SMART AUDITORIUM USING ARDUINO

MAJOR PROJECT

SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE AWARD OF THE DEGREE OF

BACHELOR OF TECHNOLOGY

IN

ELECTRONICS & COMMUNICATION ENGINEERING

Submitted By

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Certified that APOORVA BHARDWAJ (00676802814) has carried out the research work presented in this thesis entitled "**SMART AUDITORIUM USING ARDUINO"** for the award of **Bachelor of Technology** from GGSIPU DWARKA, DELHI under my supervision. The thesis embodies results of original work, and studies as are carried out by the student himself and the contents of the thesis do not form on the basis for the award of any other degree to the candidate or anybody else from this or any other University/Institution.

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We would like to acknowledge the contributions of the following people, without whose help and guidance, this report would not have been completed.

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Finally, yet importantly, we would like to express my heartfelt thanks to my beloved parents for their blessings, our friends for their help and wishes for the successful completion of the report. This acknowledgement will remain incomplete if we fail to express our deep sense of obligation to our parents and god for their consistent blessings and encouragement.

CANDIDATE'S DECLARATION

I hereby declare the work which is being presented in this Minor Project entitled**, "SMART AUDITORIUM WITH SECURITY FEATURES USING MATLAB"** submitted to **GURU GOBIND SINGH INDRAPRASTHA UNIVERSITY, NEW DELHI** in the partial fulfilment of the requirements for the award of the degree of **BACHELOR OF TECHNOLOGY** in **ELECTROMICS AND COMMUNICATION ENGINEERING**, is an authentic record of my own work carried out from FEBURARY, 2018 to APRIL, 2018 under the supervision of **MRS. DISHA.**

The matter embodied in this project has not been submitted by me for the award of any other degree.

JASPREET KAUR SHARMA	APOORVA BHARDWAJ	VAIBHAV
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This is to certify that the above statement made by the candidate is correct to the best of my knowledge.

Mrs. Disha

(Project Guide)

ABSTRACT

In this project, we intend to use image processing toolbox of MATLAB. The hardware that was used in this project was Arduino. First we need to setup hardware and configure it with laptop with the help of MAX 232 protocol. Hardware includes capacitors , resistors, wires, LEDs, temperature sensor, motor driver, metal detector and Arduino.

In this project we employed image processing technology with the help of image acquisition tool. Image is captured with the help of image acquisition tool and number of persons were calculated based on the area aquired by each image. The number of LEDs that were glowing were based on number of persons in the room. This way we can control the amount of electricity used in the room based on our calculations. We can also save energy this way and use this device in smart auditorium and save energy resources and control the amount of energy.

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CHAPTER 1

INTRODUCTION

1. INTRODUCTION

1.1 PROJECT GOAL

Electricity is one of the most important resources in this century. We should conserve the electricity. But many times we come outside the auditorium and forget to turn off the lights and fan/AC , thus the electricity is wasted. Security is also major concern to the security problem we are going to put a metal detector. To overcome these problems we are going to implement a project called “Smart Auditorium with security features using MATALAB”.

In this project we are going to make use of Image Processing technology (MATLAB) with the help of microcontroller and camera to detect the presence of people inside the auditorium, the lights will glow and turn off according to the presence and absence of people in the auditorium.

1.2 ABOUT DIGITAL IMAGE PROCESSING

Digital image processing is the processing and display of images. Emphasis is placed on the modification of the image. There are three main categories of image processing:

1) Image Enhancement:

   This provides more effective display of data for visual interpretation. An example of this is to edit the shades in an image. Used to assist with distinction of different objects

2) Image Rectification and Restoration:

   Can be used to correct geometric distortions, eliminate noise or to remove blurring in an image

3) Image Classification:

   Images can be classified based on colors or shapes in the image

There are many useful applications of image processing. It is used as remote sensing for robot guidance, and target recognition. It is also used for industrial inspection, and in medial technology such as X-Ray enhancement.

1.3 PROCESSING ALGORITHM

1.3.1 GRAY-SCALE HISTOGRAM

The gray-scale histogram of an image represents the distribution of the pixels in the image over the gray-level scale. It can be visualised as if each pixel is placed in a bin corresponding to the colour intensity of that pixel. All of the pixels in each bin are then added up and displayed on a graph. This graph is the histogram of the image.

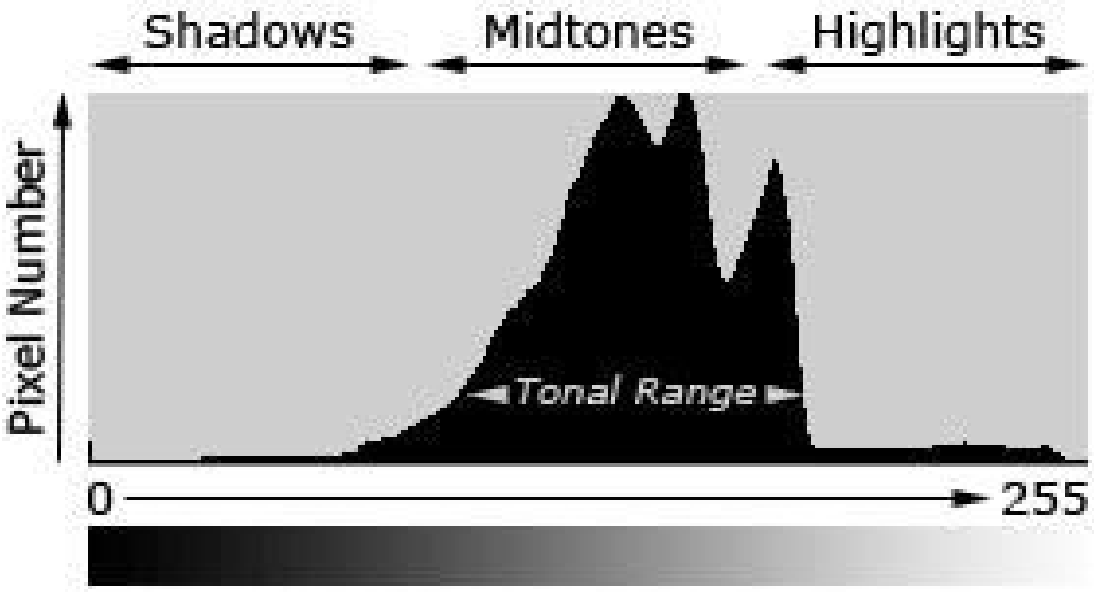

FIG 1.1 SAMPLE HISTOGRAM

The histogram is a key tool in image processing. It is one of the most useful techniques in gathering information about an image. It is especially useful in viewing the contrast of an image. If the gray-levels are concentrated near a certain level the image is contrast. Likewise if they are well spread out, it defines a high contrast image.

1.4 CONTRAST STRACHING

Contrast stretching enables the spacing of some of the output values so that they are further apart, thereby making them more easily distinguishable.

This can be done manually by choosing the upper and lower bound of the histogram and adjusting the graph to fit.It can also be done automatically by implementing the histogram-equalized stretch.

1.5 HISTOGRAM EQALISED STRECH

This stretch assigns more display values to the frequently occurring portions of the histogram. In this way, the detail in these areas will be better enhanced relative to those areas of the original histogram where values occur less frequently. The aim is to maximize the overall contrast: as shown below, a nearly uniform (i.e. flat) distribution is produced.

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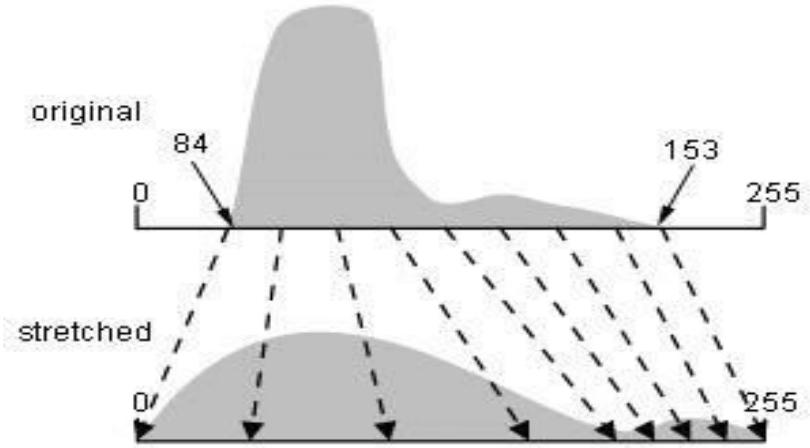
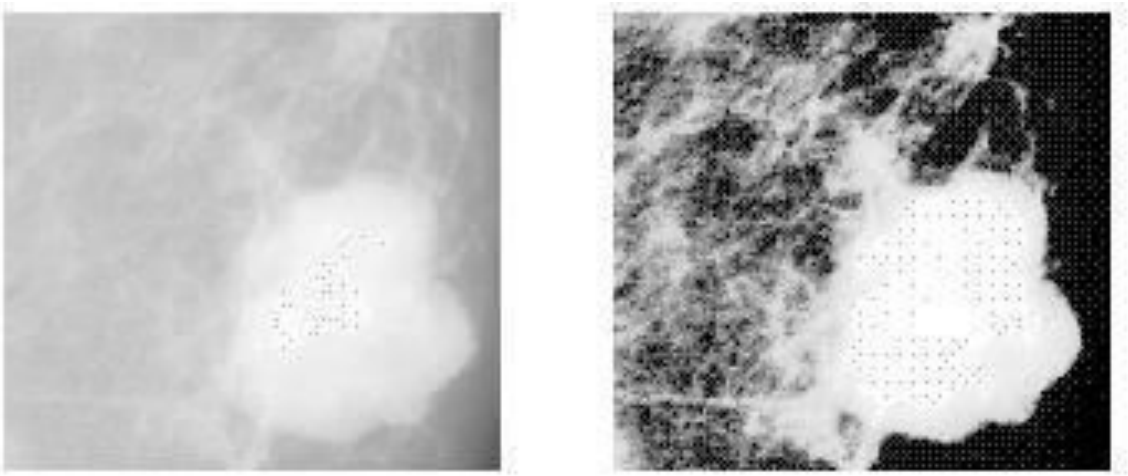


FIG 1.2 HISTOGRAM-EQUALISATION



(a) (b)

FIG 1.3 IMAGE BEFORE AND AFTER EQUALISATION

1.6 THRESHOLDING

A simple segmentation technique that is very useful for scenes with solid objects resting on a contrasting background. All pixels above a determined (threshold) grey level are assumed to belong to the object, and all pixels below that level are assumed to be outside the object. The selection of the threshold level is very important as it will affect any measurements of parameters concerning the object (the exact object boundary is very sensitive to the grey threshold level chosen).

Thresholding is often carried out on images with bimodal distributions. The best threshold level is normally taken as the lowest point in the trough between the two peaks (as above) alternatively, the mid-point between the two peaks may be chosen.

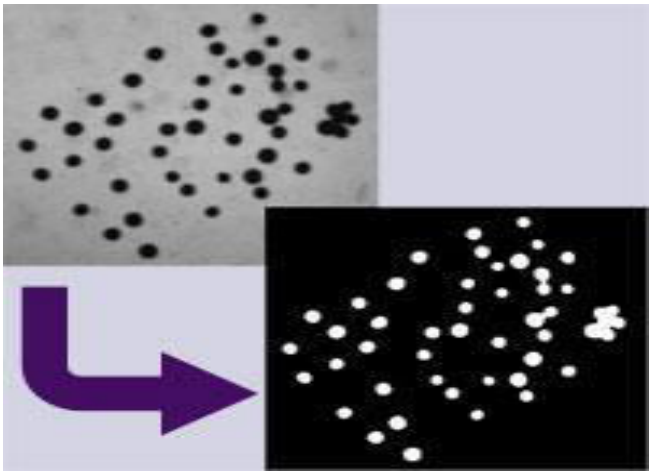


FIG 1.4 SAMPLE THRESHOLDING EXAMPLE

1.7 DIGITAL SYSTEM

The system is being designed with the Xilinx Spartan-3 Hardware Development board. Features on this board include two 256x16bit SRAM, display components, toggle switches and a Xilinx Spartan-3 Field Programmable Gate Array (FPGA).

The main components in the FPGA are:

1. Control/Status Register (CSR)
2. Block SRAM
3. Digital System Processing (DSP) block

The FPGA controls the SRAM and display components and can implement these as required. The host shall transfer data and command bytes to the FPGA via a serial porton the board.

1.7.1 CSR Block

The command bytes control CSR r/w, RAM w/r, DSP task activation. They also contain the address of the specific CSR register to address. The data bytes contain byte-wide data which is written to the addressed CSR register. They can contain a portion of the actual image, or the address to be used in the SRAM.

1.7.2 SRAM

The SRAM is made up of two memory devices. However, these can be treated as a single 256x32bit memory device. It is split up into four quadrants. The original image shall be stored in quadrant 0. After processing, the resulting image shall be stored in quadrant 2.

1.7.3 DSP Block

This is where all the processing is implemented. Initially the DSP reads the image from SRAM. When everything is ready, it then performs the desired processing technique. The aim of this project is to explore these techniques, and to see how effective they are when implemented in this manner. Finally it transmits the resulting image back to SRAM, and sends out a signal to let the system know the task is completed.

On completion of the DSP task the image gets sent from SRAM back to the host to be viewed on the host interface GUI.

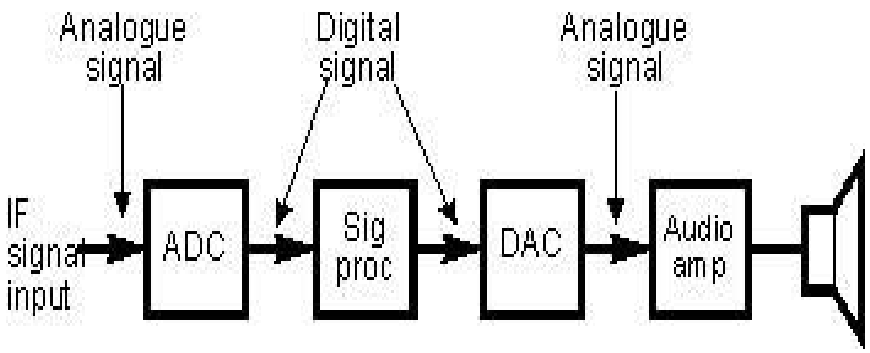


FIG 1.5 Block diagram of a Digital Signal Processor (DSP)

1.8 APPLICATION OF PROJECT

1. Digital Visitor Counter can be used in various rooms like seminar hall, conference hall where the capacity of room is limited and should not be exceeded. Project will display actual number of persons inside the room.
2. **"Automatic Room light Controller with Visitor Counter"** can be used in class rooms, study rooms in colleges.
3. Automatic Room light Controller project can also be used in our home because many times we come out of our bedroom or any other room and we forgot to turn off the room light.
4. Bidirectional person counter project can be used in Cinema halls, multiplex, malls as well as in temples to count the number of person entering inside. So that these places should not get over crowded to avoid congestion.
5. The security features and fan speed controller can be implemented anywhere from home to library.

1.9 ADVANTAGES OF THE PROJECT

1. Main advantage of this project is that it helps in energy conservation. Because when there is nobody inside the room then lights are automatically turned off.
2. Human efforts to count the number of person is eliminated. Since this project does the automatic person counting with the help of image processing.
3. They are low cost and low power devices, have a wide lens range, , pretty rugged and can be easily interfaced with other devices .
4. The same device can be used for two different purposes, thus providing multi-functionality feature.

1.10 PROJECT FUTURE DEVELOPMENT

1. Voice alarm system can be added to indicate that room is full & persons can't enter inside.
2. We can increase the maximum number of persons that can be counted by implementing the external EEPROM IC.
3. We can send this data to a remote location using mobile or internet.
4. We can implement machine learning and deep learning algorithms to get the optimum heat in the room/auditorium and can then automatically manage the room/auditorium with suitable conditions.

CHAPTER 2

PROJECT WORK

2.1 SOFTWARE USED – MATLAB

2.1.1 INTRODUCTION

A programming language developed by MathWorks, MATLAB permits matrix manipulations, plotting of functions and knowledge, implementation of algorithms, creation of user interfaces, and interfacing with programs written in different languages, together with C, C++, C#, Java, FORTRAN and Python.

Although MATLAB is meant primarily for numerical computing, Associate in numerical non-mandatory tool case uses the MuPAD symbolic engine, permitting access to symbolic computing talents. a further package, Simulink, adds graphical multi-domain simulation and model-based style for dynamic and embedded systems.

As of 2017, MATLAB has over two million users across trade and world. MATLAB users come back from varied backgrounds of engineering, science, and social science.

2.1.2 HISTORY

Cleve Moler, the chairman of the computer science department at the University of New Mexico, started developing MATLAB in the late 1970s. He designed it to give his students access to LINPACK and EISPACK without them having to learn Fortran. It soon spread to other universities and found a strong audience within the applied mathematics community. Jack Little, an engineer, was exposed to it during a visit Moler made to Stanford University in 1983. Recognizing its commercial potential, he joined with Moler and Steve Bangert. They rewrote MATLAB in C and founded MathWorks in 1984 to continue its development. These rewritten libraries were known as JACKPAC. In 2000, MATLAB was rewritten to use a newer set of libraries for matrix manipulation, LAPACK.

2.1.3 SYNTAX

The MATLAB application is built around the MATLAB scripting language. Common usage of the MATLAB application involves using the Command Window as an interactive mathematical shell or executing text files containing MATLAB code.

2.1.4 VARIABLES

Variables are defined using the assignment operator, =. MATLAB is a weakly typed programming language because types are implicitly converted. It is an inferred typed language because variables can be assigned without declaring their type, except if they are to be treated as symbolic objects, and that their type can change. Values can come from constants, from computation involving values of other variables, or from the output of a function.

2.1.5 FUNCTIONS

When creating a MATLAB function, the name of the file should match the name of the first function in the file. Valid function names begin with an alphabetic character, and can contain letters, numbers, or underscores. Functions are also often case sensitive.

2.1.6 FUNCTION HANDLES

MATLAB supports elements of lambda calculus by introducing function handles, or function references, which are implemented either in .m files or anonymous/nested functions.

2.1.7 CLASSES AND OBJECT-ORIENTED PROGRAMMING

MATLAB supports object-oriented programming including classes, inheritance, virtual dispatch, packages, pass-by-value semantics, and pass-by-reference semantics.

However, the syntax and calling conventions are significantly different from other languages. MATLAB has value classes and reference classes, depending on whether the class has handle as a super-class (for reference classes) or not (for value classes).

2.1.8 GRAPHICS AND GRAPHICAL USER INTERFACE PROGRAMMING

MATLAB supports developing applications with graphical user interface (GUI) features. MATLAB includes GUID (GUI development environment) for graphically designing GUIs. It also has tightly integrated graph-plotting features.

For example, the function *plot* can be used to produce a graph from two vectors *x* and *y*. The code:

```
x = 0:pi/100:2*pi;

y = sin(x);

plot(x,y)
```

produces the following figure of the sine function:

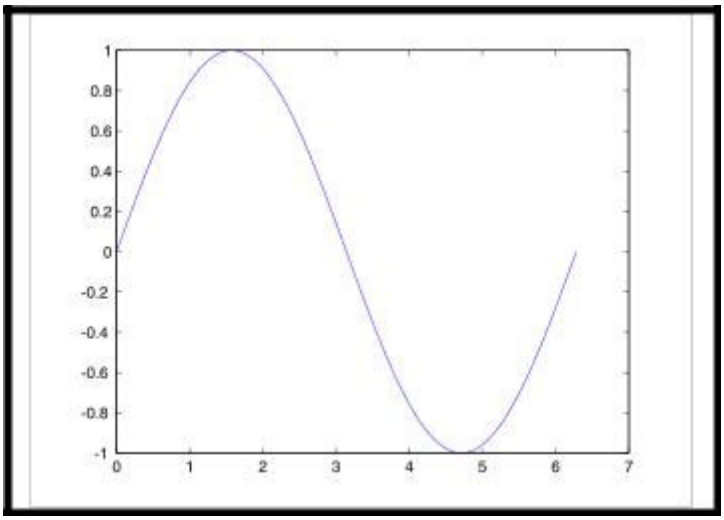


FIG 2.1 SINE FUNCTION

A MATLAB program can produce three-dimensional graphics using the functions *surf*, *plot3* or *mesh*.

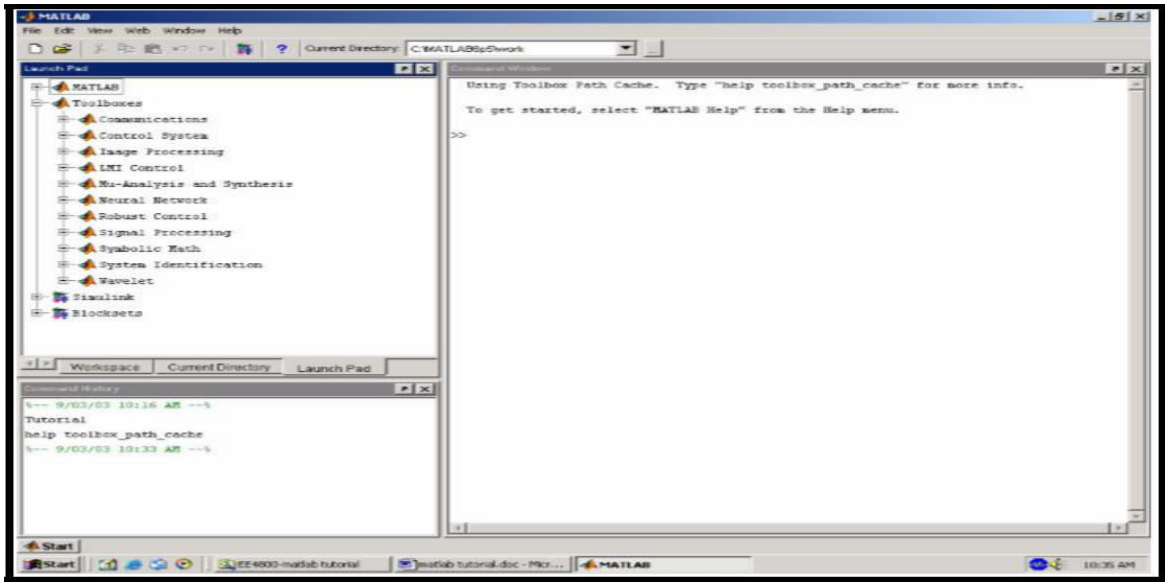
In MATLAB, graphical user interfaces can be programmed with the GUI design environment (GUIDE) tool.

2.1.9 USING MATLAB

When MATLAB opens, the screen should look something like what is pictured below:

The Command Window is the window on the right-hand side of the screen. This window is used to both enter commands for MATLAB to execute, and to view the results of these commands.

The Command History window, in the lower left side of the screen, displays the commands that have been recently entered into the Command Window.



2.2 VIEW OF MATLAB

In the upper left-hand side of the screen there is a window that can contain three different windows with tabs to select between them. The first window is the Current Directory, which tells the user which M-files are currently in use. The second window is the Workspace window, which displays which variables are currently being used and how big they are. The third window is the Launch Pad window, which is especially important since it contains easy access to the available toolboxes, of which, Image Processing is one. If these three windows do not all appear as tabs below the window space, simply go to View and select the ones you want to appear.

An M-file is a MATLAB document the user creates to store the code they write for their specific application. Creating an M-file is highly recommended, although not entirely necessary. An M-file is useful because it saves the code the user has written for their application. It can be manipulated and tested until it meets the user's specifications. The advantage of using an Mfile is that the user, after modifying their code, must only tell MATLAB to run the M-file, rather than reenter each line of code individually.

To create an M-file, select File\New ->M-file. The next step is to save the newly created M-file. In the M-file window, select File\Save As… Choose a location that suits your needs, such as a disk, the hard drive or the U drive.

2.2 IMAGE PROCESSING TOOLBOX IN MATLAB

2.2.1 INTRODUCTION

Image Processing Toolbox provides a comprehensive set of reference-standard algorithms and workflow apps for image processing, analysis, visualization, and algorithm development. You can perform image segmentation, image enhancement, noise reduction, geometric transformations, image registration, and 3D image processing.

Image Processing Toolbox apps let you automate common image processing workflows. You can interactively segment image data, compare image registration techniques, and batch-process large data sets. Visualization functions and apps let you explore images, 3D volumes, and videos; adjust contrast; create histograms; and manipulate regions of interest (ROIs).

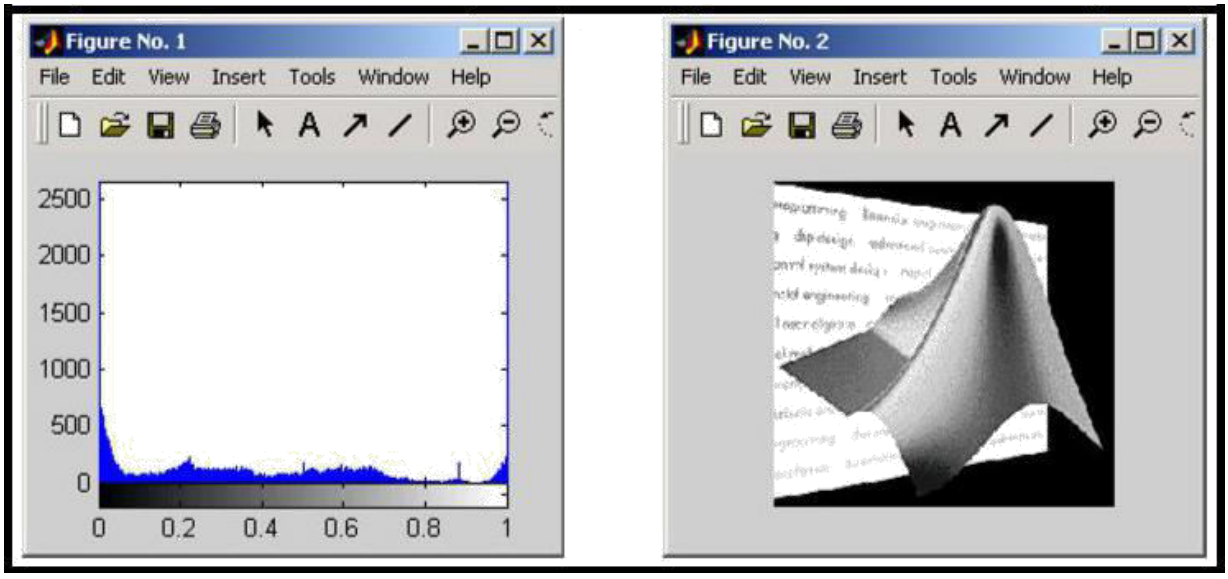
2.2.2 IMAGE PROPERTIES

i.) **HISTOGRAM**

A histogram is bar graph that shows a distribution of data. In image processing histograms are used to show how many of each pixel value are present in an image. Histograms can be very useful in determining which pixel values are important in an image. From this data you can manipulate an image to meet your specifications.
Data from a histogram can aid you in contrast enhancement and thresholding. In order to create a histogram from an image, use the imhist function. Contrast enhancement can be performed by the histeq function, while thresholding can be performed by using the graythresh function and the im2bw function.

i) HISTOGRAM

A histogram is bar graph that shows a distribution of data. In image processing histograms are used to show how many of each pixel value are present in an image. Histograms can be very useful in determining which pixel values are important in an image. From this data you can manipulate an image to meet your specifications



2.3 IMAGE PROPERTIES

ii.) **NEGATIVE**

The negative of an image means the output image is the reversal of the input image. In the case of an 8-bit image, the pixels with a value of 0 take on a new value of 255, while the pixels with a value of 255 take on a new value of 0. All the pixel values in between take on similarly reversed new values. The new image appears as the opposite of the original. The imadjust function performs this operation. See Example 5.1 for an example of how to use imadjust to create the negative of the image. Another method for creating the negative of an image is to use imcomplement**.**

2.3 HARDWARE USED

2.3.1 ARDUINO

Arduino is an open source computer hardware and software company, project, and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical world.

The project's products are distributed as open-source hardware and software, which are licensed under the GNU Lesser General Public License (LGPL) or the GNU General

Public License (GPL), the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially in preassembled form, or as do-it-yourself (DIY) kits.

Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits.

The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers. The microcontrollers are typically programmed using a dialect of features from the programming languages C and C++. In addition to using traditional compiler toolchains, the Arduino project provides an integrated development environment (IDE) based on the Processing language project.

ADVANTAGES OF ARDUINO

Arduino is an open source, computer hardware and software company, project, and user community that designs and manufactures microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical world. The project's products are distributed as open-source hardware and software, which are licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL), permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially in preassembled form, or as do-it-yourself kits. Arduino was born at the Ivrea Interaction Design Institute as an easy tool for fast prototyping, aimed at students without a background in electronics and programming.

- **Inexpensive** -Arduino boards are relatively inexpensive compared to other microcontroller platforms. The least expensive version of the Arduino module can be assembled by hand, and even the pre-assembled Arduino modules cost less than $50.
- **Cross-platform** - The Arduino Software (IDE) runs on Windows, Macintosh OSX, and Linux operating systems. Most microcontroller systems are limited to Windows.

- **Simple, clear programming environment** - The Arduino Software (IDE) is easy-to-use for beginners, yet flexible enough for advanced users to take advantage of as well. For teachers, it's conveniently based on the Processing programming environment, so students learning to program in that environment will be familiar with how the Arduino IDE works.
- **Open source and extensible software** - The Arduino software is published as open source tools, available for extension by experienced programmers. The language can be expanded through C++ libraries, and people wanting to understand the technical details can make the leap from Arduino to the AVR C programming language on which it's based. Similarly, you can add AVR-C code directly into your Arduino programs if you want to.
- **Open source and extensible hardware** - The plans of the Arduino boards are published under a Creative Commons license, so experienced circuit designers can make their own version of the module, extending it and improving it. Even relatively inexperienced users can build the breadboard version of the module in order to understand how it works and save money.

ARDUINO HARDWARE

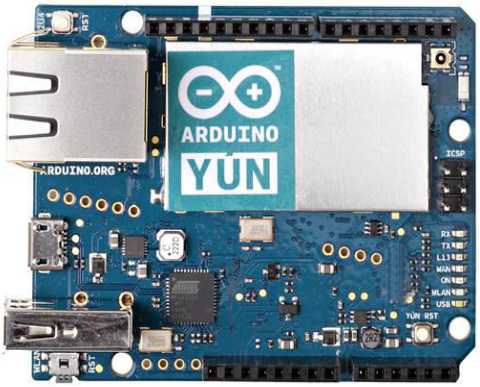
Arduino is open-source hardware. Most Arduino boards consist of an Atmel 8-bit AVR microcontroller (ATmega8, ATmega168, ATmega328, ATmega1280, ATmega2560) with varying amounts of flash memory, pins, and features. The 32-bit Arduino Due, based on the Atmel SAM3X8E was introduced in 2012. The boards use single or double-row pins or female headers that facilitate connections for programming and incorporation into other circuits. These may connect with add-on modules termed *shields*. Multiple, and possibly stacked shields may be individually addressable via an I²C serial bus. Most boards include a 5 V linear regulator and a 16 MHz crystal oscillator or ceramic resonator. Some designs, such as the Lily Pad, run at 8 MHz and dispense with the on board voltage regulator due to specific form-factor restrictions.

Some of the Arduino boards are:

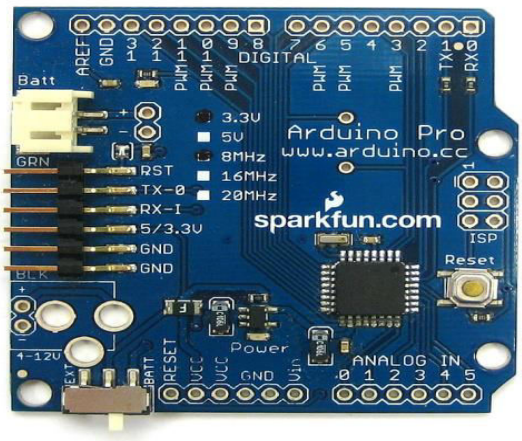
- Arduino RS232
- Arduino Diecimila
- Arduino Duemilanove

- Arduino Uno R2
- Arduino Uno SMD R3
- Arduino Leonardo
- Arduino Pro
- Arduino LilyPad 00
- Arduino Mega
- Arduino Nano
- Arduino Robot
- Arduino Esplora
- Arduino Ethernet
- Arduino Yun

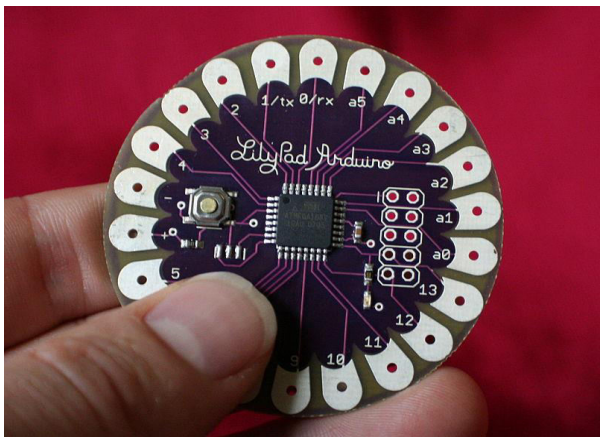
Arduino Uno R2



Arduino Yun



Arduino Leonardo



Arduino LilyPad 00

FIG 2.4 DIFFERENT TYPES OF ARDUINO BOARDS

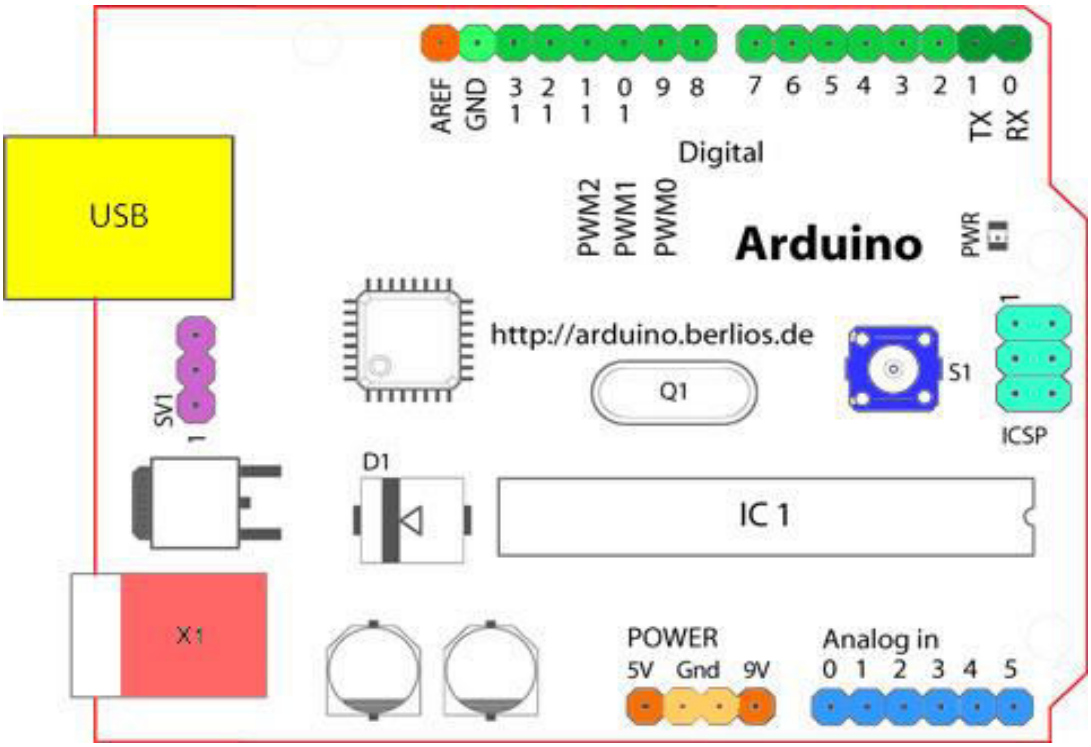


FIG 2.5 ARDUINO BOARD SCHEMATIC REPRESENTATION

COMPONENTS

- Analog Reference pin (orange)
- Digital Ground (light green)
- Digital Pins 2-13 (green)
- Digital Pins 0-1/Serial In/Out - TX/RX (dark green) - *These pins cannot be used for digital i/o (***digitalRead** *and* **digitalWrite***) if you are also using serial communication (e.g.* **Serial.begin***).*
- Reset Button - S1 (dark blue)
- In-circuit Serial Programmer (blue-green)
- Analog In Pins 0-5 (light blue)
- Power and Ground Pins (power: orange, grounds: light orange)
- External Power Supply In (9-12VDC) - X1 (pink)
- Toggles External Power and USB Power (place jumper on two pins closest to desired supply) - SV1 (purple)
- USB (used for uploading sketches to the board and for serial communication between the board and the computer; can be used to power the board) (yellow).

i. Digital Pins

In addition to the specific functions listed below, the digital pins on an Arduino board can be used for general purpose input and output via the pinMode(), digitalRead(), and digitalWrite() commands. Each pin has an internal pull-up resistor which can be turned on and off using digitalWrite() (w/ a value of HIGH or LOW, respectively) when the pin is configured as an input. The maximum current per pin is 40 mA.

- **Serial: 0 (RX) and 1 (TX).** Used to receive (RX) and transmit (TX) TTL serial data. On the Arduino Diecimila, these pins are connected to the corresponding pins of the FTDI USB-to-TTL Serial chip. On the Arduino BT, they are connected to the corresponding pins of the WT11 Bluetooth module. On the Arduino Mini and LilyPad Arduino, they are intended for use with an external TTL serial module (e.g. the Mini-USB Adapter).
- **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 attachInterrupt() function for details.
- **PWM: 3, 5, 6, 9, 10, and 11.** Provide 8-bit PWM output with the analogWrite() function. On boards with an ATmega8, PWM output is available only on pins 9, 10, and 11.
- **BT Reset: 7.** (Arduino BT-only) Connected to the reset line of the bluetooth module.
- **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 Arduino language.
- **LED: 13.** On the Diecimila and LilyPad, 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's off.

ii. Analog Pins

In addition to the specific functions listed below, the analog input pins support 10-bit analog-to-digital conversion (ADC) using the analogRead() function. Most of the analog inputs can also be used as digital pins: analog input 0 as digital pin 14 through analog input 5 as digital pin 19. Analog inputs 6 and 7 (present on the Mini and BT) cannot be used as digital pins.

- **I^2C: 4 (SDA) and 5 (SCL).** Support I^2C (TWI) communication using the Wire library Power Pins.

- **VIN** (sometimes labelled "9V"). The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin. Note that different boards accept different input voltages ranges, please see the documentation for your board. Also note that the LilyPad has no VIN pin and accepts only a regulated input.
- **5V.** The regulated power supply used to power the microcontroller and other components on the board. This can come either from VIN via an on-board regulator, or be supplied by USB or another regulated 5V supply.
- **3V3.** (Diecimila-only) A 3.3 volt supply generated by the on-board FTDI chip.
- **GND.** Ground pins.

Other Pins

- **AREF.** Reference voltage for the Analog inputs. Not currently supported by the Arduino software.
- **Reset.** (Diecimila-only) Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the one on the board.

2.3.2 RESISTANCE

The **electrical resistance** of an electrical conductor is a measure of the difficulty to pass an electric current through that conductor The SI unit of electrical resistance is the ohm (Ω), An object of uniform cross section has a resistance proportional to its resistivity and length and inversely proportional to its cross-sectional area. All materials show some resistance, except for superconductors, which have a resistance of zero. The resistance (R) of an object is defined as the ratio of voltage across it (V) to current through it (I), while the conductance (G) is the inverse:

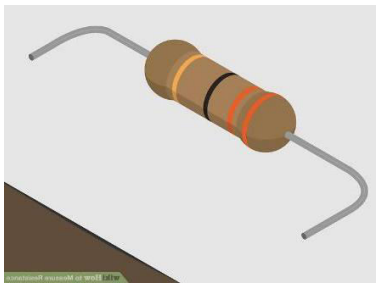


FIG 2.6 RESISTANCE

2.3.3 LIGHT EMITTING DIODES (LED's)

A **light-emitting diode** (**LED**) is a two-lead semiconductor light source. It is a p–n junction diode that emits light when activated. When a suitable voltage is applied to the leads, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons. This effect is called electroluminescence, and the color of the light (corresponding to the energy of the photon) is determined by the energy band gap of the semiconductor. LEDs are typically small (less than 1 mm2) and integrated optical components may be used to shape the radiation pattern.

Appearing as practical electronic components in 1962, the earliest LEDs emitted low-intensity infrared light. Infrared LEDs are still frequently used as transmitting elements in remote-control circuits, such as those in remote controls for a wide variety of consumer electronics. The first visible-light LEDs were also of low intensity and limited to red. Modern LEDs are available across the visible, ultraviolet, and infrared wavelengths, with very high brightness.

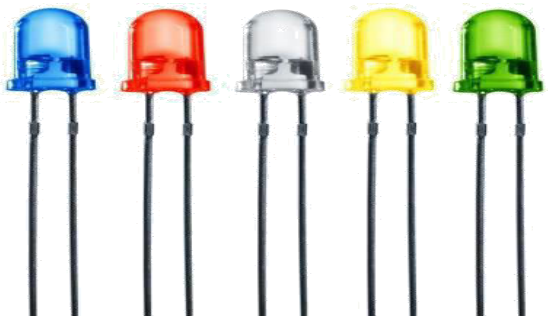


FIG 2.7 LIGHT EMTTING DIODES

Recent developments have produced LEDs suitable for environmental and task lighting. LEDs have led to new displays and sensors, while their high switching rates are useful in advanced communications technology. LEDs have many advantages over incandescent light sources, including lower energy consumption, longer lifetime, improved physical robustness, smaller size, and faster switching.

2.3.4 CAPACITOR

A **capacitor** is a passive two-terminal electrical component that stores electrical energy in an electric field. The effect of a capacitor is known as capacitance. While capacitance exists between any two electrical conductors of a circuit in sufficiently close proximity, a capacitor is specifically designed to provide and enhance this effect for a variety of practical applications by consideration of size, shape, and positioning of closely spaced conductors, and the intervening dielectric material. A capacitor was therefore historically first known as an electric condenser. The physical form and construction of practical capacitors vary widely and many capacitor types are in common use. Most capacitors contain at least two electrical conductors often in the form of metallic plates or surfaces separated by a dielectric medium.
Capacitors are widely used as parts of electrical circuits in many common electrical devices. Unlike a resistor, an ideal capacitor does not dissipate energy.

When two conductors experience a potential difference, for example, when a capacitor is attached across a battery, an electric field develops across the dielectric, causing a net positive charge to collect on one plate and net negative charge to collect on the other plate. No current actually flows through the dielectric, however, there is a flow of charge through the source circuit. If the condition is maintained sufficiently long, the current through the source circuit ceases. However, if a time-varying voltage is applied across the leads of the capacitor, the source experiences an ongoing current due to the charging and discharging cycles of the capacitor.

FIG 2.8 CAPACITORS

2.3.5 MICROCONTROLER ATMEGA328

The high-performance Microchip 8-bit AVR RISC-based microcontroller combines 32KB ISP flash memory with read-while-write capabilities, 1KB EEPROM, 2KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts.
The device operates between 1.8-5.5 volts.

FIG 2.9 ATMEGA 328

2.3.6 TEMPERATURE SENSOR(LM35)

DESCRIPTION

The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly-proportional to the Centigrade temperature. The LM35 device has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from the output to obtain convenient Centigrade scaling.
The LM35 device does not require any external calibration or trimming to provide typical accuracies of ±¼°C at room temperature and ±¾°C over a full −55°C to 150°C temperature range. Lower cost is assured by trimming and calibration at the wafer level. The low-output impedance, linear output, and precise inherent calibration of the LM35 device makes interfacing to readout or control circuitry especially easy.
The device is used with single power supplies, or with plus and minus supplies.As the LM35 device draws only 60 µA from the supply, it has very low self-heating of less

than 0.1°C in still air.

FEATURES

- Calibrated Directly in Celsius (Centigrade)
- Linear + 10-mV/°C Scale Factor
- 0.5°C Ensured Accuracy (at 25°C)
- Rated for Full −55°C to 150°C Range
- Suitable for Remote Applications
- Low-Cost Due to Wafer-Level Trimming
- Operates From 4 V to 30 V
- Less Than 60-µA Current Drain
- Low Self-Heating, 0.08°C in Still Air
- Non-Linearity Only ±¼°C Typical
- Low-Impedance Output, 0.1 Ω for 1-mA Load

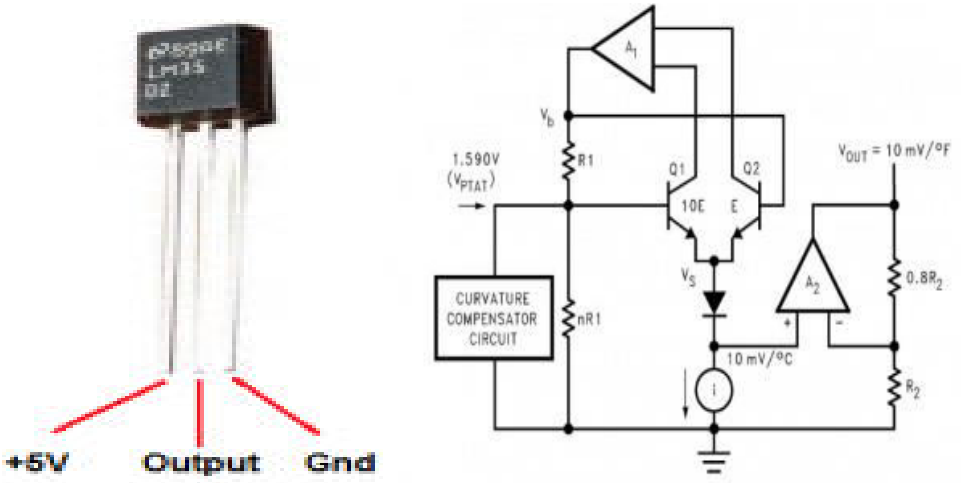


FIG 2.10 -SCHEMAIC DIAGRAM (LM35)

WORKING PRINCIPLE

There are two transistors in the centre of the drawing. One has ten times the emitter area of the other. This means it has one tenth of the current density, since the same current is going through both transistors. This causes a voltage across the resistor R1 that is proportional to the absolute temperature, and is almost linear across the range.

The amplifier at the top ensures that the voltage at the base of the left transistor (Q1) is proportional to absolute temperature (PTAT) by comparing the output of the two transistors. The amplifier at the right converts absolute temperature (measured in Kelvin) into either Fahrenheit or Celsius, depending on the part (LM34 or LM35).The little circle with the "i" in it is a constant current source circuit.

CONNECTION OF LM35 TO ARDUINO UNO

The LM35 IC has 3 pins-2 for the power supply and one for the analog output.It is a low voltage IC which uses approximately +5VDC of power.The output pin provides an analog voltage output that is linearly proportional to the Celsius (centigrade)

temperature. Pin 2 gives an output of 1 millivolt per 0.1°C (10mV per degree).So to get the degree value in Celsius, all that must be done is to take the voltage output and divide it by 10-this give out the value degrees in Celsius.

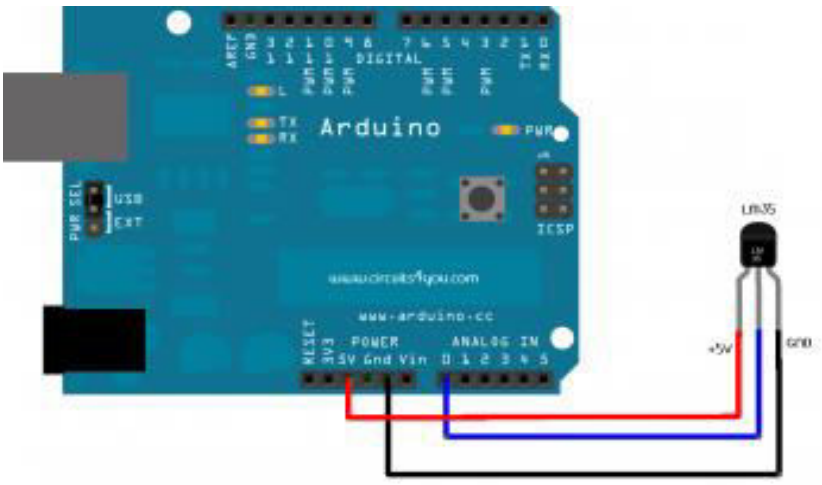


FIG 2.11 CIRCUIT CONNECTIONS WITH LM35

The circuit connections are made as follows:

- Pin 1 of the LM35 goes into +5V of the arduino
- Pin 2 of the LM35 goes into analog pin A0 of the arduino
- Pin 3 of the LM35 goes into ground (GND) of the arduino

2.3.7 MQ-2 GAS SENSOR

The **MQ-2 Gas sensor** can detect or measure gasses like LPG, Alcohol, Propane, Hydrogen, CO and even methane. The module version of this sensor comes with a Digital Pin which makes this sensor to operate even without a microcontroller and that comes in handy when you are only trying to detect one particular gas. When it comes to measuring the gas in ppm the analog pin has to be used, the analog pin also TTL driven and works on 5V and hence can be used with most common microcontrollers.
So if you are looking for a sensor to detect or measure gasses like LPG, Alcohol, Propane, Hydrogen, CO and even methane with or without a microcontroller then this sensor might be the right choice for you.The MQ-2 smoke sensor is sensitive to smoke and to the following flammable gases:

- LPG
- Butane
- Propane
- Methane
- Alcohol
- Hydrogen

FIG 2.12GAS SENSOR

The resistance of the sensor is different depending on the type of the gas.The smoke sensor has a built-in potentiometer that allows you to adjust the sensor sensitivity according to how accurate you want to detect gas.

WORKING

The voltage that the sensor outputs changes accordingly to the smoke/gas level that exists in the atmosphere. The sensor outputs a voltage that is proportional to the concentration of smoke/gas.

In other words, the relationship between voltage and gas concentration is the following:

- **The greater**the gas concentration,**the greater**the output voltage
- **The lower**the gas concentration,**the lower**the output voltage

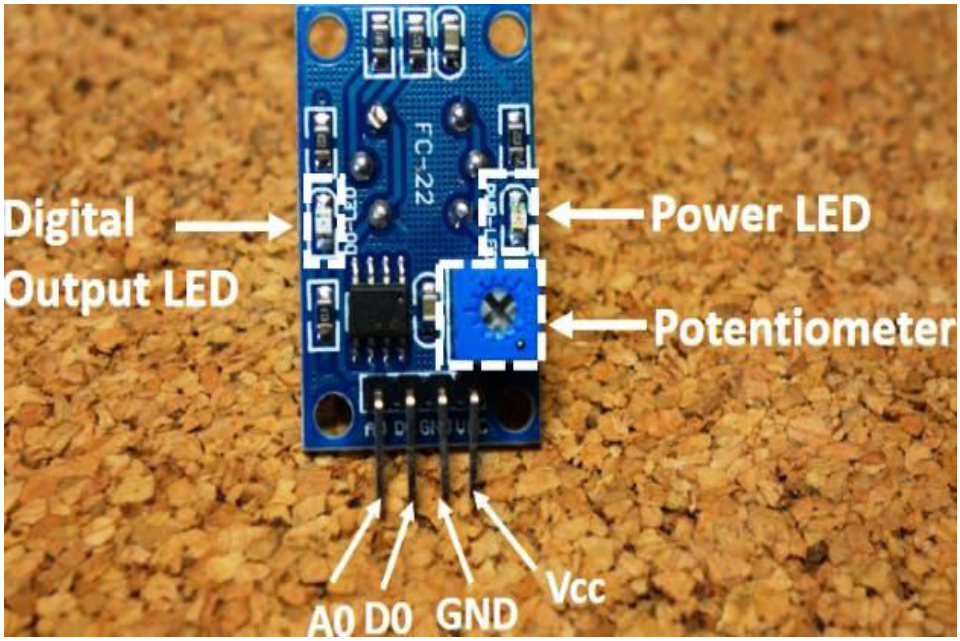


FIG 2.13 SENSOR PIN OUT DETAILS

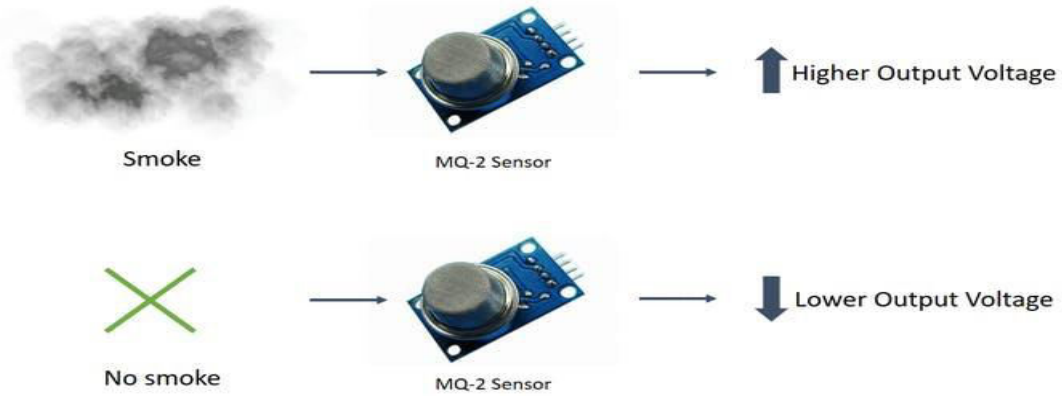


FIG 2.14 WORKING MECHANISM

The output can be an analog signal (A0) that can be read with an analog input of the Arduino or a digital output (D0) that can be read with a digital input of the Arduino.

PIN CONFIGURATION

Pin No:	Pin Name:	Description
For Module		
1	Vcc	This pin powers the module, typically the operating voltage is +5V
2	Ground	Used to connect the module to system ground
3	Digital Out	You can also use this sensor to get digital output from this pin, by setting a threshold value using the potentiometer
4	Analog Out	This pin outputs 0-5V analog voltage based on the intensity of the gas
For Sensor		
1	H -Pins	Out of the two H pins, one pin is connected to supply and the other to ground
2	A-Pins	The A pins and B pins are interchangeable. These pins will be tied to the Supply voltage.
3	B-Pins	The A pins and B pins are interchangeable. One pin will act as output while the other will be pulled to ground.

CONNECTION TO SCHEMATIC DIAGRAM

Using an MQ sensor it detects a gas is very easy. You can either use the digital pin or the analog pin to accomplish this. Simply power the module with 5V and you should notice the power LED on the module to glow and when no gas it detected the output LED will remain turned off meaning the digital output pin will be 0V. Remember that these sensors have to be kept on for pre-heating time (mentioned in features above)

before you can actually work with it. Now, introduce the sensor to the gas you want to detect and you should see the output LED to go high along with the digital pin, if not use the potentiometer until the output gets high. Now every time your sensor gets introduced to this gas at this particular concentration the digital pin will go high (5V) else will remain low (0V).

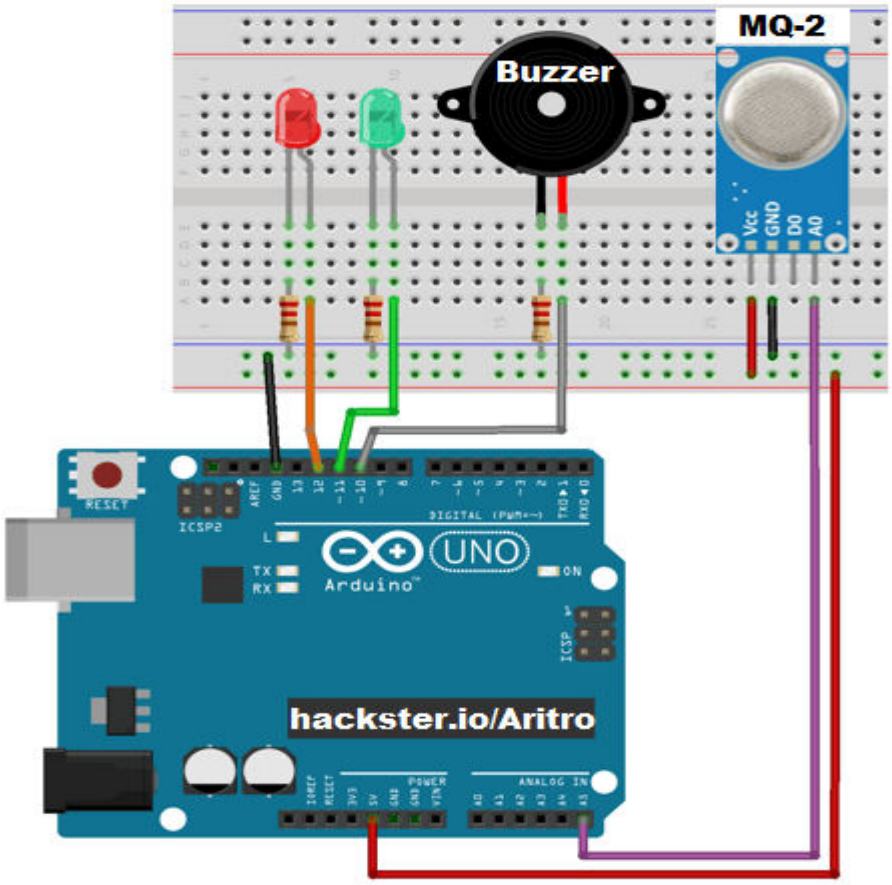


FIG 2.15 CONNECTIONS WITH ARDUINO

You can also use the analog pin to achieve the same thing. Read the analog values (0-5V) using a microcontroller, this value will be directly proportional to the concentration of the gas to which the sensor detects. You can experiment with this values and check how the sensor reacts to different concentration of gas and develop your program accordingly.

PIN WIRING

The MQ-2 sensor has 4 pins.

Pin----------Wiring to Arduino Uno

A0----------Analog pins

D0----------Digital pins

GND----------GND

VCC----------5V

FEATURES:

- Operating Voltage is +5V
- Can be used to Measure or detect LPG, Alcohol, Propane, Hydrogen, CO and methane.
- Analog output voltage: 0V to 5V
- Digital Output Voltage: 0V or 5V (TTL Logic)
- Preheat duration 20 seconds
- Can be used as a Digital or analog sensor
- The Sensitivity of Digital pin can be varied using the potentiometer

APPLICATIONS:

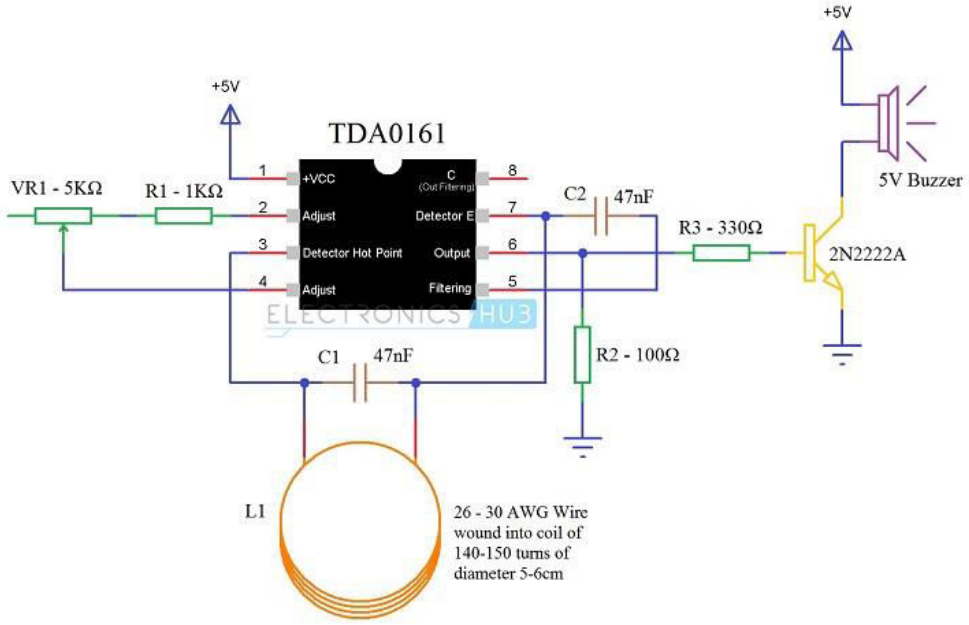
- Detects or measure Gases like LPG, Alcohol, Propane, Hydrogen, CO and methane
- Air quality monitor
- Gas leak alarm
- Safety standard maintenance
- Maintaining environment standards in hospitals.

2.3.8 METAL DETECTOR

Metal detector is a very common device that is used for checking persons, luggage or bags in shopping malls, hotels, cinema halls, etc. to ensure that person is not carrying any metals or illegal things like guns, bombs etc. Metal Detectors detect the presence of metals.There are different types of metal detectors like hand held metal detectors, walk through metal detectors and ground search metal detectors. Metal detectors can be created easily and the circuit for a basic metal detector is not that complex.

METAL DETECTOR CIRCUIT EXPLANATION

When the LC circuit that is L1 and C1 has got any resonating frequency from any metal which is near to it, electric field will be created which will lead to induces current in the coil and changes in the signal flow through the coil.



2.16 CIRCUIT DIAGRAM OF METAL DETECTOR.

- Variable resistor is used to change the proximity sensor value equal to the LC circuit, it is better to check the value when there is coil not near to the metal. When the metal is detected the LC circuit will have changed signal. The changed signal is given to the proximity detector (TDA 0161), which will detect the change in the signal and react accordingly. The output of the proximity sensor will be of 1mA when there is no metal detected and it will be around 10mA when coil is near to the metal.
- When the output pin is high the resistor R3 will provide positive voltage to transistor Q1. Q1 will be turned on and led will glow and buzzer will give the buzz. Resistor r2 is used to limit the current flow.

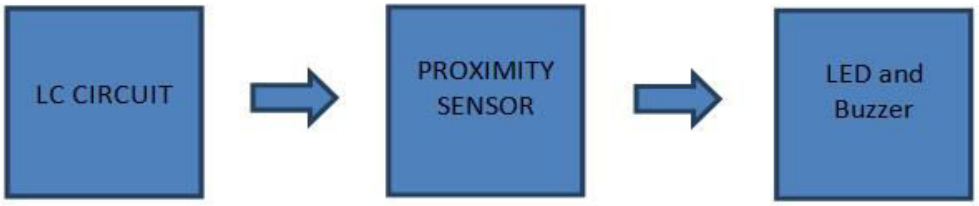


FIG 2.17 BLOCK DIAGRAM REPRESENTATION

There are three main parts in the metal detector circuit: the LC Circuit, the Proximity Sensor , output LED and the Buzzer. The coil and the capacitor C1, which are connected in parallel, will form the LC circuit.
Proximity sensor(TDA0161), is triggered by this LC circuit if any metal is detected. The Proximity sensor will then turn on the led and produces alarm using buzzer.

- **LC Circuit:** LC circuit has inductor and capacitor connected in parallel.This circuit sarts resonating when there is same frequency material near to it. The LC circuit charges capacitor and inductor alternatively.When the capacitor is charged fully ,charge is applied to inductor.
- **Proximity Sensor:** The proximity sensor can detect the objects with out any physical interference. The proximity sensor will work same as infrared sensor, proximity also release a signal, it will not give output unless and until there is no change in the reflected back signal.

WORKING

The LC Circuit, which consists of L1 (coil) and C1, is the main metal detector part of the circuit. With the help of this LC Circuit, which is also called as Tank Circuit or Tuned Circuit, the TDA0161 IC acts as an oscillator and oscillates at a particular frequency.
When the LC circuit detects any resonating frequency from any metal which is near to it, electric field will be created which will lead to induces current in the coil and changes in the signal flow through the coil.Variable resistor is used to change the proximity sensor value equal to the LC circuit, it is better to check the value when the coil is not near any metal object. When the metal is detected, the LC circuit will have changed signal.
The changed signal is given to the proximity detector (TDA 0161), which will detect the change in the signal and react accordingly. The output of the proximity sensor will less than 1mA when there is no metal detected and it will be around 10mA (usually greater than 8mA) when coil is near to the metal.

ADVANTAGES

- The Proximity Detector IC TDA0161 based Metal Detector Circuit is a very simple and easy to construct metal detector that can be used to detect small metals in our homes, offices and gardens.
- There is need for any microcontroller as the Proximity Sensor will be sufficient to implement the project.

DISADVANTAGES

- The main disadvantage of this Metal Detector Circuit is the range of detection. The metal object has to be at a distance of 10mm for the detector to detect it.

APPLICATIONS

- This simple Metal Detector can be used to identify metals like iron, gold, silver etc.
- Since it is a simple project, we can use this in our home to scan for nails, metal scraps etc. which are not easily spottable by naked eye.

2.3.9 MOTOR DRIVER L293D

L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control two DC motor with a single L293D IC.

CONCEPT

It works on the concept of H-bridge. H-bridge is a circuit which allows the voltage to be flown in either direction. As you know voltage need to change its direction for being able to rotate the motor in clockwise or anticlockwise direction, Hence H-bridge IC are ideal for driving a DC motor. In a single L293D chip there are two h-Bridge circuit inside the IC which can rotate two dc motor independently.
Due its size it is very much used in robotic application for controlling DC motors
There are two Enable pins on l293d. Pin 1 and pin 9, for being able to drive the motor, the pin 1 and 9 need to be high.

For driving the motor with left H-bridge you need to enable pin 1 to high. And for right H-Bridge you need to make the pin 9 to high. If anyone of the either pin1 or pin9

goes low then the motor in the corresponding section will suspend working. It's like a switch.

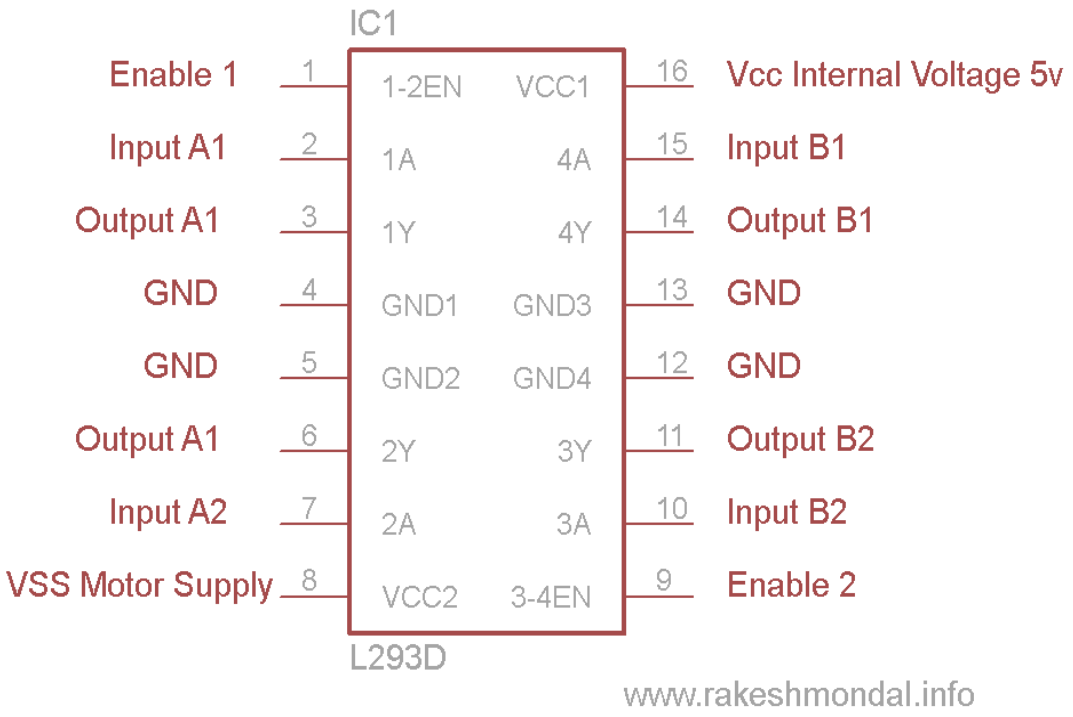


FIG 2.18 L293D PIN DIAGRAM

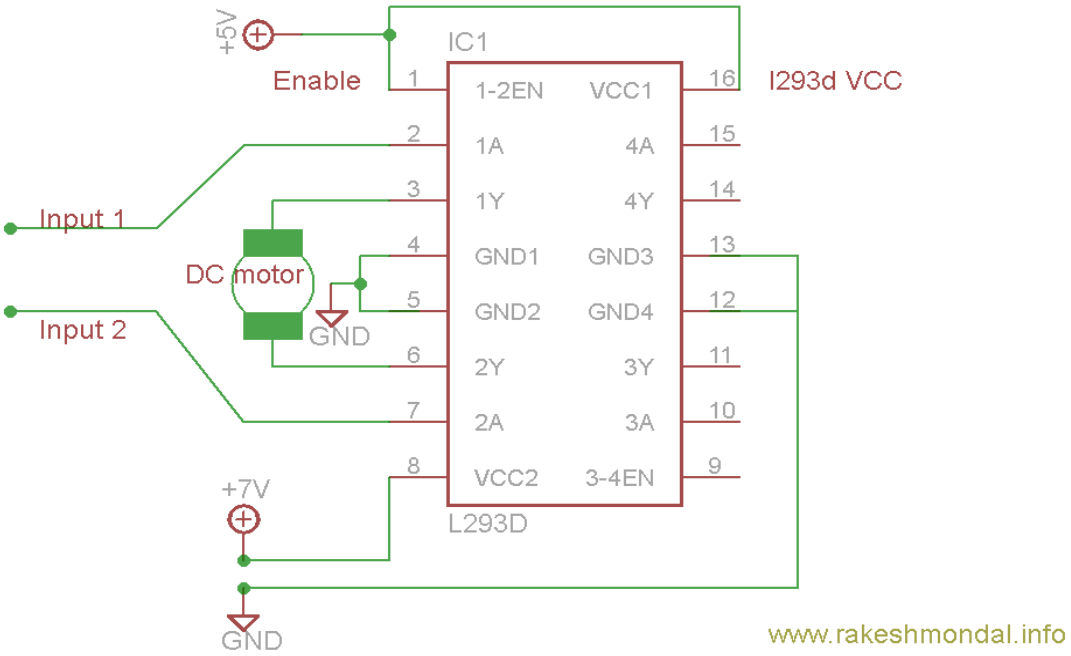


FIG 2.19 CIRCUIT DIAGRAM

WORKING

There are 4 input pins for l293d, pin 2,7 on the left and pin 15 ,10 on the right as shown on the pin diagram. Left input pins will regulate the rotation of motor connected across left side and right input for motor on the right hand side. The motors are rotated on the basis of the inputs provided across the input pins as LOGIC 0 or LOGIC 1.

In simple you need to provide Logic 0 or 1 across the input pins for rotating the motor.

LOGIC TABLE

Lets consider a Motor connected on left side output pins (pin 3,6). For rotating the motor in clockwise direction the input pins has to be provided with Logic 1 and Logic 0.

- **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** | Idle [No rotation] [Hi-Impedance state]
- **Pin 2** = **Logic 1** and **Pin 7** = **Logic 1** | Idle [No rotation]

VOLTAGE SPECIFICATION

VCC is the voltage that it needs for its own internal operation 5v; L293D will not use this voltage for driving the motor. For driving the motors it has a separate provision to provide motor supply VSS (V supply). L293d will use this to drive the motor. It means if you want to operate a motor at 9V then you need to provide a Supply of 9V across VSS Motor supply.

The maximum voltage for VSS motor supply is 36V. It can supply a max current of 600mA per channel.Since it can drive motors Up to 36v hence you can drive pretty big motors with this l293d.

CONNECTIONS WITH ARDUINO

1. Module 5V (VCC) - Arduino 5V.
2. Module GND - Arduino GND.
3. Module 1 - Arduino D8.
4. Module 2 - Arduino D9.

5. Module 3 - Arduino D10.

6. Module 4 - Arduino D11.

7. Module Motor terminals - DC motors.

8. Module VSS power terminal- External power source of 9V.

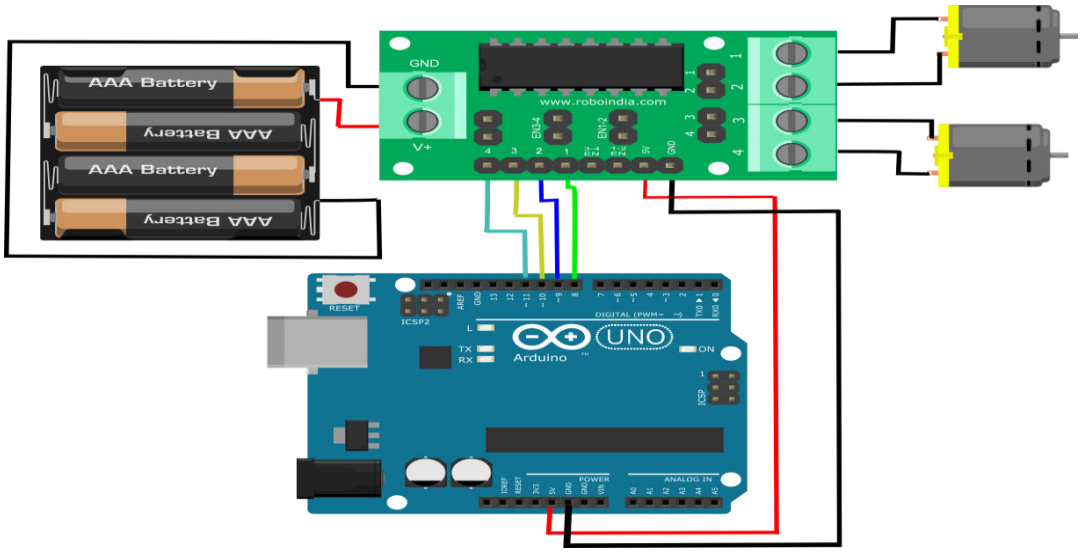


FIG 2.20 CONNECTION WITH ARDUINO

2.3.10 LIQUID CRYSTAL DISPLAY(LCD)

A **liquid-crystal display** (**LCD**) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in color or monochrome.[1] 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 up of a large number of small pixels, while other displays have larger elements.

FIG 2.21 LCD DISPLAY

LED,s 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 smartphones. 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.

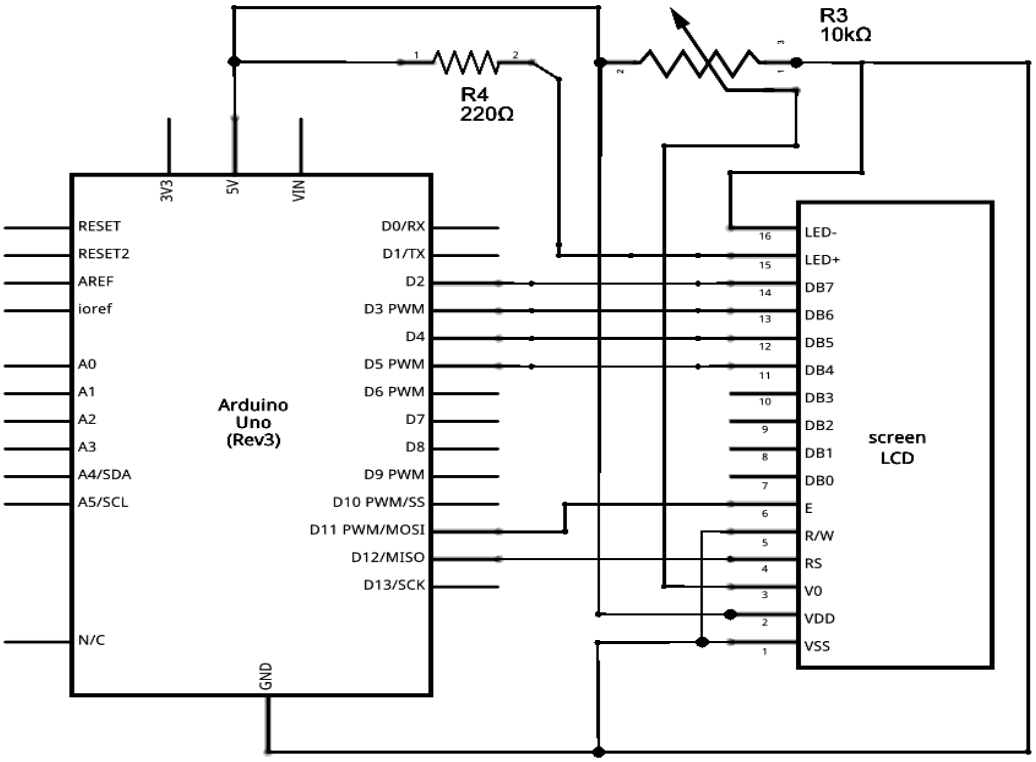


FIG 2.22 SCHEMATIC DIAGRAM OF LCD

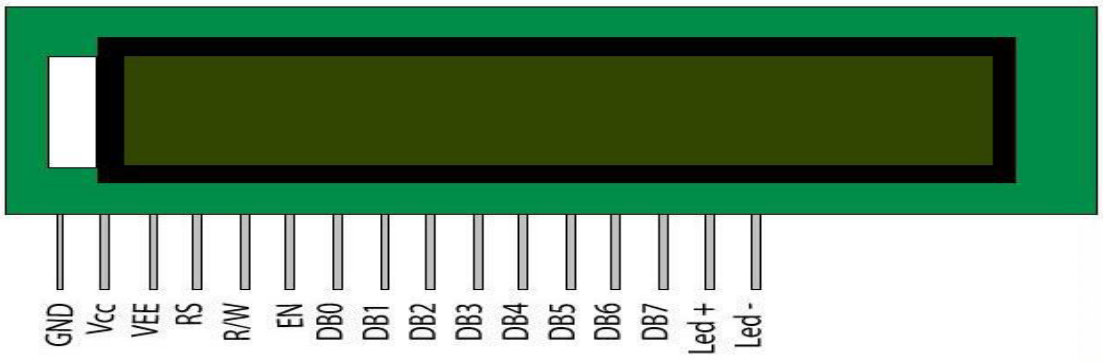


FIG 2.23 DIAGRAM OF 2X16 LCD PINS

CONNECTION WITH ARDUINO

One can easily interface a liquid crystal display (LCD) with an Arduino to provide a user interface.Liquid crystal displays (LCDs) are a commonly used to display data in devices such as calculators, microwave ovens, and many other electronic devices.

To wire your LCD screen to your board, connect the following pins:

- LCD RS pin to digital pin 12
- LCD Enable pin to digital pin 11
- LCD D4 pin to digital pin 5
- LCD D5 pin to digital pin 4
- LCD D6 pin to digital pin 3
- LCD D7 pin to digital pin 2

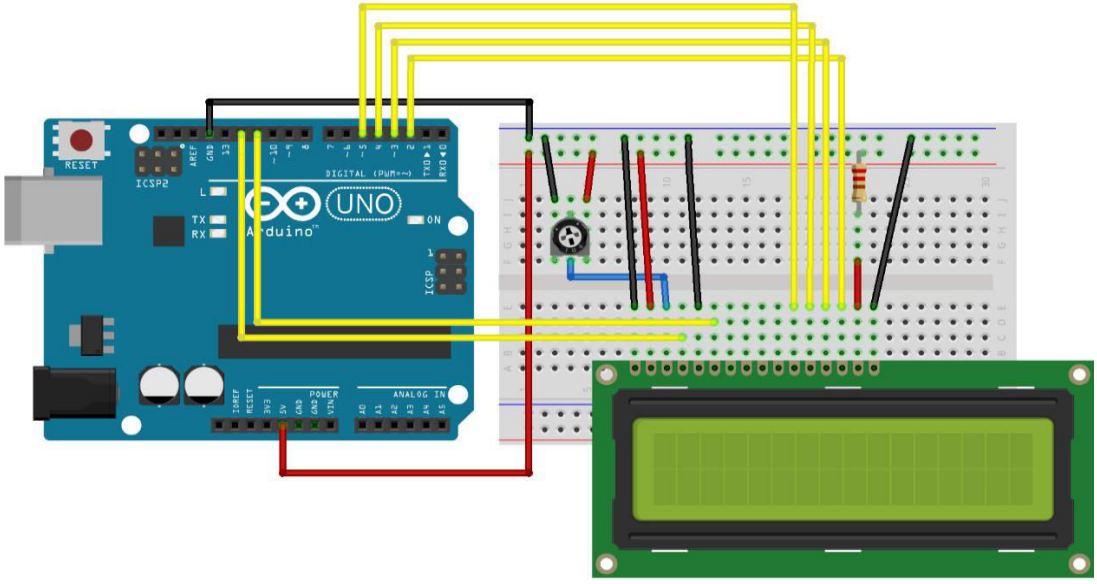


FIG 2.24 2X16 LCD CONNECTIONS WITH ARDUINO

2.4 ARDUINO CODE

```
#include<LiquidCrystal.h>
LiquidCrystal lcd(13,12,8,A3,10,11);

String I="";
boolean complete=false;
unsigned char LED[8]={7,6,5,4,3,2,A4,A5};
unsigned char L[4]={0,0,0,0};
int i;
void setup() {
 Serial.begin(9600);

 for(i=0;i<8;i++)
   {
    pinMode(LED[i],OUTPUT);
    digitalWrite(LED[i],HIGH);
   }
 lcd.begin(16,2);
 lcd.setCursor(0,0);
 lcd.print("Matlab");
 lcd.setCursor(0,1);
 lcd.print("  RoomLight  ");
 delay(2000);
 lcd.clear();

 pinMode(9,OUTPUT);
 pinMode(A1,INPUT);
 pinMode(A3,OUTPUT);

 I.reserve(10);
 }
int temp,metal;
int light=0;
```

```
void loop() {
   serialData();
   if(complete)
    {
     complete=false;
     for(i=0;i<I.length();i++)
      {
       if(I.charAt(i)=='*')
          {
           L[0]=I.charAt(i+1)-'0';
           L[1]=I.charAt(i+2)-'0';
           L[2]=I.charAt(i+3)-'0';
           L[3]=I.charAt(i+4)-'0';
          }
      }
     I="";
      light=0;
      for(i=0;i<4;i++)
       {
        if(L[i]==0)
          {digitalWrite(LED[(i*2)],HIGH); digitalWrite(LED[(i*2)+1],HIGH); }
        if(L[i]==1)
          {digitalWrite(LED[(i*2)],LOW); digitalWrite(LED[(i*2)+1],HIGH); }
        if(L[i]==2)
          {digitalWrite(LED[(i*2)],LOW); digitalWrite(LED[(i*2)+1],LOW); }

        light=light+L[i];
       }
      light=light*12.5;
    }
   temp=0;
   for(i=0;i<5;i++)
    { temp=temp+analogRead(A0)*4.887; delay(60); }
```

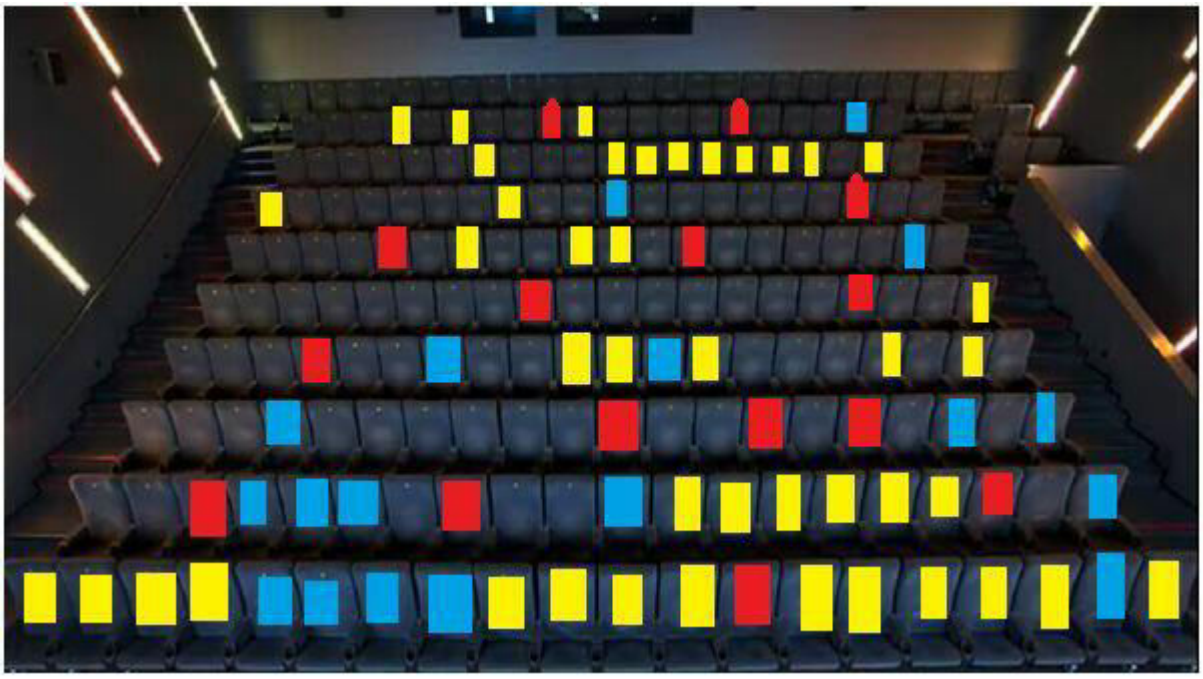
```
  temp=temp/50;

  lcd.setCursor(0,0);
  lcd.print("TEMP:");
  lcd.print(temp);

  if(temp<35)
    analogWrite(9,180);
  else if(temp<55)
    analogWrite(9,120);
  else if(temp<65)
    analogWrite(9,70);
  else if(temp<75)
    analogWrite(9,20);

  lcd.print(" L:");
  lcd.print(light/100);
  lcd.print((light/10)%10);
  lcd.print(light%10);
  lcd.print("%   ");

void serialData()
 {
  char inChar;

  while(Serial.available()>0)
    {
     inChar=(char)Serial.read();
     I=I+inChar;
     if(inChar=='#')
        complete=true;
    }
```

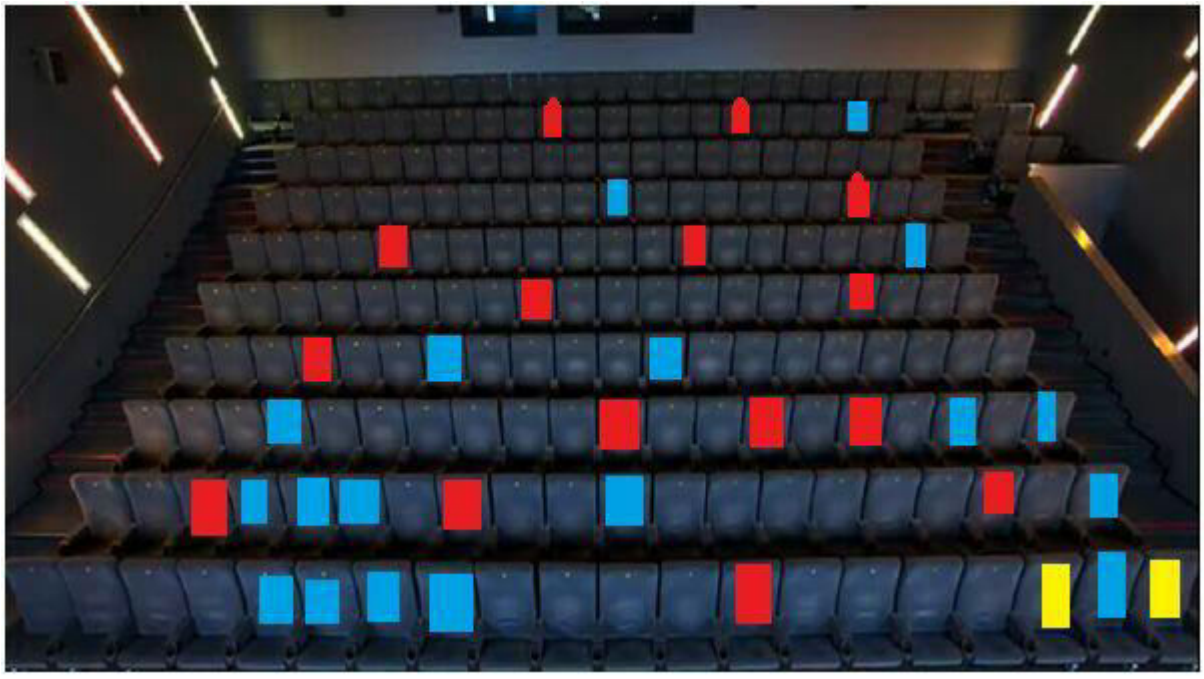
CHAPTER 3

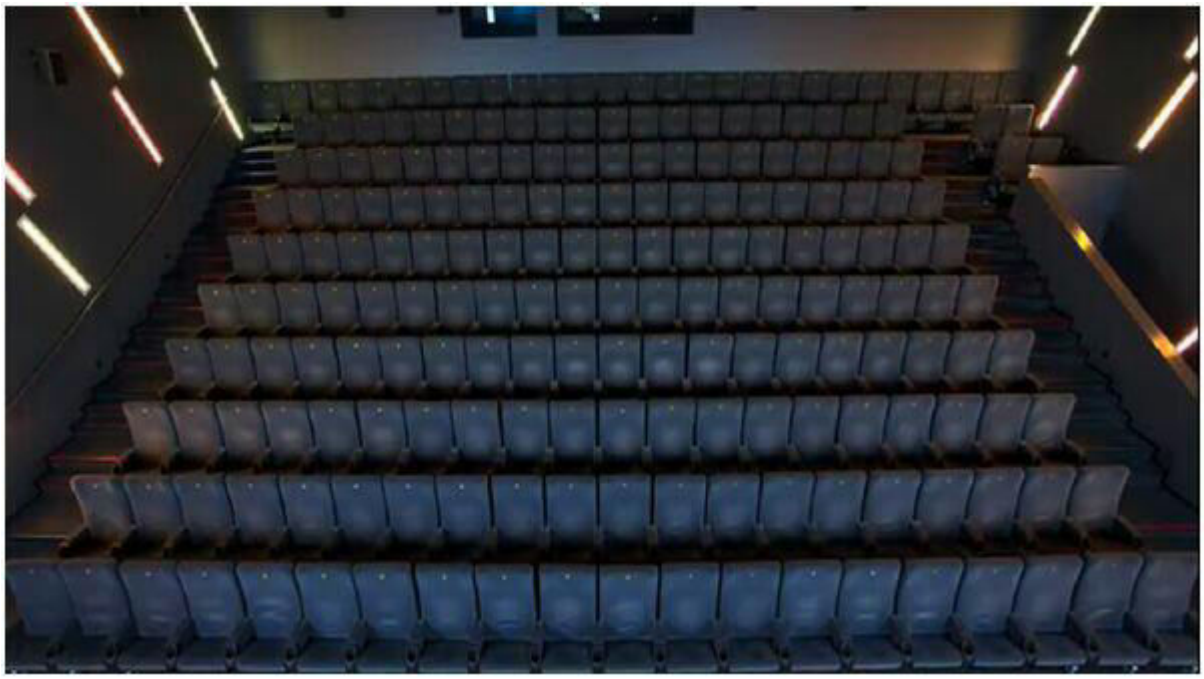
RESULT AND DISCUSSION

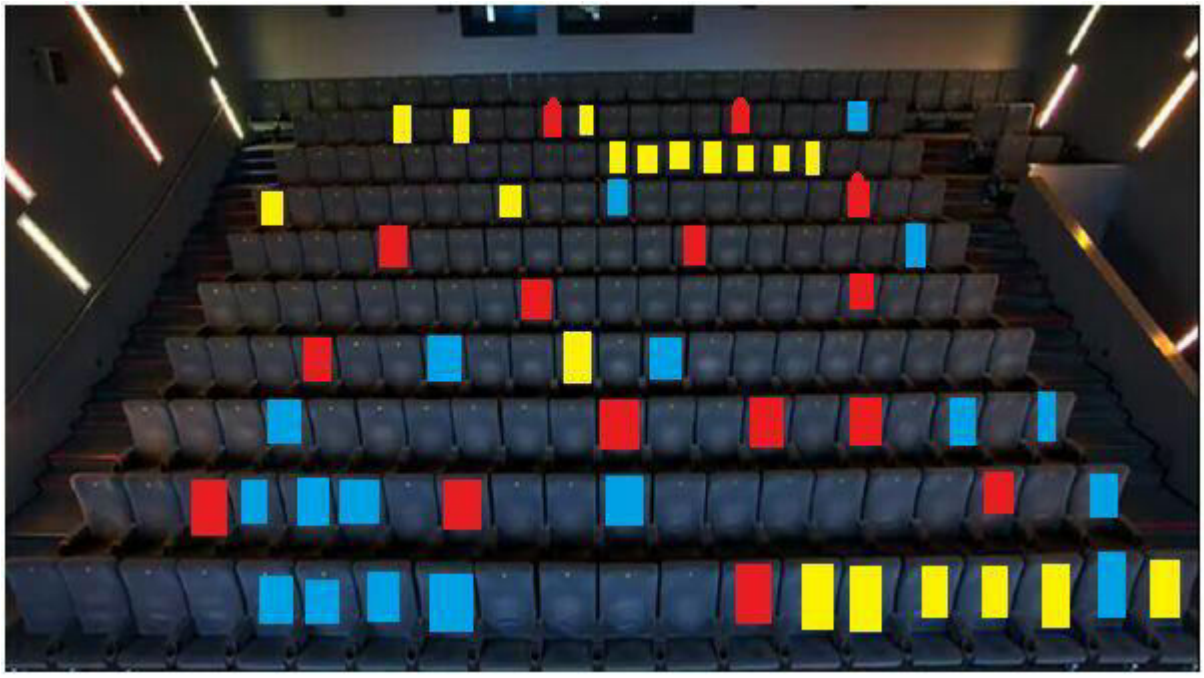
3. RESULT AND DISCUSSION

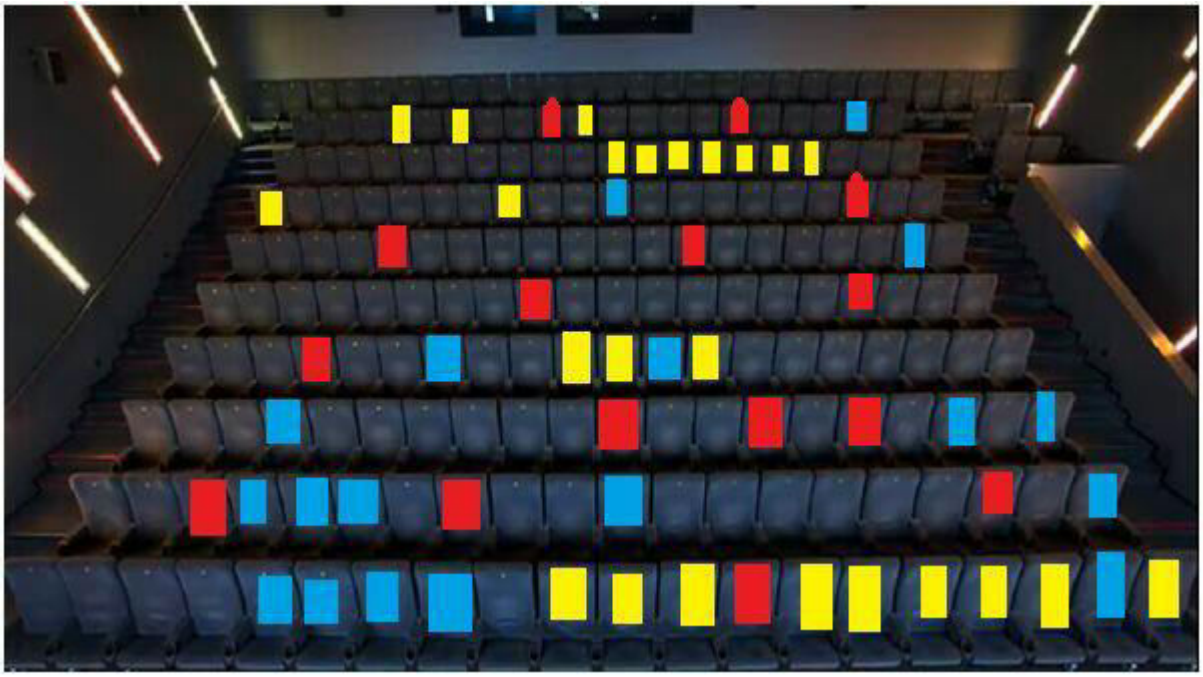
3.2 MATLAB INPUTS



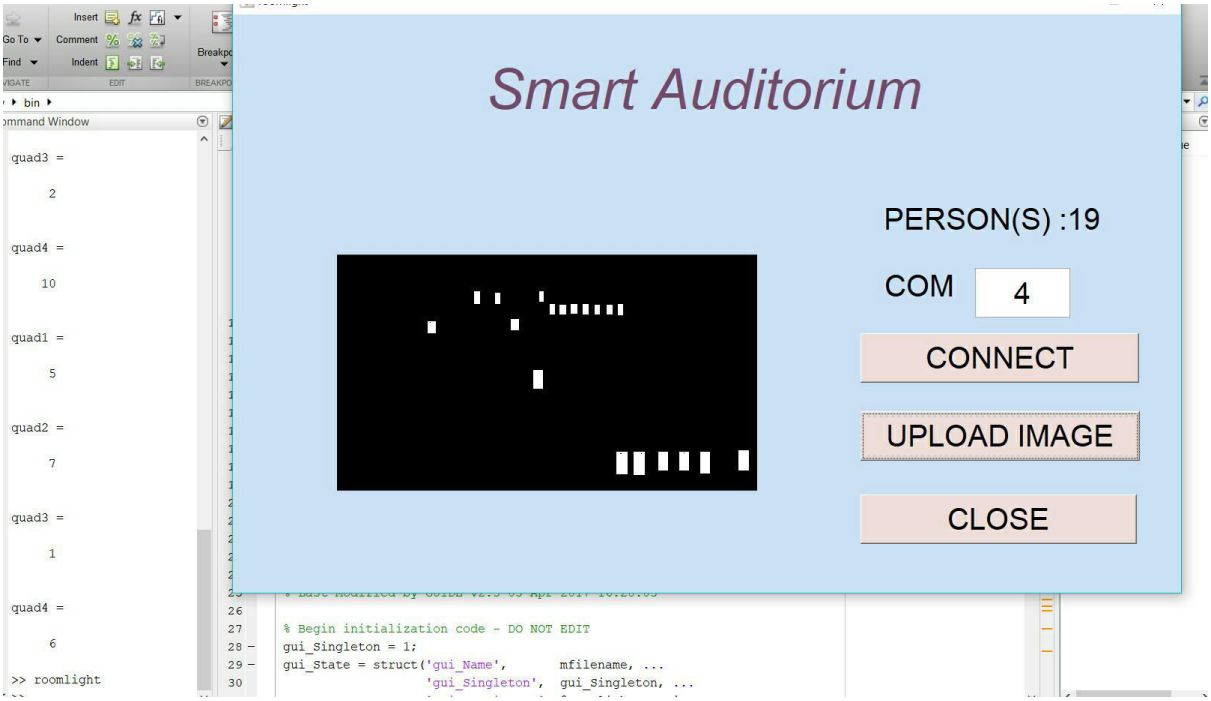


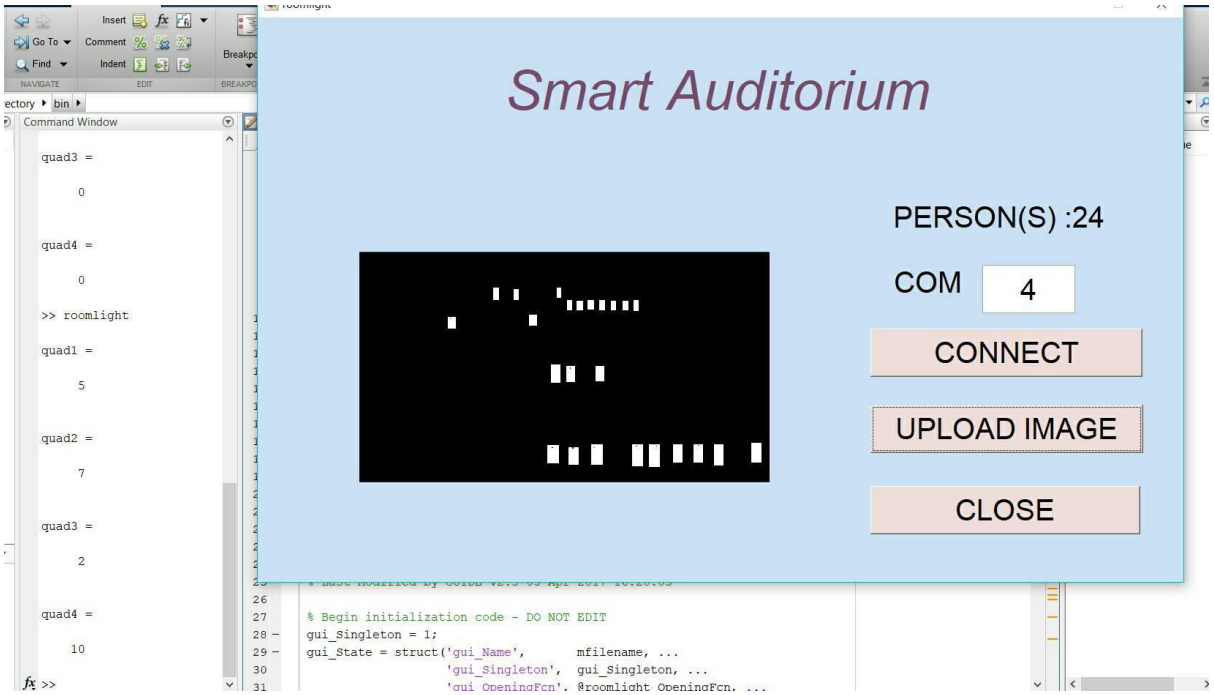


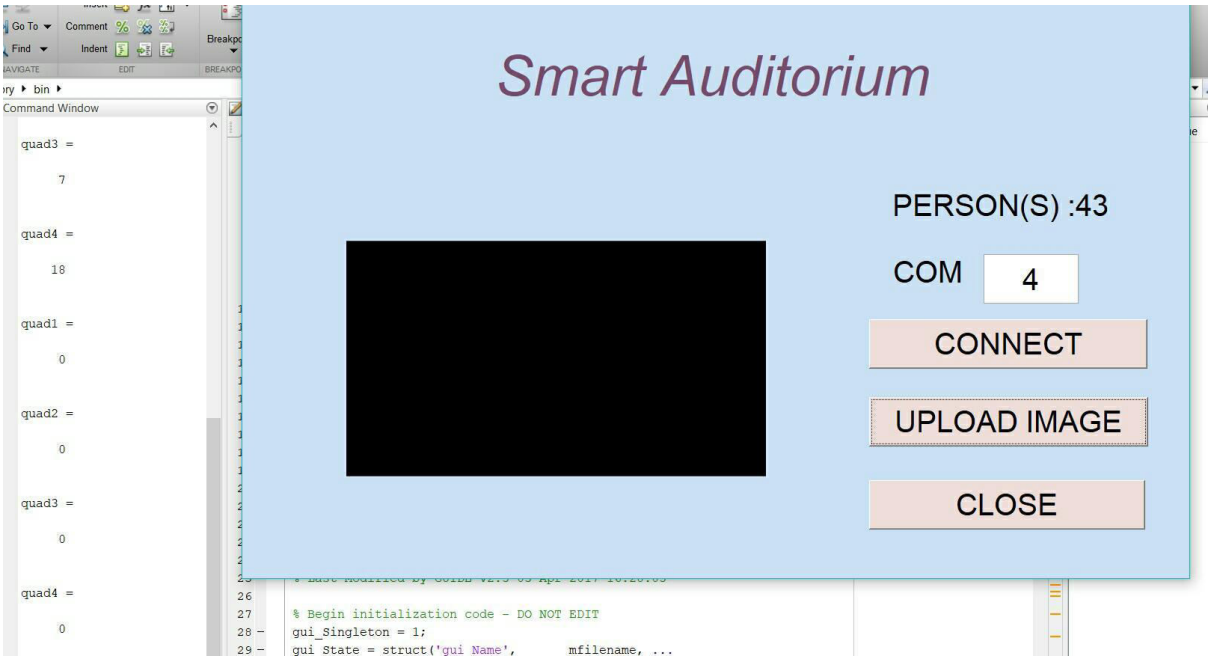


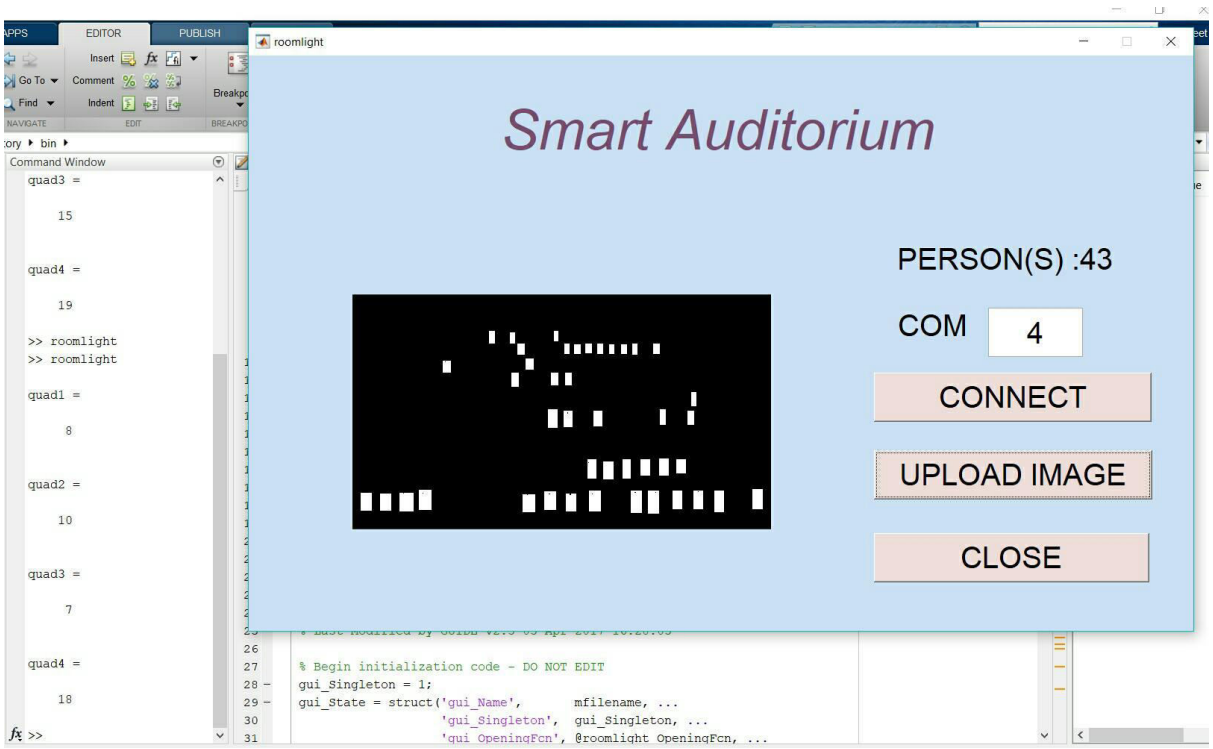


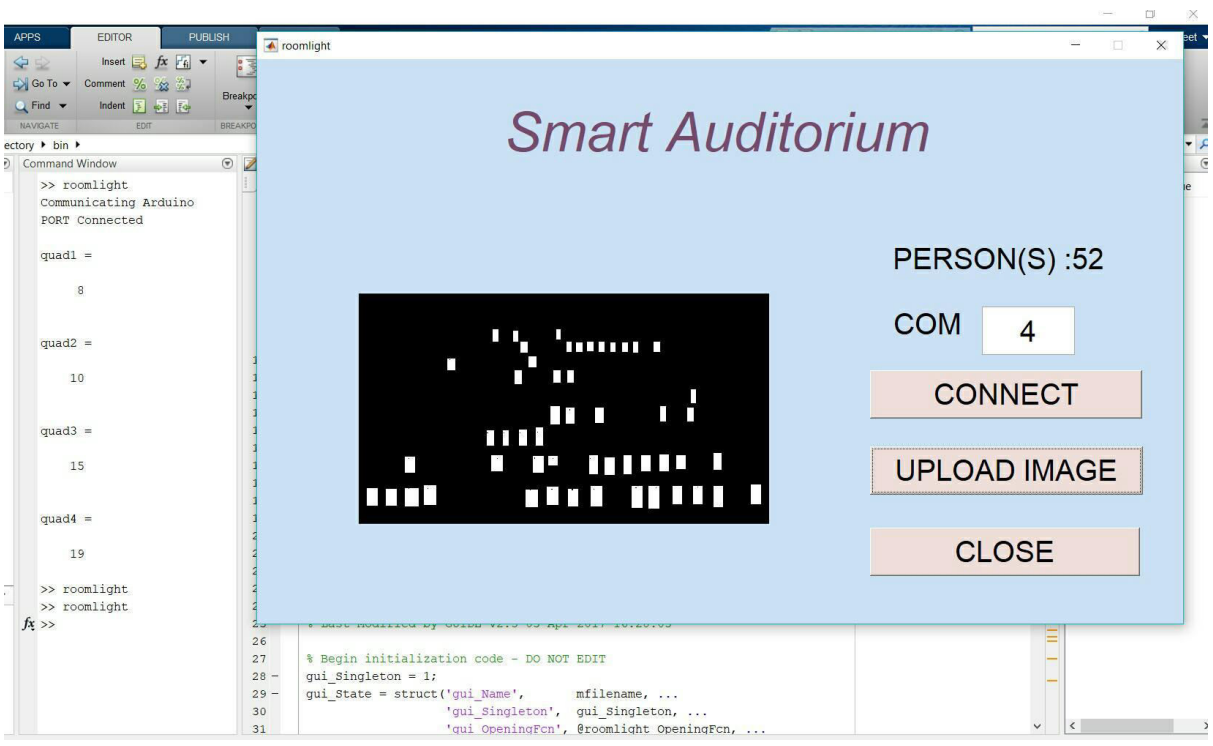
3.1 MATLAB OUTPUTS




Smart Auditorium
PERSON(S) :24
COM
4
CONNECT
UPLOAD IMAGE
CLOSE
Command Window
quad3 =
0
quad4 =
0
>> roomlight
quad1 =
5
quad2 =
7
quad3 =
2
quad4 =
10
% Begin initialization code - DO NOT EDIT
gui_Singleton = 1;
gui_State = struct('gui_Name', mfilename, ...
'gui_Singleton', gui_Singleton, ...


Smart Auditorium
PERSON(S) :43
COM
4
CONNECT
UPLOAD IMAGE
CLOSE
Command Window
quad3 =
7
quad4 =
18
quad1 =
0
quad2 =
0
quad3 =
0
quad4 =
0
% Begin initialization code - DO NOT EDIT
gui_Singleton = 1;
gui_State = struct('gui_Name', mfilename, ...


roomlight
Smart Auditorium
PERSON(S) :43
COM
4
CONNECT
UPLOAD IMAGE
CLOSE
Command Window
quad3 =
15
quad4 =
19
>> roomlight
>> roomlight
quad1 =
8
quad2 =
10
quad3 =
7
quad4 =
18
>>
% Begin initialization code - DO NOT EDIT
gui_Singleton = 1;
gui_State = struct('gui_Name', mfilename, ...
'gui_Singleton', gui_Singleton, ...
'gui_OpeningFcn', @roomlight_OpeningFcn, ...


roomlight
Smart Auditorium
PERSON(S) :52
COM
4
CONNECT
UPLOAD IMAGE
CLOSE
Command Window
>> roomlight
Communicating Arduino
PORT Connected
quad1 =
8
quad2 =
10
quad3 =
15
quad4 =
19
>> roomlight
>> roomlight
>>
% Begin initialization code - DO NOT EDIT
gui_Singleton = 1;
gui_State = struct('gui_Name', mfilename, ...
'gui_Singleton', gui_Singleton, ...
'gui_OpeningFcn', @roomlight_OpeningFcn, ...

3.3 ADVANTAGES

1. **Lighting Scenes show your home off at its best:-** With a Lutron or Crestron system lighting levels can be preset and instantly recalled at the push of a button – you can even have different lighting levels for different activities. This allows you to light your home perfectly, adding warmth, ambience and highlighting features.

2. **They add convenience:-** Large houses can waste huge amounts of energy simply be leaving lights on when they aren't required. Fully Integrated lighting systems allow

   you to easily see where lights are on and allow you to control them from a central location. Integration with security alarms can switch all the lights in the home off when the alarm is set or start to replay your usual activity so it looks like you are home.

3. **They Save Energy:-** Crestron and Lutron digital dimmers save energy when they dim. Dimming lights by 10% can result in huge savings across a large property without being noticable to clients. Incoporating dimmed lights into lighting scenes (mentioned above) can save huge amounts of energy whilst a bulb dimmed to its lowest level can add real warmth feeling to a room. Ensuring lights aren't on and automating light switching can also save huge amounts of energy. On one of our projects a generator designed to run for two days in the event of power loss ran for 12 straight days – with all lights full on in the home – the benefits of coupling our lighting system with our LED lamps and drivers. Fan speed will help in avoiding wastage of energy.

4. **They Increase Lamp Life:-** Lighting control systems have a slow ramp up to full lamp brightness, vastly increasing the life of your lamps. This might not sound very impressive given the low cost of a lamp but our lighting systems regularly

control huge chandeliers in double height spaces – replacing lamps involves scaffolding towers, disruption and high labour costs!

5. **You can easily set up scenes**:- Full integration of a lighting system on to an iPad allows the client to stand in the room and dim lighting channels up and down until the perfect scene is created. These light levels can then be saved down and recalled by pressing a scene button on a wall mounted keypad or the iPad

3.4 APPLICATIONS AND USES

When we enter a room or auditorium, as a habitual tendency, we often search for a switch to turn the light on, and if we are new to the room, we often find it difficult to locate the switch. Most of the times, many of us forget to switch off the lights while leaving the room in which we stay most of the time.

This results in unnecessary power wastage. Therefore, an automatic room-light controller automatically turns on the lights when a person enters into a room, and turns off the lights when the person leaves the room. This automatic room controller can be implemented by using a simple Arduino, webcam and by image processing technique.

FIG 3.3 AUTOMATIC ROOM LIGHT CONTROL

3.5 DISADVANTAGES

1. **Wireless systems can be unreliable** – with our systems we require 100% reliability and low maintenance. By definition wireless technologies are subject to

interference and a higher level of maintenance, even if this is just periodic battery changing. For this reason we always try to install wired lighting systems although we have evaluated and installed wireless lighting when there is no option.

2. **Badly Setup Systems can be difficult to use** – A badly designed and installed system can be difficult to use even if this is just because it differs from the normal switches people expect. For this reason we like to instal al fully customisable systems with bespoke engraving. Off the shelf systems tend to have pre-engraved buttons which may not always fit the clients requirements.

CHAPTER 4

CONLUSION AND FUTURE SCOPE

4. CONCLUSION AND FUTURE SCOPE

4.1 CONCLUSION

The main aim of the project is to save the power which is wasted in the auditorium due to the running of fan in case when auditorium is empty. The guiding system is simple system which is ultimately implemented to achieve power saving. Security is achieved by the metal detector at the entry door. The arduino controller is the backbone of our system, because everything from sensing the entry and exit, turning on the fan and its speed control depending on the temperature is managed by it. Constant power supply is required to maintain smooth functioning of the system. This concept not only ensures that our work will be useful in the future but it will also provide flexibility to adapt and extend as needs change. This device is compatible with our existing system used for providing comfort. In this paper we have developed a real time model that can control and monitor the complete status of all appliances of any place like auditorium, shopping mall, theatre, school, college, bus stand etc automatically without having human interference. So that there is a chance to reduce the power wastage and human efforts. An automated auditorium can be a very simple grouping of controls, or it can be heavily automated where any appliance that is plugged in to electrical power supply is remotely controlled. It monitors the entrance and exit s of the auditorium so that we need not to check manually. This system has a lot of advantages such as simple structure, small size, low power consumption, low cost and stable.

Smart Energy Information Management System will be controlled by redistributing demand which reduce demand –supply Mismatch significantly

Smart Data warehouse is designed to handle the Petabytes (thousands of Tetra bytes data) The distribution systems will have advanced metering, robust communications capability, extensive automation, distributed generation, and distributed storage. Through the integrated use of these technologies, Smart Grids will be able to self heal, provide high reliability and power quality, be resistant to cyber attacks, operate with multi-directional power flow, increase equipment utilization, operate with lower cost, and offer customers a variety of service choices.

Reduced variability in consumption leads to lower breakdowns and lower operating costs. OLAP system can be used to decide the load conditions based on aggregate consumption data and supply data and this information 377 can be relayed to smart

appliances control panels of select customer groups for automatically adjusting demand.

OLAP systems can be used to combine appliance wise power consumption at each customer site with real time price information which is a function of demand.

This information can be made available to the consumer using a web interface and helps the customer analyze the energy consumptions of different appliances in terms of cost and program the smart appliances better.

Smart appliances need to be programmed to intelligently to deal with demand signals from the smart grid e.g. not shutting down when they are very close to the completion of an operation or in case they are performing a critical operation.

The proposed architecture provides numerous other benefits like better demand forecasting, providing information for trading and investment decisions.

Smart grid used with smart appliances has the potential to revolutionize the energy management as it reduces and re- distribute demand automatically.

Provides valuable insights to customers which ultimately save the environment by reducing the carbon footprint of power companies.

Balance of local (smart appliances) and global (supplier driven) Energy optimization

Reduced variability in consumption leads to lower operating costs for suppliers.

4.2 FUTURE SCOPE

Following things can be further implemented:

- Fan and Light of any type
- Camera for surveillance
- Alarm or Buzzer
- Basic mobile phone for intimation

In this project analysis has been carried out with consumption patterns at various levels. The analysis can be extended to generations plants in the SEIMS.

As discussed in this thesis, the analysis is considered for Anantapur district it can be extended to Andhra Pradesh and India.

Modeling of energy Data warehouse can be implemented on different Data warehouse Software's and analyze the Pros and cons

The different types TOU tariff can be designed by analyzing the different load patterns Master data standardization can be developed for strong analysis

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