts, in honor of Volta. In 1800, Volta invented the battery by placing many voltaic cells in series, literally piling them one above the other. This Voltaic pile gave a greatly enhanced net emf for the combination,[7] with a voltage of about 50 volts for a 32-cell pile.[8] In many parts of Europe batteries continue to be called piles.[9][10]

Volta did not appreciate that the voltage was due to chemical reactions. He thought that his cells were an inexhaustible source of energy,[11]and that the associated chemical effects (e.g. corrosion) were a mere nuisance, rather than an unavoidable consequence of their operation, asMichael Faraday showed in classic studies that yielded the names anions and cations and anode and cathode (1834).[12] According to Faraday, cations (positively charged ions) are attracted to the cathode, and anions (negatively charged ions) are attracted to the anode.

Although early batteries were of great value for experimental purposes, in practice their voltages fluctuated and they could not provide a large current for a sustained period. Later, starting with the Daniell cell in 1836, batteries provided more reliable currents and were adopted by industry for use in stationary devices, particularly in telegraph networks where they were the only practical source of electricity, since electrical distribution networks did not then exist.[13] These wet cells used liquid electrolytes, which were prone to leakage and spillage if not handled correctly. Many used glass jars to hold their components, which made them fragile. These characteristics made wet cells unsuitable for portable appliances. Near the end of the 19th century, the invention of Dry cell batteries, which replaced liquid in electrolyte with a paste, made portable electrical devices practical.

Since then, batteries have gained popularity as they became portable and useful for a variety of purposes.[14] According to a 2005 estimate, the worldwide battery industry generates US$48 billion in sales each year,[15] with 6% annual growth.[16]

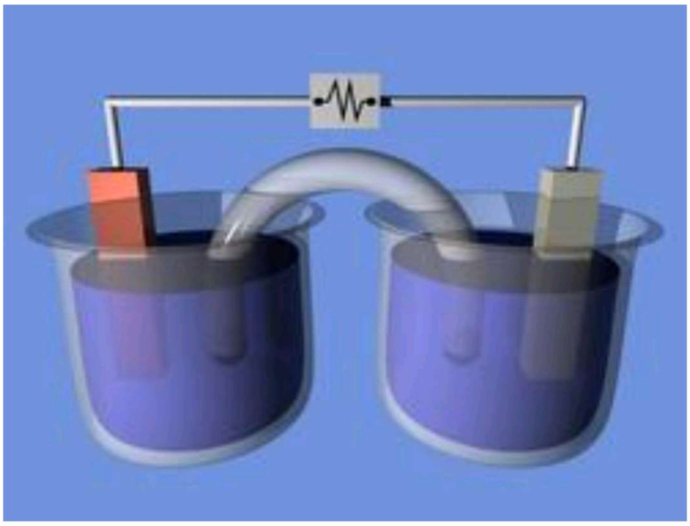

Figure 9 :Battery

15. DC MOTOR

An **electric motor** uses electrical energy to produce mechanical energy. The reverse process, that of using mechanical energy to produce electrical energy, is accomplished by a generator or dynamo. Traction motors used on locomotives often perform both tasks if the locomotive is equipped with dynamic brakes. Electric motors are found in household appliances such as fans, refrigerators, washing machines, pool pumps, floor vacuums, and fan-forced ovens.

Brushless DC motors use a rotating permanent magnet in the rotor, and stationary electrical magnets on the motor housing. A motor controller converts DC to AC. This design is simpler than that of brushed motors because it eliminates the complication of transferring power from outside the motor to the spinning rotor. Advantages of brushless motors include long life span, little or no maintenance, and high efficiency. Disadvantages include high initial cost, and more complicated motor speed controllers.

15.1 DC motors

A DC motor is designed to run on DC electric power. Two examples of pure DC designs are Michael Faraday's homopolar motor (which is uncommon), and the ball bearing motor, which is (so far) a novelty. By far the most common DC motor types are the brushed and brushless types, which use internal and external commutation respectively to create an oscillating AC current from the DC source -- so they are not purely DC machines in a strict sense.

Many of the limitations of the classic commutator DC motor are due to the need for brushes to press against the commutator. This creates friction. At higher speeds, brushes have increasing difficulty in maintaining contact. Brushes may bounce off the irregularities in the commutator surface, creating sparks. This limits the maximum speed of the machine. The current density per unit area of the brushes limits the output of the motor. The imperfect electric contact also causes electrical noise. Brushes eventually wear out and require replacement, and the commutator itself is subject to wear and maintenance. The commutator assembly on a large machine is a costly element, requiring precision assembly of many parts.

These problems are eliminated in the brushless motor. In this motor, the mechanical "rotating switch" or commutator/brushgear assembly is replaced by an external electronic switch synchronised to the rotor's position. Brushless motors are typically 85-90% efficient, whereas DC motors with brushgear are typically 75-80% efficient.

Midway between ordinary DC motors and stepper motors lies the realm of the brushless DC motor. Built in a fashion very similar to stepper motors, these often use a permanent magnet external rotor, three phases of driving coils, one or more Hall effect sensors to sense the position of the rotor, and the associated drive electronics. The coils are activated, one phase after the other, by the drive electronics as cued by the signals from the Hall effect sensors. In effect, they act as three-phase synchronous motors containing their own variable-frequency drive electronics. A specialized class of brushless DC motor controllers utilize EMF feedback through the main phase connections instead of Hall effect sensors to determine position and velocity. These motors are used extensively in electric radio-controlled vehicles, and referred to by modelists as outrunner motors (since the magnets are on the outside).

Brushless DC motors are commonly used where precise speed control is necessary, computer disk drives or in video cassette recorders the spindles within CD, CD-ROM (etc.) drives, and mechanisms within office products such as fans, laser printers and photocopiers. They have several advantages over conventional motors:

A **brushless DC motor** (**BLDC**) is a synchronous electric motor which is powered by direct-current electricity (DC) and which has an electronically controlled commutation system, instead of a mechanical commutation system based on brushes. In such motors, current and torque, voltage and rpm are linearly related.

16. EMBEDDED SYSTEM

16.1 INTRODUCTION TO MICROCONTROLLER SYSTEMS

Embedded systems are controllers with on chip control. They consist of microcontroller, input and output devices, memories etc., on chip and they can be used

for a specific application.

A small computer designed in a single chip is called a single chip microcomputer. A single chip microcomputer typically includes a microprocessor RAM, ROM, timer, interrupt and peripheral controller in a single chip. This single chip microcomputer is also called as microcontroller; These Microcontrollers are used for variety of applications where it replaces the computer. The usage of this microcomputer for a specific application, in which the microcontrollers a part of application, is called embedded systems.

An Embedded system is a combination of computer hardware and software. As with any electronic system, this system requires a hardware platform and that is built with a microprocessor or microcontroller. The Embedded system hardware includes elements like user interface, Input / Output interfaces, display and memory, etc. Generally, an embedded system comprises power supply, processor, memory, timers, serial communication ports and system application specific circuits.

Embedded systems are used for real time applications with high reliability, accuracy and precision, Embedded systems are operated with Real Time Operating systems like WinCE, RT Linux, VxWorks, PSOS, etc..,

Embedded systems are very popular these days Most of the Electrical, Electronics, Mechanical, Chemical, Industrial, Medical, Space and many more areas have the embedded systems in their applications

APPLICATION OF EMBEDDED SYSTEM

16.2 Embedded systems are used in the following areas;

Robotics

Aviation

Telecommunication and Broadcasting

Mobile Phones and mobiles networking

Wires Application

Satellite Communication

Military Application

Medical Instruments

Toy industries

16.3 ROLE OF EMBEDDED SYSTEMS

Embedded systems are compact, smart, efficient, and economical and user friendly, they are closed systems and respond to the real world situation very fast, closed system means, everything required for a specific application is embedded on the chip and hence, they do not call for external requirement for their functioning.

16.4 SEGMENTS OF EMBEDDED SYSTEMS

Embedded systems basically consists of the following four segments

Embedded Controllers (8-bit, 6-bit,32-bit,64-bit,128-bit,..)

Embedded software’s (RTOS)

Embedded Memories (DRAM, SRAM, EPROM, Flash etc)

Embedded Boards

17. MICROCONTROLLERVERSUS MICROPROCESSORS

Microcontrollers differ from a microprocessor in many ways, first and the most important is its functionality. In order for a microprocessor to be used, other components for receiving and sending data must be added to it, In short that means that microprocessor is the very heart of the computer. On the other hand, microcontroller is designed to be all of that in one, No other external components are needed for its application because all necessary peripherals are already built into, thus, one can save the time and space needed to construct device.

Comparing microcontroller and microprocessor in terms of cost is not justified. Undoubtedly a microcontroller is far cheaper than a microprocessor. However microcontroller cannot be used in place of microprocessor and using a microprocessor is not advised in place of a microcontroller as it makes the application quite costly. Microprocessor cannot be used stand alone. They need other peripherals like RAM, ROM, buffer, I/O ports etc and hence a system designed around a microprocessor is quite costly.

Microprocessors are used to execute big and generic applications, while a microcontroller will only be used to execute a single task within one application. Some of the benefits of microcontrollers include the following:

· Cost advantage: The biggest advantage of microcontrollers against larger microprocessors is that the design and hardware costs are much lesser and can be kept to a minimum. A microcontroller is cheap to replace, while microprocessors are ten times more expensive.

· Lesser power usage: Microcontrollers are generally built using a technology known as Complementary Metal Oxide Semiconductor (CMOS). This technology is a competent fabrication system that uses less power and is more immune to power spikes than other techniques.

All-in-one: A microcontroller usually comprises of a CPU, ROM, RAM and I/O ports, built within it to execute a single and dedicated task. On the other hand, a microprocessor generally does not have a RAM, ROM or IO pins and generally uses its pins as a bus to interface to peripherals such as RAM, ROM, serial ports, digital and analog IO. Read more about the difference between microcontroller and microprocessor.

17.1 The difference can be highlighted as follows:

MICROPROCESSORS	MICROCONTROLLER
Contains ALU,GP registers, SP, PC, clock timing circuit and interrupts	In addition, it contains inbuilt ROM, RAM I/O devices, Timers/Counters, etc..,
Many instructions to move data between Memory and CPU	One or two instructions to move data between memory and CPU
One or two bit handling instructions are available	Powerful Boolean processor instruction set is available
Access time for memory and I/O devices are more	Less access time for inbuilt memory and I/O devices
Requires more hardware, increase in PCB size	Requires less hardware, reduced PCB size and increased reliability
More flexible from design point of view	Less Flexible
Single memory map for data and code	Separate memory Map for data and code
Few pins are multifunctional	More pins are multifunctional

17.2 CROSS-COMPILER

Cross-compiler is a software program, which is used to convert high –level language program like C to machine language of a specific Microcontroller, using cross-compiler user can write programs in C language, which speeds up the development process.

17.3 SIMULATOR

Simulator is software, which implements the features of a specific Microcontroller on PC. It helps in testing and debugging the programs and interfaces that are to be actually implemented on a Microcontroller at a later stage. Using simulator, the program can be executed and tested without using the evaluation kit, usually the program is simulated under pc environment.

17.4 EMULATOR

Emulator is an in-circuit Microcontroller emulation probe, which provides the user with substantial control over all of the Microcontroller functions and responsibilities. It provides hardware assistance for debugging the most difficult real time problems. Emulators offer visibility into system initialization, before software based debuggers can function, Emulators can identify the code corrupting a data structure, it can also be used to determine how often a particular function is invoked.

17.5 DEBUGGER

It is a software tool used to debug the programs. A debugger detects the non-workability of the program by detecting the errors online (i.e. while the program is running in the target it has the capability to detect proper functioning of the application program

18. PROGRAMS

```
#include <HX711.h>
#include <LiquidCrystal.h>
LiquidCrystal lcd(7, 8, 9, 10, 11, 12);

#define DT A0
#define SCK A1
#define sw 13

long sample=0;
float val=0;
long count=0;

unsigned long readCount(void)
{
unsigned long Count;
unsigned char i;
pinMode(DT, OUTPUT);
digitalWrite(DT,HIGH);
digitalWrite(SCK,LOW);
Count=0;
pinMode(DT, INPUT);
while(digitalRead(DT));
for (i=0;i<24;i++)
{
digitalWrite(SCK,HIGH);
Count=Count<<1;
```

```
digitalWrite(SCK,LOW);
if(digitalRead(DT))
Count++;
}
digitalWrite(SCK,HIGH);
Count=Count^0x800000;
digitalWrite(SCK,LOW);
return(Count);
}

void setup()
{
pinMode(SCK, OUTPUT);
pinMode(sw, INPUT_PULLUP);
lcd.begin(16, 2);
lcd.print(" Weight ");
lcd.setCursor(0,1);
lcd.print(" Measurement ");
delay(1000);
lcd.clear();
calibrate();
}

void loop()
{
count= readCount();
int w=(((count-sample)/val)-2*((count-sample)/val));
lcd.setCursor(0,0);
```

```
lcd.print("Measured Weight");
lcd.setCursor(0,1);
lcd.print(w);
lcd.print("g ");

if(digitalRead(sw)==0)
{
val=0;
sample=0;
w=0;
count=0;
calibrate();
}
}

void calibrate()
{
lcd.clear();
lcd.print("Calibrating...");
lcd.setCursor(0,1);
lcd.print("Please Wait...");
for(int i=0;i<100;i++)
{
count=readCount();
sample+=count;
}
sample/=100;
lcd.clear();
```

```
lcd.print("Put 100g & wait");
count=0;
while(count<1000)
{
count=readCount();
count=sample-count;
}
lcd.clear();
lcd.print("Please Wait....");
delay(2000);
for(int i=0;i<100;i++)
{
count=readCount();
val+=sample-count;
}
val=val/100.0;
val=val/100.0; // put here your calibrating weight
lcd.clear();
}
```

```
#include <LiquidCrystal.h> // includes the LiquidCrystal Library
LiquidCrystal lcd(7, 8, 9, 10, 11, 12); //  (rs, enable, d4, d5, d6, d7)
#include <SoftwareSerial.h>

SoftwareSerial mySerial(2, 3); // Rx, Tx  D2,D3
#define relay1  5
#define relay2  6

#define cylinder 13

#define buzzer 4

#define temp_pin A0
#define gas_pin A1

float  temp = 0;
float gas = 0;


void setup() {

  Serial.begin(9600);
  mySerial.begin(9600);
 pinMode(relay1, OUTPUT);
  pinMode(relay2, OUTPUT);
  pinMode(cylinder, INPUT_PULLUP);
  digitalWrite(relay1,LOW);
```

```
digitalWrite(relay2,HIGH);
pinMode(buzzer, OUTPUT);
digitalWrite(buzzer,LOW);
 lcd.begin(16, 2);

 lcd.clear();
 lcd.setCursor(0,0);
 lcd.print("Automatic Gas"); //HYDROPHONICS BY USING IOT
 lcd.setCursor(0,1);
 lcd.print("Leakage Detect");
 delay(1500);

 lcd.clear();
 lcd.setCursor(0,0);
 lcd.print("and LPG cylinder"); //HYDROPHONICS BY USING IOT
 lcd.setCursor(0,1);
 lcd.print("Booking Ststem");
 delay(1500);

 lcd.clear();
 lcd.setCursor(0,0);
 lcd.print("using Arduino"); //HYDROPHONICS BY USING IOT
 lcd.setCursor(0,1);
 lcd.print("with SMS Alert");
 delay(1500);

 lcd.clear();
 lcd.setCursor(0,0);
```

```
 lcd.print("  GSM MODEM");
 lcd.setCursor(0,1);
 lcd.print("INITIALIZING....");
 delay(5500);

  modem_init();
 send_sms1();

 lcd.clear();
 main_display();

}

void loop()
      {
       delay(10);
      temp = analogRead(temp_pin);
      temp = temp/1023*100;
      temp = temp*4;
     // conversion(0, 13, 3,temp);
     lcd.setCursor(12,0);
    lcd.print(temp);

     delay(10);
     gas  = analogRead(gas_pin);
     gas = gas/1023*100;
   //  conversion(1, 13, 3, gas);
    lcd.setCursor(12,1);
```

```
   lcd.print(gas);


   check_temp_value();


     }
//*************************************8


void main_display()
{
 lcd.setCursor(0,0);
 lcd.print("Temperature:");
 lcd.setCursor(0,1);
 lcd.print("Gas_level:");


}




//&&&&&&&&&&&&&&&&&&&&&&&&&&&&&  GSM commands
&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&
void modem_init(void)
{


//  Serial.println("Testing GSM SIM800L");


   delay(5000);
   mySerial.println("AT");
   mySerial.write(0x0d);
   delay(1000);
```

```
  mySerial.println("AT+CMGF=1");
  mySerial.write(0x0d);
  delay(1000);

  mySerial.println("AT+CSMP=17,167,0,0");
  mySerial.write(0x0d);
  delay(1000);

  mySerial.println("AT+CNMI=2,2,0,0,0");
  mySerial.write(0x0d);
  delay(3000);

}
void send_sms1(void)
{
    mySerial.println("AT+CMGS=\"6374231858\"\r"); // change to the phone number you using
    //mySerial.println("AT+CMGS=\"8489056662\"\r"); // change to the phone number you using
    mySerial.write(0x22);
    mySerial.write(0x0d);
    delay(1000);
    mySerial.print("\r\n Automatic Message Sending System"); // Enter the custom message
    mySerial.print("\r\n SMS TEST ");
     mySerial.print("\r\n Device Condition Good");
  //   mySerial.print(lat_val, 6);
    mySerial.write(0x1A);
    delay(2000);
}
```

```
void send_sms2(void)
{
    mySerial.println("AT+CMGS=\"6374231858\"\r"); // change to the phone number you using
    //mySerial.println("AT+CMGS=\"8489056662\"\r"); // change to the phone number you using
    mySerial.write(0x22);
    mySerial.write(0x0d);
    delay(1000);
    mySerial.print("\r\n Automatic Message Sending System"); // Enter the custom message
     mySerial.print("\r\n Your cylinder area tenperature over heated ");
    mySerial.print("\r\n TEMPERATURE: ");
    mySerial.print(temp);
    mySerial.write(0x1A);
    delay(2000);
}
void send_sms3(void)
{
    mySerial.println("AT+CMGS=\"6374231858\"\r"); // change to the phone number you using
    mySerial.println("AT+CMGS=\"8489056662\"\r"); // change to the phone number you using
    mySerial.write(0x22);
    mySerial.write(0x0d);
    delay(1000);
    mySerial.print("\r\n Automatic Message Sending System"); // Enter the custom message
    mySerial.print("\r\n Gas Leakage Detected: ");
    mySerial.print(gas);
    mySerial.write(0x1A);
    delay(2000);
}
void send_sms4(void)
```

```
{
    mySerial.println("AT+CMGS=\"6374231858\"\r"); // change to the phone number you using
    delay(1000);
    mySerial.println("AT+CMGS=\"7339263779\"\r"); // change to the phone number you using
    mySerial.write(0x22);
    mySerial.write(0x0d);
    delay(1000);
    mySerial.print("\r\n Automatic Message Sending System"); // Enter the custom message
    mySerial.print("\r\n Your cylinder was booked. ");
    mySerial.print("\r\n Booking Number: 687754533 ");
     mySerial.print("\r\n Your cylinder will deliver with two working days ");
    //mySerial.print(gas);
    mySerial.write(0x1A);
    delay(2000);
}
//################################## condition checking  ##########################
void check_temp_value()
  {
    if(  temp > 40 )
   {
   digitalWrite(relay1,HIGH);
   digitalWrite(buzzer,HIGH);
   lcd.clear();
   lcd.setCursor(0,0);
   lcd.print("  Warning ");
   lcd.setCursor(0,1);
   lcd.print("Temeprature ");
   delay(1500);
```

```
send_sms2();
lcd.clear();
main_display();
}

if(  gas > 90 )
{
digitalWrite(relay2,HIGH);
digitalWrite(buzzer,HIGH);
lcd.clear();
lcd.setCursor(0,0);
lcd.print("  Warning ");
lcd.setCursor(0,1);
lcd.print("Gas Leakage ");
delay(1500);
send_sms3();
lcd.clear();
main_display();
}

if(digitalRead(cylinder)==0)
{
lcd.clear();
lcd.setCursor(0,0);
lcd.print("Your Cylinder");
lcd.setCursor(0,1);
lcd.print("Booking..wait");
delay(3500);
```

```
   send_sms4();
   lcd.clear();
   main_display();
   }

   if( ( temp < 40 )  && ( gas < 90 )  )
  {
  digitalWrite(relay1,LOW);
  digitalWrite(relay2,LOW);
  digitalWrite(buzzer,LOW);
   }
  }
Void load()
{
{
count= readCount();
int w=(((count-sample)/val)-2*((count-sample)/val));
lcd.setCursor(0,0);
lcd.print("Measured Weight");
lcd.setCursor(0,1);
lcd.print(w);
lcd.print("g ");

if(digitalRead(sw)==0)
{
val=0;
sample=0;
w=0;
```

```
count=0;
calibrate();
}
}

void calibrate()
{
lcd.clear();
lcd.print("Calibrating...");
lcd.setCursor(0,1);
lcd.print("Please Wait...");
for(int i=0;i<100;i++)
{
count=readCount();
sample+=count;
}
sample/=100;
lcd.clear();
lcd.print("Put 100g & wait");
count=0;
while(count<1000)
{
count=readCount();
count=sample-count;
}
lcd.clear();
lcd.print("Please Wait....");
delay(2000);
```

```
for(int i=0;i<100;i++)

{

count=readCount();

val+=sample-count;

}

val=val/100.0;

val=val/100.0; // put here your calibrating weight

lcd.clear();

}
```

19.Advantage:

1. The main advantage is Automatic Booking of LPG Cylinder by sending a SMS to the Distribute company and also alert the user.
2. It ensures the security from the GAS Leakage and Hazards.
3. It is very less time consuming and Cylinder replace in time.

20. Dis Advantage:

21 . Conclusion

This paper consists of two sections transmitter part and the receiver part. In this, the automated booking of the latest LPG cylinder is enforced. With the assistance of the gas device and cargo device ready to able to observe the amount of the gas and also the gas leak.