ESD PROJECT

WINTER
2019

RFID BASED ATTENDANCE AND SECURITY SYSTEM

Project Report

Embedded System Design

In

ICT

By

Manav Shah (1741042)
Dhruvil Shah (1741024)
Deep Gohel (1741060)
Yug Patel (1741017)

Under the guidance of

Prof. Anurag Lakhlani

School of Engineering and Applied Science

Ahmedabad University

Ahmedabad - 380009

February 2019

INDEX

1

INTRODUCTION:-

As we all know how important is to have security in a campus. Nowadays security services are getting costly. Radio Frequency Identification (RFID) based security system is one of the solutions to address this problem. Professors lose their time taking attendance. There is also a solution which is Radio Frequency Identification (RFID) based attendance system. Our project uses Arduino MEGA, RFID Tags, LED and LCD to display whether you are permitted and simultaneously if you are a student to marks your presence. RFID system sends a signal to the tag using an antenna. The tag receives this information and resends this information along with the information in its memory. The reader receives this signal and transmits to the Arduino MEGA using USART (Universal Synchronous/Asynchronous Receiver/Transmitter). When the signal is received by the processor, it further checks the identity of the user. If the user id a faculty, staff or a student, it gives access to the classroom. If the user identifies as a guest then he/she is not permitted to enter the premise. If the user identifies as a student his/her's attendance is marked.

MOTIVATION:-

Attendance in colleges is generally paper based which may sometimes cause errors. Taking attendance manually consumes more time. So, the proposed attendance system uses RFID technology to take attendance.In this system, each student is issued an RFID tag. Controlling unit is in the institute. Whenever the card is placed near the reader, it will take the attendance.Also it can send details through message to parents of the student.

2

MARKET SURVEY OF PRODUCTS

The market of student RFID (radio frequency identification) tracking is segmented into three categories based on deployment, product type and end use. By deployment the market is segmented by cloud and on premises. In terms of product type the market of student RFID tracking is segmented by tags, readers, middleware. On the basis of end use the market of student RFID tracking is segmented by K-12 and higher education. Top impacting factors which can affects global RFID Markets are from 2017 to 2024. During these years, main factors will be
1)Increase in penetration of sensors in broad application
2) High RFID cost
3)Reads from greater distance in harsh environment
4) Robust Security
5) helps business to track inventory and equipment

The radio-frequency identification (RFID) market is expected to be valued at USD 31.42 Billion by 2023, growing at a CAGR of 7.7% between 2017 and 2023. The growth of this market is fueled by the increasing installation of RFID in manufacturing units for productivity improvement; increased usage of security & access control application; increasing government initiatives; high adoption of RFID technology in retail industry; and development in the RFID ecosystem through organic growth strategies such as mergers and acquisitions, and collaborations.
The Americas is expected to hold the largest share of the RFID market during the forecast period. The players in the Americas region are emphasizing on research and development activities, to facilitate operational efficiency through advanced technologies. Furthermore, the adoption of RFID technologies and a significant number of established players in the market are driving the demand for RFID tags in the Americas.

RFID Sensor Market Key Segments:

By Product

- Tags

- Reader
- Software

By Frequency Band

- Low Frequency
- High Frequency
- Ultrahigh Frequency

By Type

- Active
- Passive

By Application

- Access Control
- Livestock Tracking
- Ticketing
- Cashless Payment
- Inventory Management

By Industry Vertical

- Transportation & Logistics
- Healthcare
- Hospitality
- Food & Beverages
- Retail
- Manufacturing
- Government

By Region

- North America
    - U.S.
    - Canada
    - Mexico
- Europe
    - UK

    - Germany
    - France
    - Russia
    - Rest of Europe
- Asia-Pacific
    - China
    - India
    - Japan
    - Australia
    - Rest of Asia-Pacific
- LAMEA
    - Latin America
    - Middle East
    - Africa

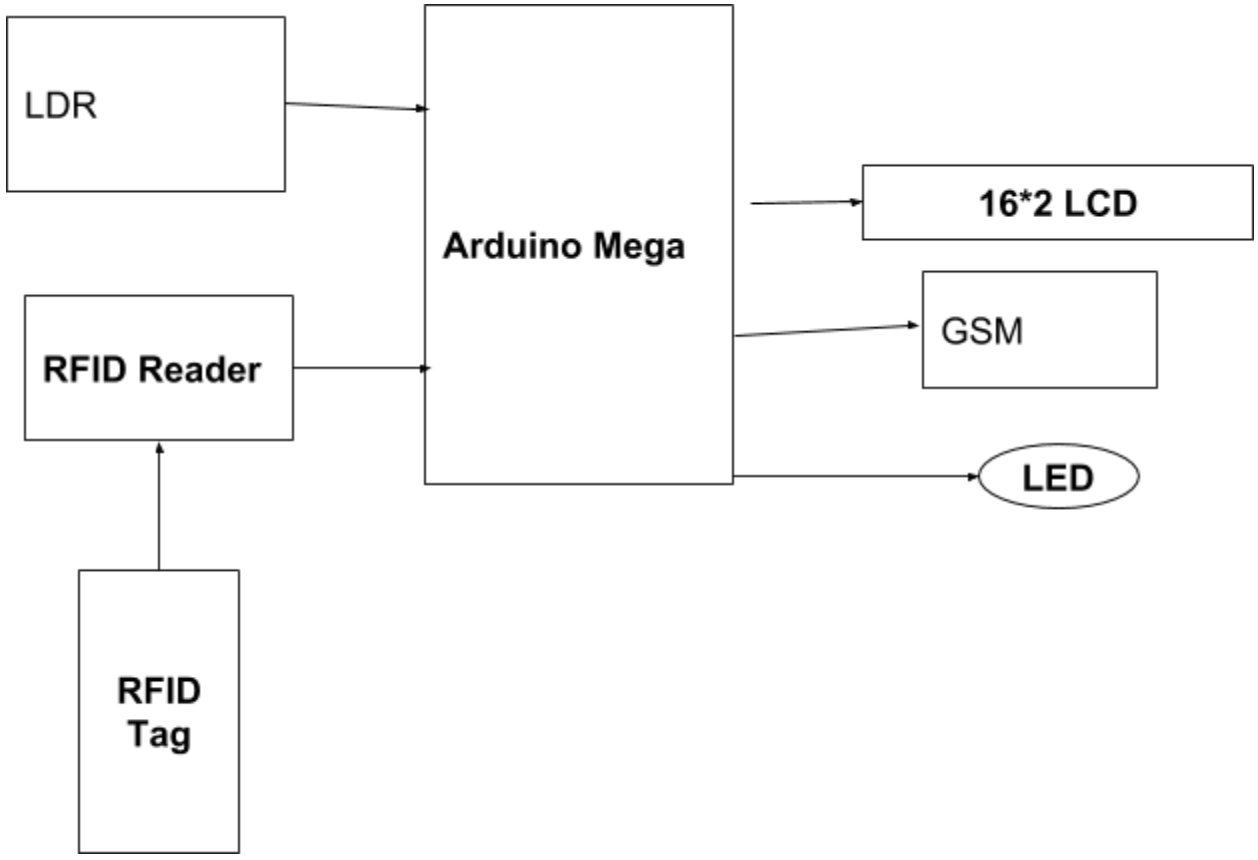
By Company

The major companies profiled in the report are :-

- Murata Manufacturing Co., Ltd.
- Vitaran Electronics, SMARTRAC,
- ELA Innovation, Balluff Inc.
- AB&R (American Barcode and RFID)
- VisualScan Inc.
- Imprint Enterprises
- Coridian Technologies, Inc.
- AbeTech Corporate
- Invengo Technology Pte. Ltd.

3

BLOCK DIAGRAM

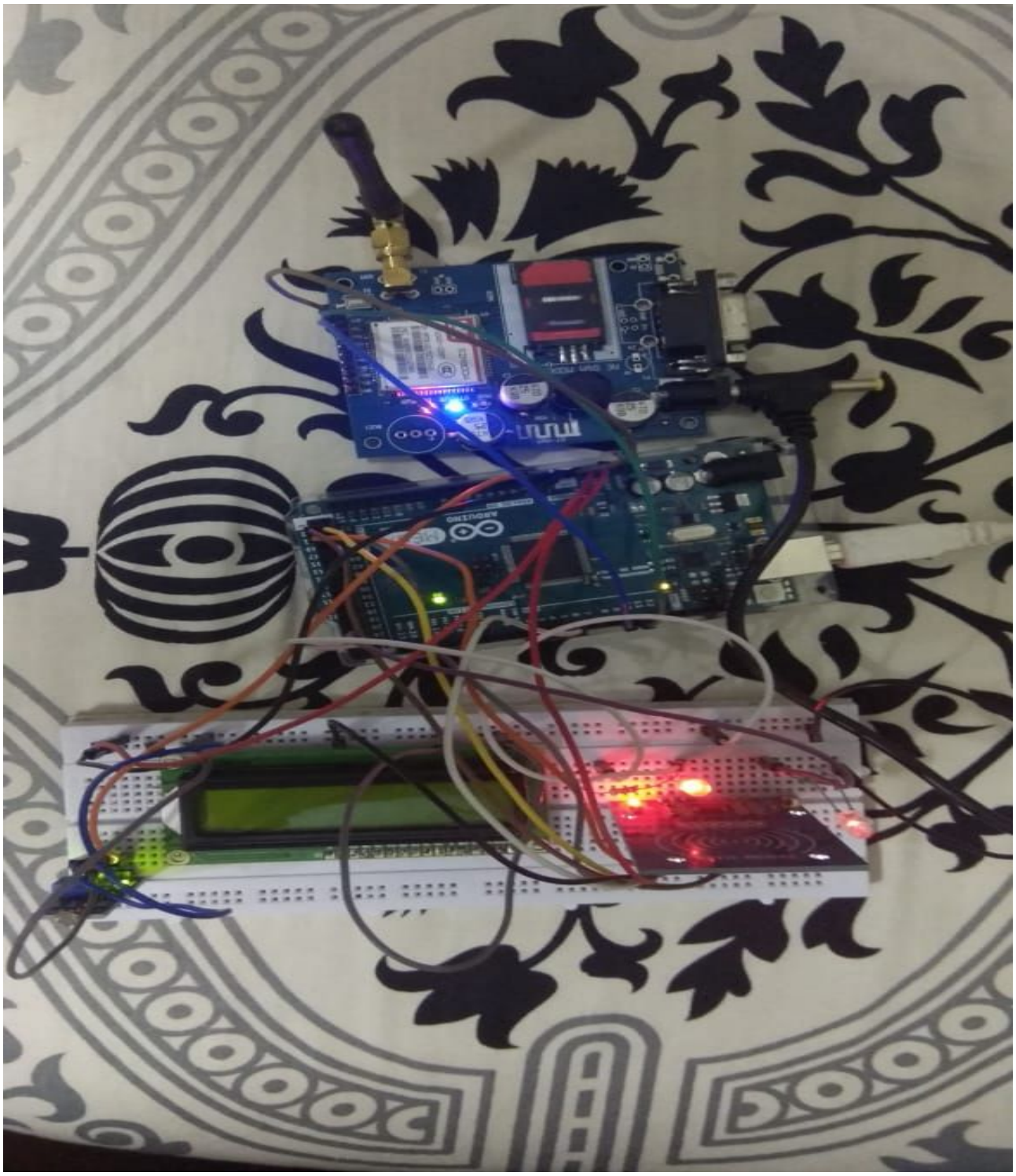


Explanation:-

Through this project we will accomplish that security comes first in matter of anything and attendance is must for student .Through this system, we can achieve security for teachers and no outsider can come inside and cannot have access of anything . Here we have input as RFID Tag which will scan card and send it to reader, the reader will then read whether it is teacher's card , student's card or outsider's, blink particular LED and through GSM we will sent the particular message to what to do . We have LCD , LED and GSM as output .

4

CIRCUIT DIAGRAM:-



EXPLANATION:-

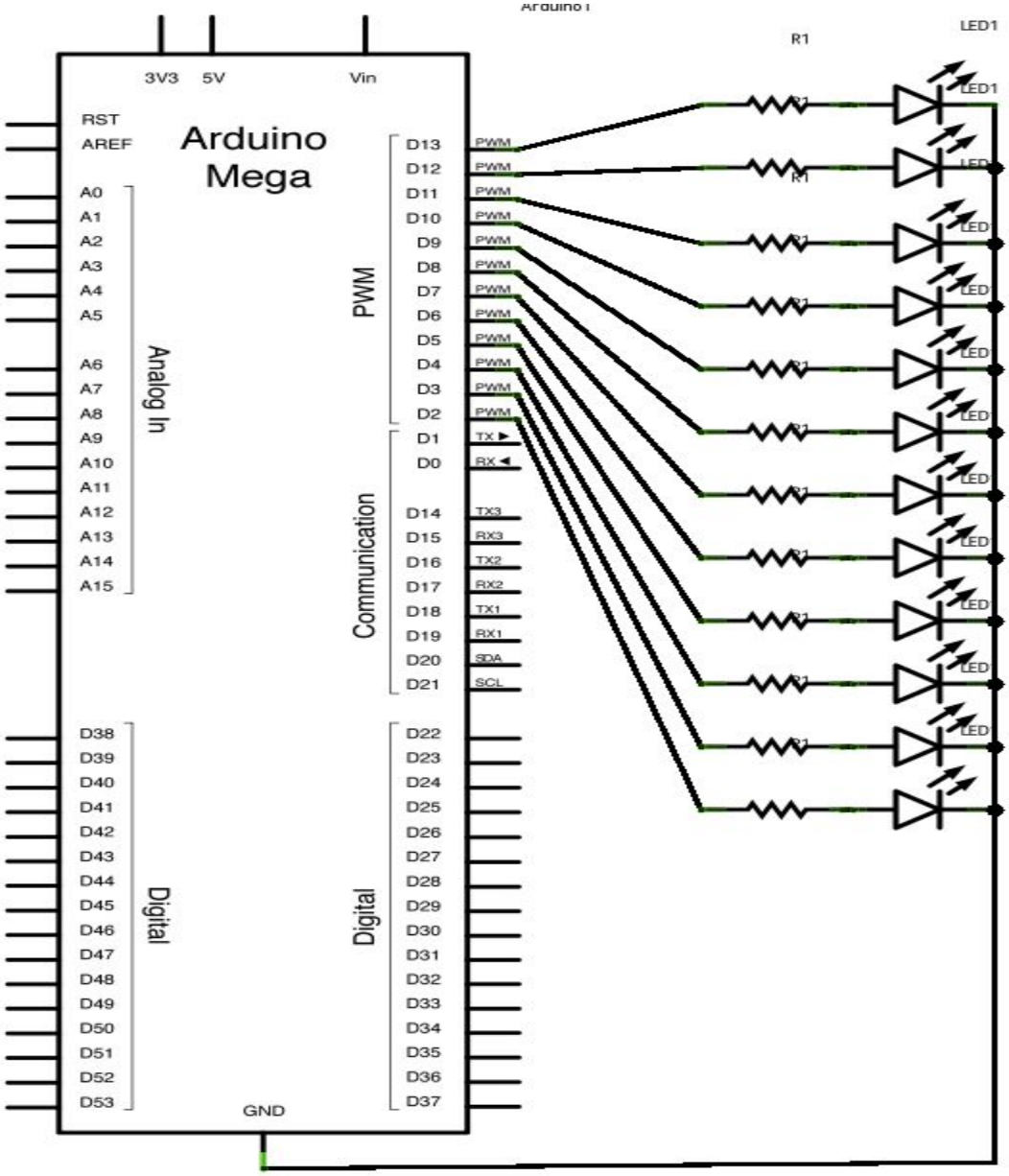
In this diagram, processor is arduino mega. From RFID reader, the id of RFID tag will be taken and store attendance of a particular student by his tag id and also it will show on LCD which is feet on breadboard. After taking tag id , a message will be send to mobile phone of a particular student.this message is sent by GSM module. If total attendance is greater than 0, than the l9ight will be on and this task will be done by a LDR sensor.

So, our components for the project is:-

- Arduino Mega
- RFID reader
- RFID tag
- 16*2 LCD
- GSM Module
- LDR sensor
- RTC (real time counter)

5 Arduino Features

Arduino Mega :-



Details of Arduino Mega :-

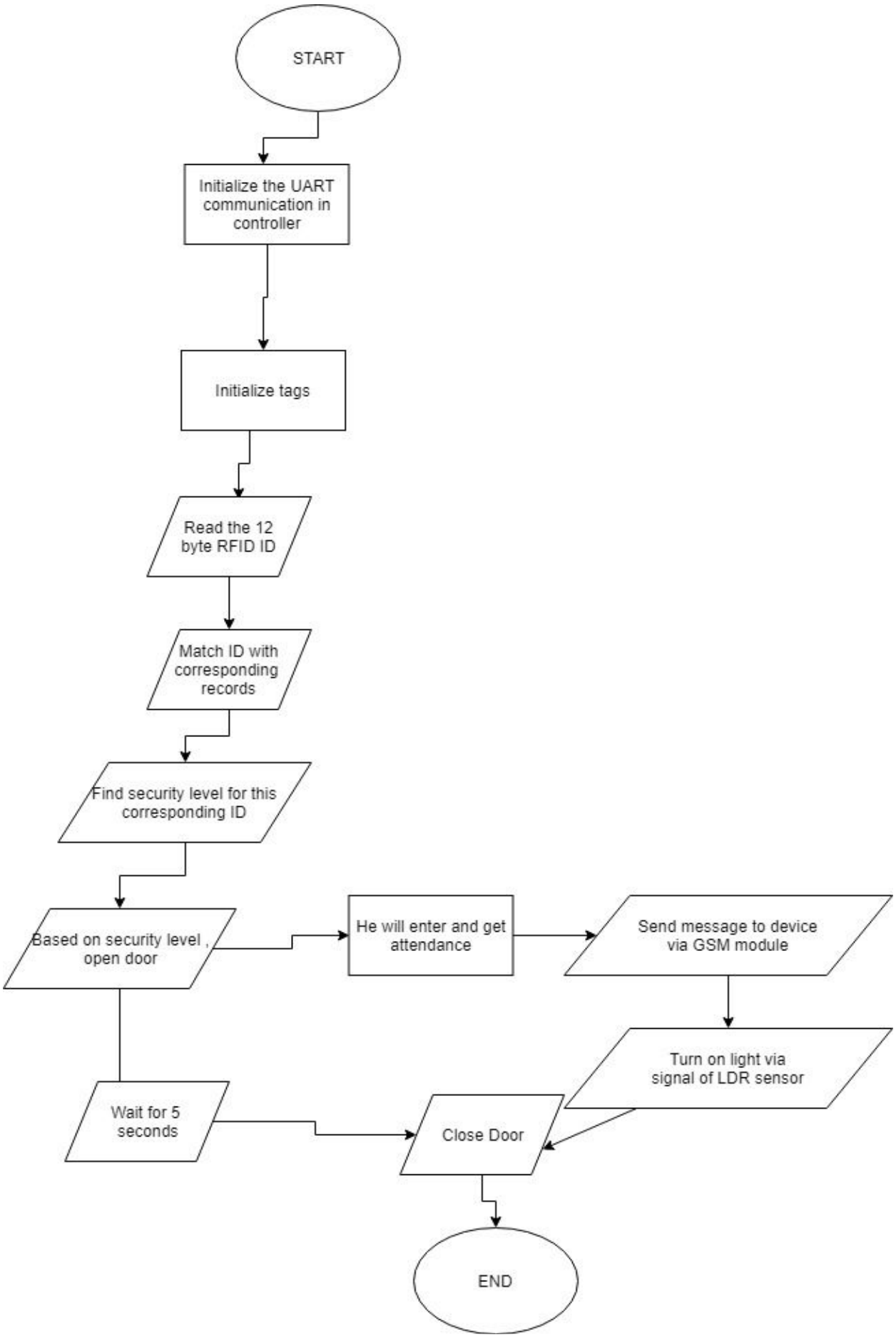
The Arduino Mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 14 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

Features :-

Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limit)	6-20V
Digital I/O Pins	54 (of which 15 provide PWM output)
Analog Input Pins	16
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	256 KB of which 8 KB used by bootloader
SRAM	8 KB
EEPROM	4 KB
Clock Speed	16 MHz
LED_BUILTIN	13
Length	101.52 mm

Width	53.3 mm
Weight	37 g

6
FLOWCHART:-


START
Initialize the UART communication in controller
Initialize tags
Read the 12 byte RFID ID
Match ID with corresponding records
Find security level for this corresponding ID
Based on security level , open door
He will enter and get attendance
Send message to device via GSM module
Turn on light via signal of LDR sensor
Wait for 5 seconds
Close Door
END

7

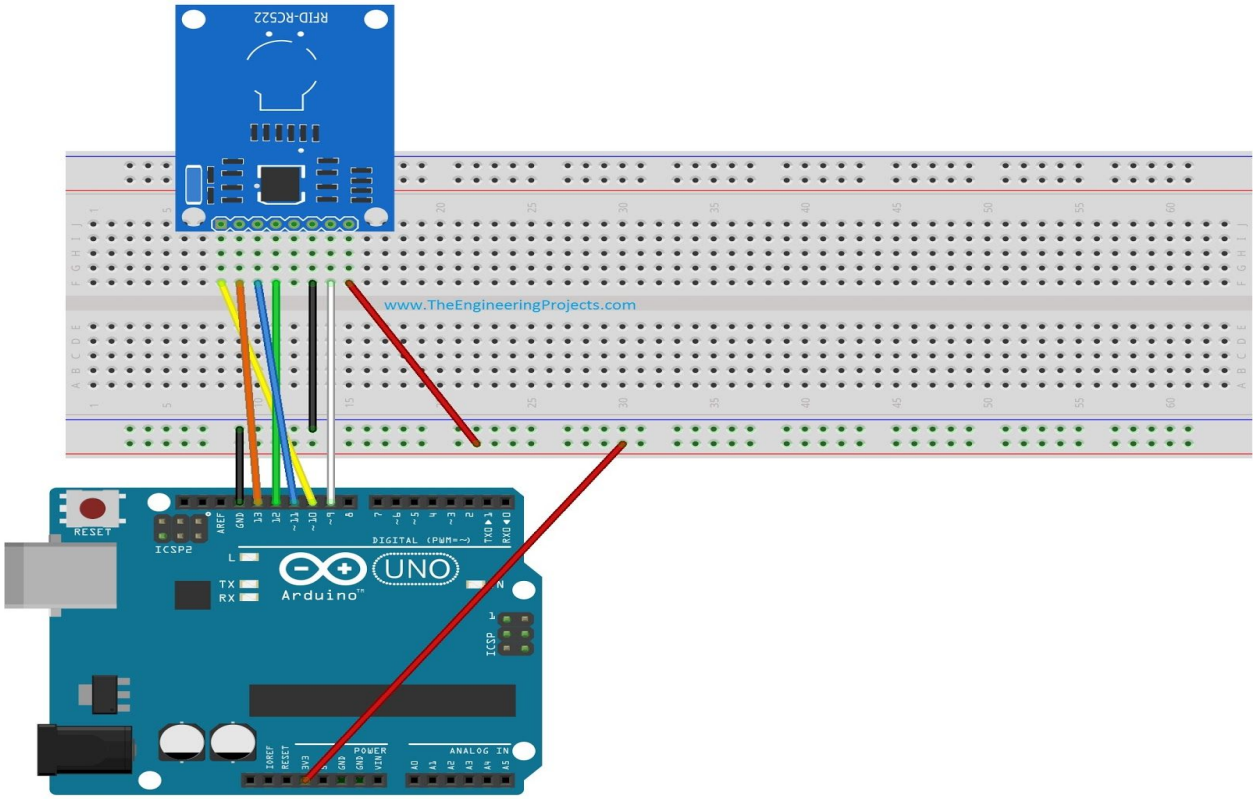
SENSORS

RFID:-

How RFID works?

RFID belongs to a group of technologies referred to as Automatic Identification and Data Capture (AIDC). AIDC methods automatically identify objects, collect data about them, and enter those data directly into computer systems with little or no human intervention. RFID methods utilize radio waves to accomplish this. At a simple level, RFID systems consist of three components: an RFID tag or smart label, an RFID reader, and an antenna. RFID tags contain an integrated circuit and an antenna, which are used to transmit data to the RFID reader (also called an interrogator). The reader then converts the radio waves to a more usable form of data. Information collected from the tags is then transferred through a communications interface to a host computer system, where the data can be stored in a database and analyzed at a later time.

Diagram:-



- **MEASUREMENT RANGE:-**

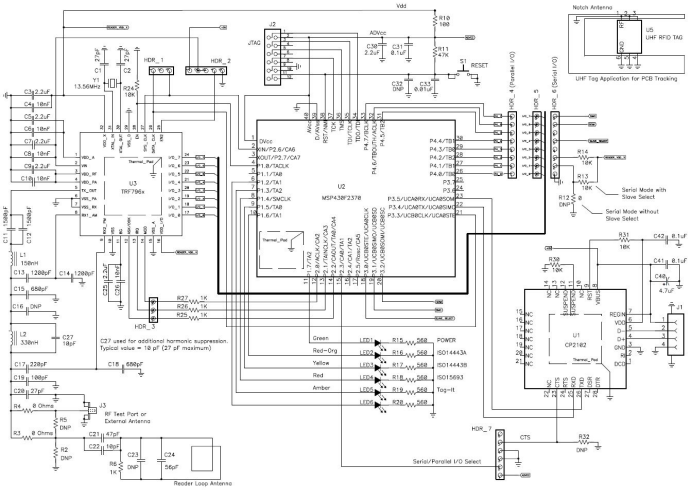
Active RFID

- Primary Frequency Range: 433 MHz, (Can use 2.45 GHz - under the Extremely High Frequency Range)
- Read Range: 30 - 100+ Meters
- Average Cost Per Tag: $25.00 - $50.00
- Applications: Vehicle Tracking, Auto Manufacturing, Mining, Construction, Asset Tracking
- Pros: Very Long Read Range, Lower Infrastructure Cost (vs. Passive RFID), Large Memory Capacity, High Data Transmission Rates
- Cons: High Per Tag Cost, Shipping Restrictions (due to batteries), Complex Software may be Required, High Interference from Metal and Liquids; Few Global Standards

Passive RFID

- Primary Frequency Ranges: 860 - 960 MHz
- Read Range: Near Contact - 25 Meters
- Average Cost Per Tag: $0.09 - $20.00
- Applications: Supply Chain Tracking, Manufacturing, Pharmaceuticals, Electronic Tolling, Inventory Tracking, Race Timing, Asset Tracking
- Pros: Long Read Range, Low Cost Per Tag, Wide Variety of Tag Sizes and Shapes, Global Standards, High Data Transmission Rates
- Cons: High Equipment Costs, Moderate Memory Capacity, High Interference from Metal and Liquids.

- **PIN DIAGRAM:-**



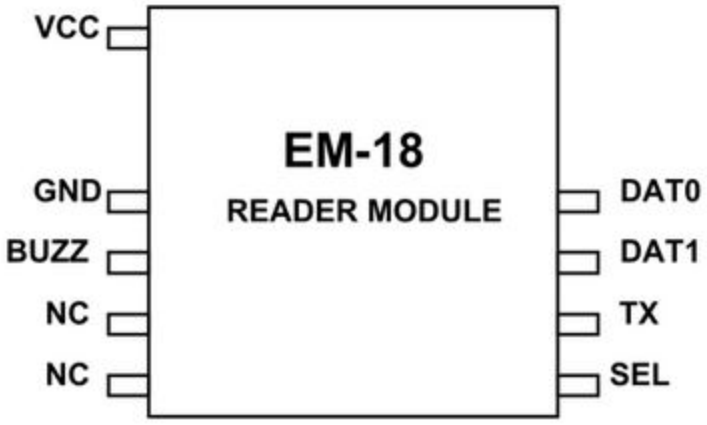
PHYSICAL DIMENSION:

electric field= $kq1/r^2$
So we can say field= force/charge
Now force = mass * accn
Accn = metre / $time^2$
So dimensions of force = $M^1L^1T^{-2}$
Charge = I(current) * time
So dimensions of charge= A^1T^1
From this dimensions of field comes to be = $M^1L^1T^{-2}/A^1T^1$

= **$M^1L^1T^{-3}A^{-1}$**

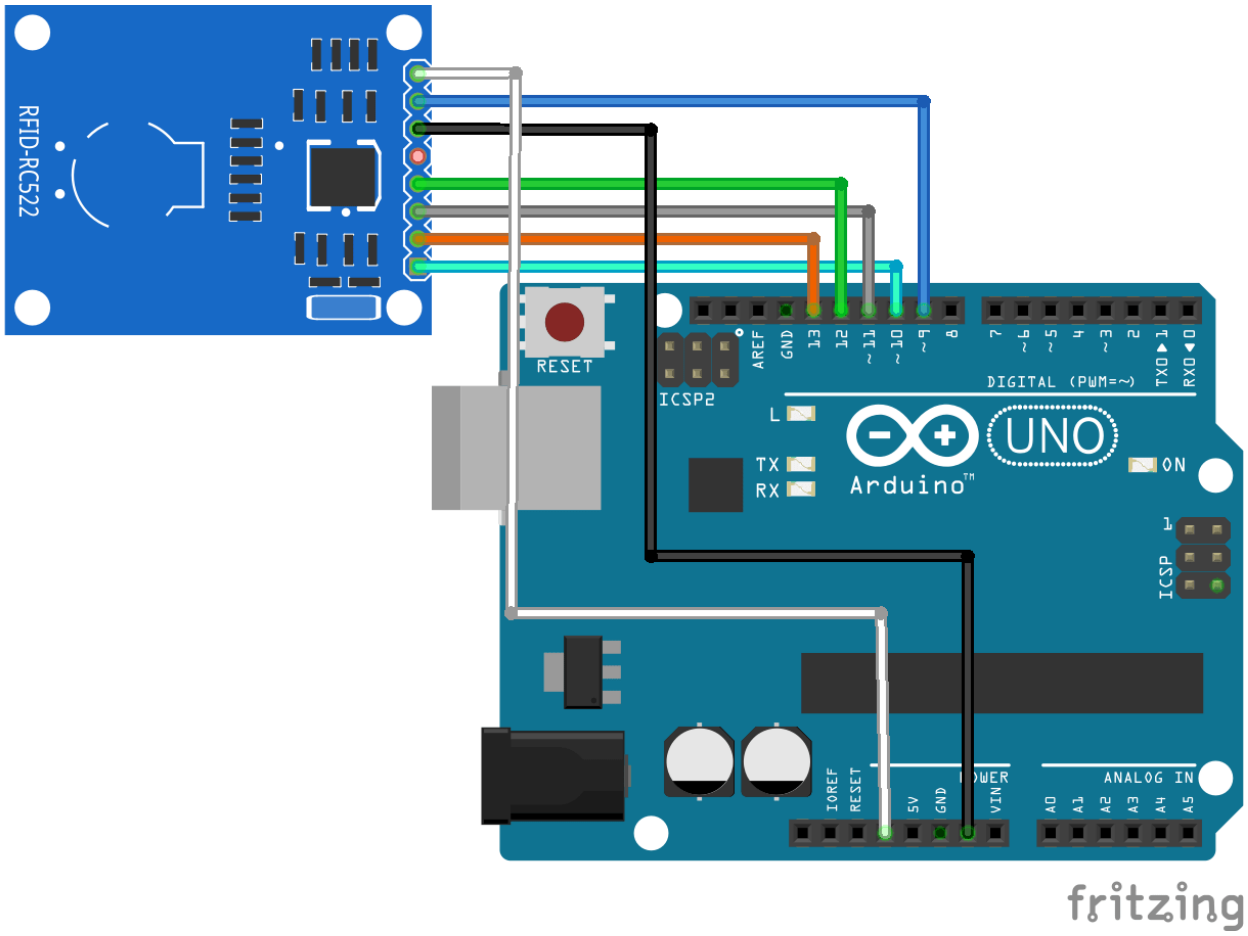
POWER RATING
Can operate on LOW power

PIN DIAGRAM



Type of interface

Simple and complex both
Interfacing with arduino diagram



Code:-

```
Typical pin layout used:
 * -----------------------------------------------------------------------------------------
 *             MFRC522      Arduino       Arduino   Arduino    Arduino          Arduino
 *             Reader/PCD   Uno/101       Mega      Nano v3    Leonardo/Micro   Pro Micro
 * Signal      Pin          Pin           Pin       Pin        Pin              Pin
 * -----------------------------------------------------------------------------------------
 * RST/Reset   RST          9             5         D9         RESET/ICSP-5     RST
 * SPI SS      SDA(SS)      10            53        D10        10               10
 * SPI MOSI    MOSI         11 / ICSP-4   51        D11        ICSP-4           16
 * SPI MISO    MISO         12 / ICSP-1   50        D12        ICSP-1           14
 * SPI SCK     SCK          13 / ICSP-3   52        D13        ICSP-3           15
 */

#include <SPI.h>
#include <MFRC522.h>
#include <AddicoreRFID.h>

constexpr uint8_t RST_PIN = 5;          // Configurable, see typical pin layout above
constexpr uint8_t SS_PIN = 53;          // Configurable, see typical pin layout above

MFRC522 mfrc522(SS_PIN, RST_PIN);  // Create MFRC522 instance

void setup() {
  Serial.begin(9600);   // Initialize serial communications with the PC
  while (!Serial);    // Do nothing if no serial port is opened (added for Arduinos based on
ATMEGA32U4)
  SPI.begin();      // Init SPI bus
  mfrc522.PCD_Init();   // Init MFRC522
  mfrc522.PCD_DumpVersionToSerial();  // Show details of PCD - MFRC522 Card Reader
details
  Serial.println(F("Scan PICC to see UID, SAK, type, and data blocks..."));
}

void loop() {
  // Look for new cards
  if ( ! mfrc522.PICC_IsNewCardPresent()) {
    return;
  }

  // Select one of the cards
  if ( ! mfrc522.PICC_ReadCardSerial()) {
    return;
  }
```

```
  // Dump debug info about the card; PICC_HaltA() is automatically called
  mfrc522.PICC_DumpToSerial(&(mfrc522.uid));
}
```

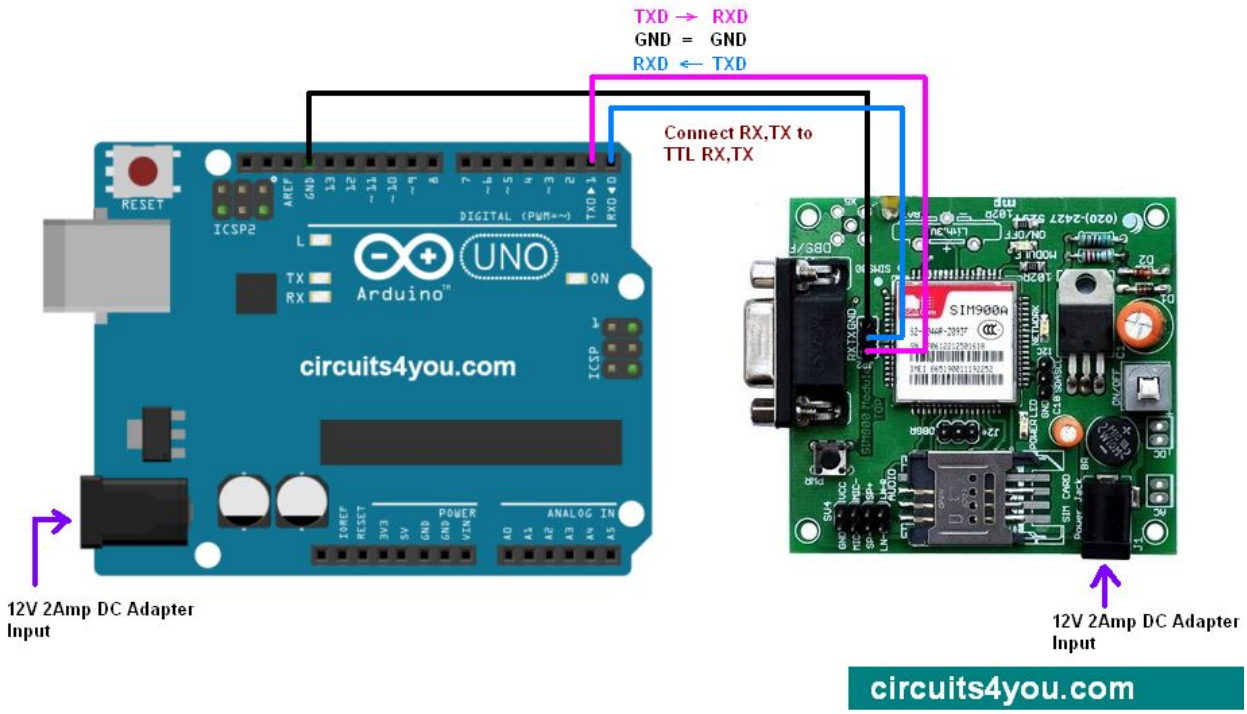
8

Actuators and Displays

GSM:-

Working Principle-

GSM/GPRS engine- SIM900, works on frequencies 850/ 900/ 1800/ 1900 MHz. The Modem is coming with RS232 interface,which allows you connect PC as well as microcontroller with RS232 Chip(MAX232). The baud rate is configurable from 9600-115200 (default baud rate is 9600) through AT command. The GSM/GPRS Modem is having internal TCP/IP stack to enable you to connect with internet via GPRS. It is suitable for SMS, Voice as well as DATA transfer application in M2M interfac**e.**

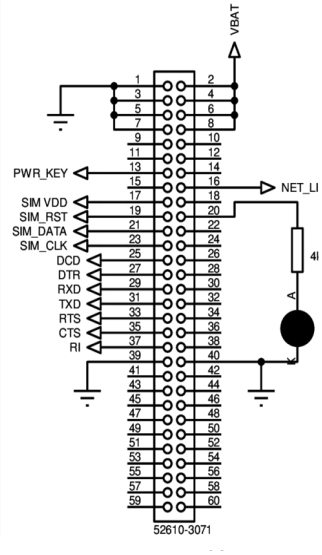


Physical Dimension

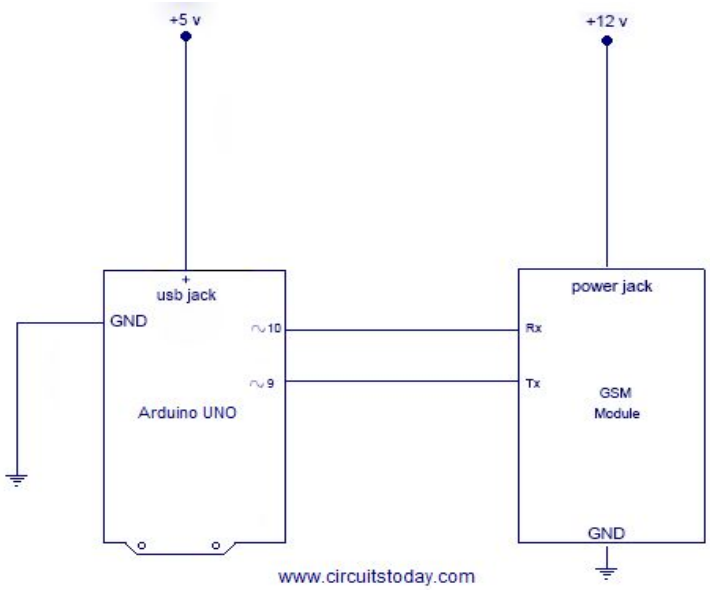
Physical dimensions 35.0X39.0X2.9 mm (typical) Connection 60 pins
Measurement Range

POWER RATING
Min- 4.5 v , Max -5.5 v , Unit - VDc

PIN DIAGRAM



Type of interface is very simple and normal.
Details and diagram of interfacing



Code of interfacing:-

```
  #include <SoftwareSerial.h>
SoftwareSerial GPRS(10, 9); //10 = TX,9 = RX
unsigned char buffer[64]; //port
int count=0;
int i = 0; //if i = 0, send SMS.
void setup() {
  GPRS.begin(115200); // the GPRS baud rate
  Serial.begin(9600); // the Serial port of Arduino baud rate.
  Serial.print("I'm ready");
  Serial.print("Hello?");
}

void loop() {
  if (GPRS.available()) {
    // if date is coming from softwareserial port ==> data is coming from GPRS shield
    while(GPRS.available()) {
      // reading data into char array
      buffer[count++]=GPRS.read();
      // writing data into array
      if(count == 64)
        break;
    }
    Serial.write(buffer,count);
    // if no data transmission ends, write buffer to hardware serial port
    clearBufferArray();
    // call clearBufferArray function to clear the stored data from the array
    count = 0; // set counter of while loop to zero
  }
  //if (Serial.available())
    // if data is available on hardwareserial port ==> data is coming from PC or notebook
    //GPRS.write(Serial.read()); // write it to the GPRS shield
  if(i == 0) {
```

```
   GPRS.write("AT+CMGF=1\r"); //sending SMS in text mode
   delay(1000);
   Serial.println("AT+CMGF=1\r");
   GPRS.write("AT+CMGS=\"+917046373050\"\r"); // phone number
   delay(1000);
   GPRS.write("Hi\r"); // message
   delay(1000);
   Serial.println("Hi Sent \r");
   delay(1000);
   GPRS.write(0x1A);
   //send a Ctrl+Z (end of the message)
   delay(1000);
   Serial.println("SMS sent successfully");
   i++;
  }
}

void clearBufferArray(){
  // function to clear buffer array
  for (int i=0; i<count;i++){
    buffer[i]='\0';
    // clear all index of array with command NULL
  }
}
```

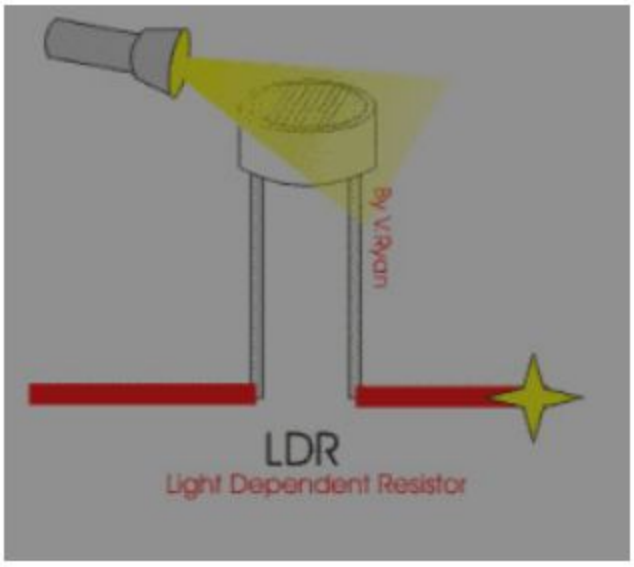
Code size = 4,966 bytes
Execution time = 10 sec

LDR :-

This resistor works on the principle of photoconductivity. It is nothing but, when the light falls on its surface, then the material conductivity reduces and also the electrons in the valence band of the device are excited to the conduction band. These photons in the incident light must have energy greater than the band gap of the semiconductor material.This makes the electrons to jump from the valence band to conduction.

Measurement Range:-

Photo resistors, also known as light dependent resistors (LDR), are light sensitive devices most often used to indicate the presence or absence of light, or to measure the light intensity. In the dark, their resistance is very high, sometimes up to 1MΩ, but when the LDR sensor is exposed to light, the resistance drops dramatically, even down to a few ohm, depending on the light intensity.



Working Principle of LDR

Unit of Measurement and definition:-

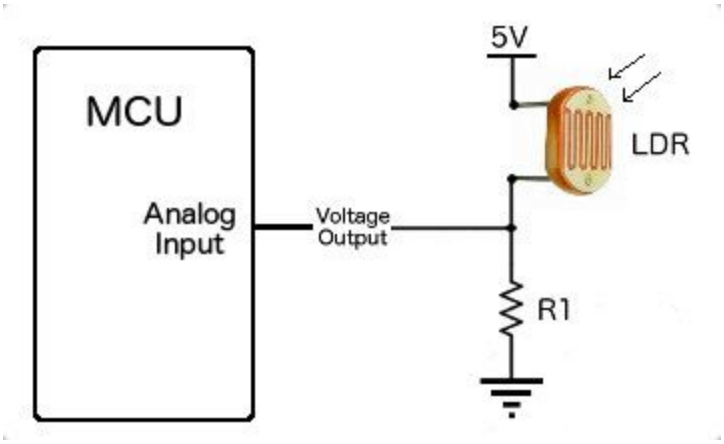
Unit is ohm and definition is transmitting a current of one ampere when subjected to a potential difference of one volt.

Physical Dimension :- LDR are available in 5mm, 8mm, 12mm and 25mm dimensions. LDR is made of high resistance semiconductor material.

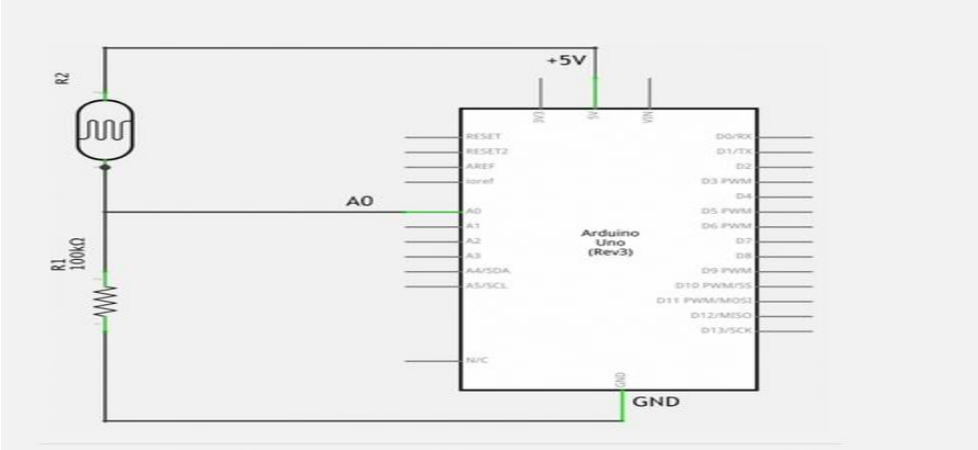
Power rating:-

Photo Light Dependent Resistors - LDR
Voltage Rating - **100V**
 Resistance Lux - 5k ohm
Resistor Case Style TO-18
 Power Rating - 50mW
Operating Temperature Min-60°C

PIN DIAGRAM



INTERFACE WITH ARDUINO DIAGRAM



INTERFACE WITH ARDUINO CODE

DRvoid setup()

{

```
  Serial.begin(9600);

  pinMode(22, OUTPUT);

}



void loop()

{

  unsigned int AnalogValue;

  AnalogValue = analogRead(0);

  Serial.println(AnalogValue);

  if(AnalogValue > 400)

  {

     digitalWrite(22, HIGH);

     delay(10000);
```

```
 }

 else

 {

  digitalWrite(22, LOW);

   delay(1000);

 }

}
```

CODE SIZE
2,604 bytes

Execution SIze
2 sec

LCD

PHYSICAL DIMENSION

MECHANICAL DATA		
ITEM	STANDARD VALUE	UNIT
Module Dimension	80.0 x 36.0	mm
Viewing Area	66.0 x 16.0	mm
Dot Size	0.56 x 0.66	mm
Character Size	2.96 x 5.56	mm

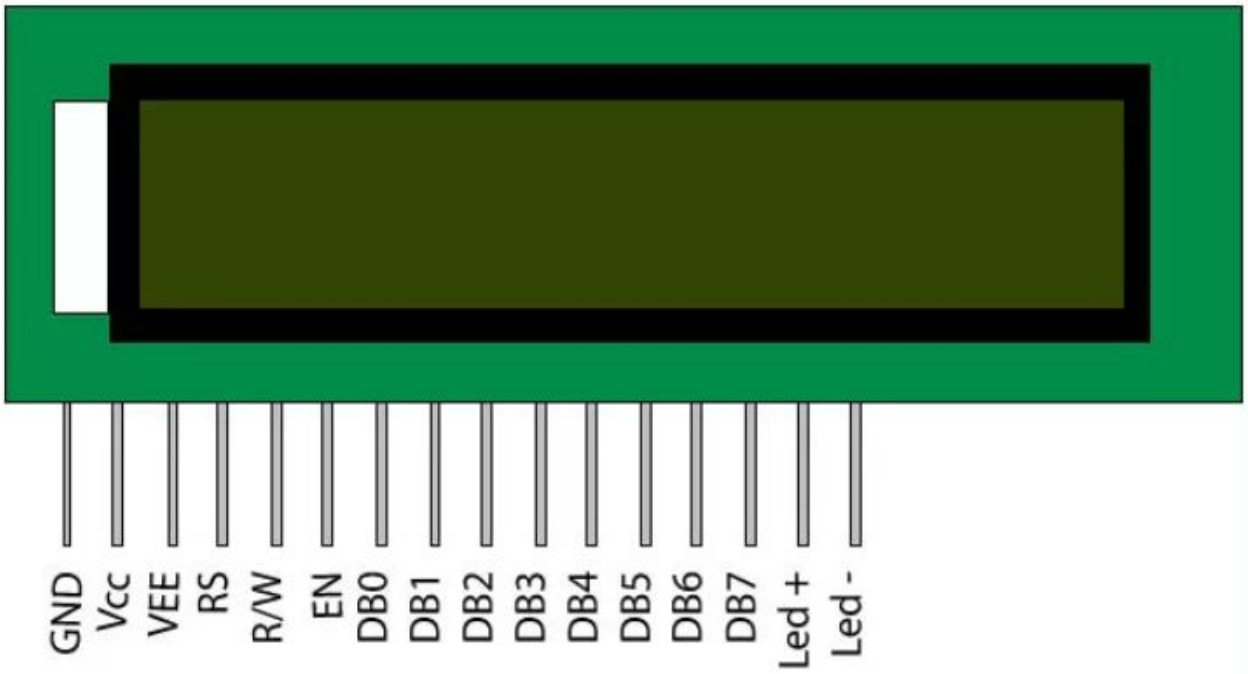
POWER RATING

5V power supply(also +3V) ,

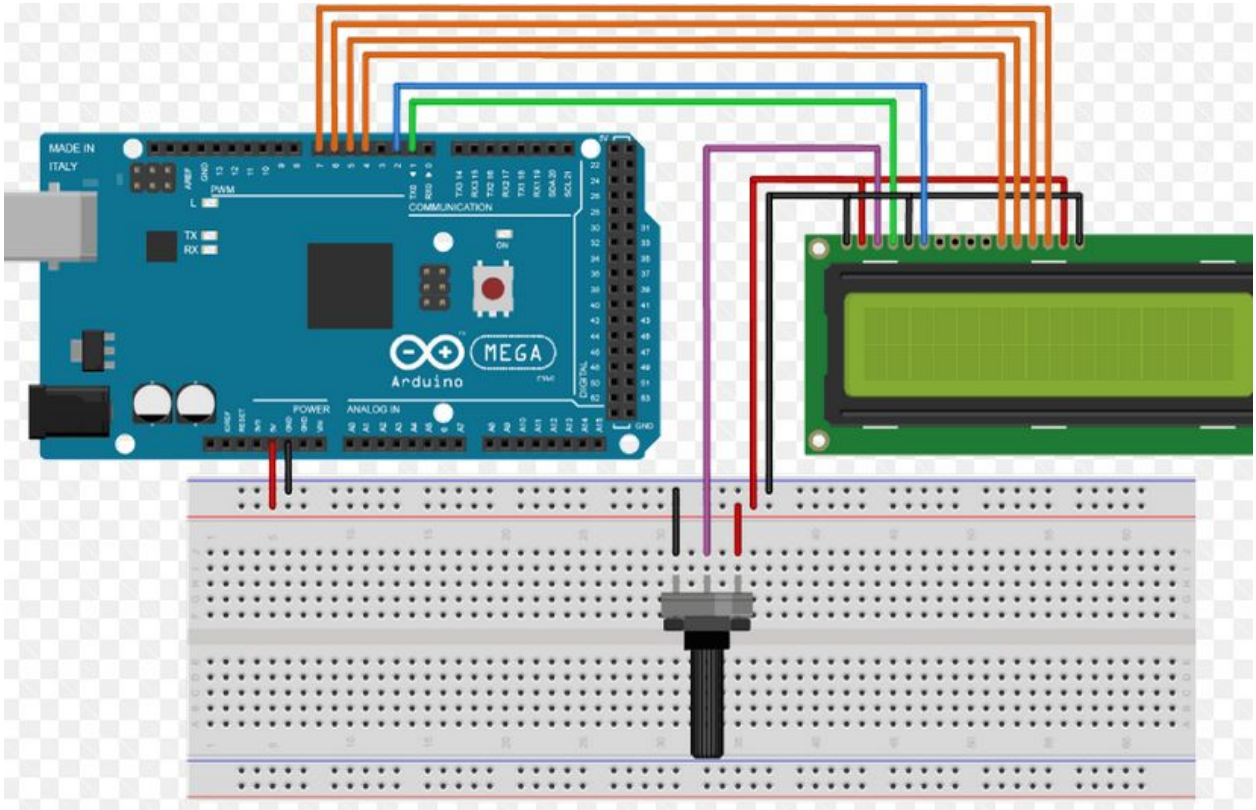
ABSOLUTE MAXIMUM RATING					
ITEM	SYMBOL	STANDARD VALUE			UNIT
		MIN.	TYP.	MAX.	
Power Supply	VDD-VSS	- 0.3	–	7.0	V
Input Voltage	VI	- 0.3	–	VDD	V

NOTE: VSS = 0 Volt, VDD = 5.0 Volt

PIN DIAGRAM



Interfacing Diagram and code



Code

```
#include <LiquidCrystal.h>
const int rs = 12, en = 11, d4 = 6  , d5 = 4, d6 = 3, d7 = 2;
LiquidCrystal lcd(rs, en, d4, d5, d6, d7);

void setup()
{
  lcd.begin(16,2);
  lcd.clear();
  lcd.setCursor(0,0);
  lcd.print("Hello");
}

void loop() {
  lcd.display();
  delay(500);
}
```

Code Size - 2352 bytes

9

Appendix A:-

GSM

2 SIM900A Overview

Designed for global market, SIM900A is a dual-band GSM/GPRS engine that works on frequencies EGSM 900MHz and DCS 1800MHz. SIM900A features GPRS multi-slot class 10/ class 8 (optional) and supports the GPRS coding schemes CS-1, CS-2, CS-3 and CS-4.

With a tiny configuration of 24mm x 24mm x 3mm, SIM900A can meet almost all the space requirements in you applications, such as M2M, smart phone, PDA and other mobile devices.

The physical interface to the mobile application is a 68-pin SMT pad, which provides all hardware interfaces between the module and customers' boards.

- The keypad and SPI display interface will give you the flexibility to develop customized applications.
- Serial port and Debug port can help you easily develop your applications.
- One audio channel includes a microphone input and a speaker output.
- Programmable General Purpose Input & Output.

The SIM900A is designed with power saving technique so that the current consumption is as low as 1.5mA in SLEEP mode.

The SIM900A is integrated with the TCP/IP protocol; extended TCP/IP AT commands are developed for customers to use the TCP/IP protocol easily, which is very useful for those data transfer applications.

ARDUINO MEGA

Overview

The Arduino Mega 2560 is a microcontroller board based on the ATmega2560 (datasheet). It has 54 digital input/output pins (of which 14 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Mega is compatible with most shields designed for the Arduino Duemilanove or Diecimila.

Schematic & Reference Design

EAGLE files: arduino-mega2560-reference-design.zip

Summary

Microcontroller	ATmega2560
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	54 (of which 14 provide PWM output)
Analog Input Pins	16
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	256 KB of which 8 KB used by bootloader
SRAM	8 KB
EEPROM	4 KB
Clock Speed	16 MHz

Power

The Arduino Mega can be powered via the USB connection or with an external power supply. The power source is selected automatically.

External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector.

The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable.

RFID

The EM-18 RFID Reader module operating at 125kHz is an inexpensive solution for your RFID based application. The Reader module comes with an on-chip antenna and can be powered up with a 5V power supply. Power-up the module and connect the transmit pin of the module to recieve pin of your microcontroller. Show your card within the reading distance and the card number is thrown at the output. Optionally the module can be configured for also a weigand output.

Typical Applications

- e-Payment
- e-Toll Road Pricing
- e-Ticketing for Events
- e-Ticketing for Public Transport
- Access Control
- PC Access
- Authentication
- Printer / Production Equipment

Features	
RF Transmit Frequency	125kHz
Supported Standards	EM4001 64-bit RFID tag compatible
Communications Interface	TTL Serial Interface, Wiegand output
Communications Protocol	Specific ASCII
Communications Parameter	9600 bps, 8, N, 1
Power Supply	4.6V - 5.5VDC ± 10% regulated
Current Consumption	50 mA < 10mA at power down mode.
Reading distance	Up to 100mm, depending on tag
Antenna	Integrated
Size (LxWxH)	32 x 32 x 8mm

LDR

Two cadmium sulphide (cdS) photoconductive cells with spectral responses similar to that of the human eye. The cell resistance falls with increasing light intensity. Applications include smoke detection, automatic lighting control, batch counting and burglar alarm systems.

Guide to source illuminations

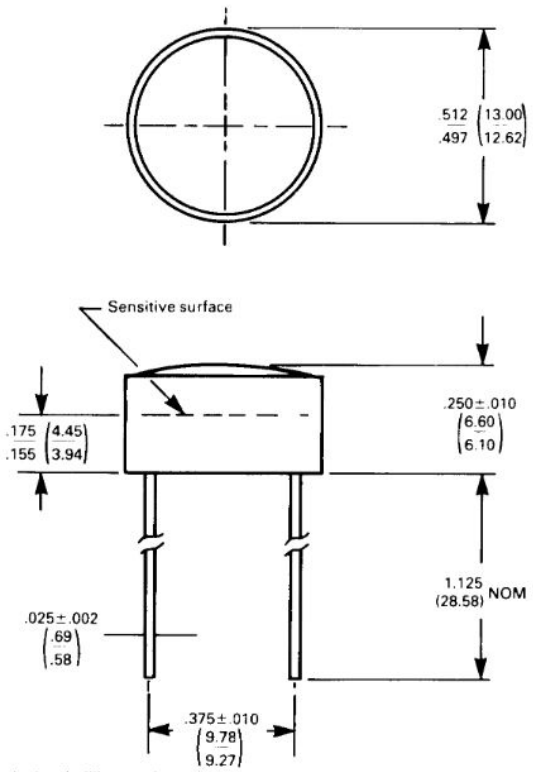
Light source	Illumination (Lux)
Moonlight	0.1
60W bulb at 1m	50
1W MES bulb at 0.1m	100
Fluorescent lighting	500
Bright sunlight	30,000

Circuit symbol

Light memory characteristics

Light dependent resistors have a particular property in that they remember the lighting conditions in which they have been stored. This memory effect can be minimised by storing the LDRs in light prior to use. Light storage reduces equilibrium time to reach steady resistance values.

Dimensions



Units in inches (millimetres)

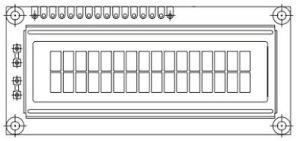
LCD 16*2

VISHAY

LCD-016M002B

Vishay

16 x 2 Character LCD



FEATURES

- 5 x 8 dots with cursor
- Built-in controller (KS 0066 or Equivalent)
- + 5V power supply (Also available for + 3V)
- 1/16 duty cycle
- B/L to be driven by pin 1, pin 2 or pin 15, pin 16 or A.K (LED)
- N.V. optional for + 3V power supply

MECHANICAL DATA

ITEM	STANDARD VALUE	UNIT
Module Dimension	80.0 x 36.0	mm
Viewing Area	66.0 x 16.0	mm
Dot Size	0.56 x 0.66	mm
Character Size	2.96 x 5.56	mm

ABSOLUTE MAXIMUM RATING

ITEM	SYMBOL	STANDARD VALUE			UNIT
		MIN.	TYP.	MAX.	
Power Supply	VDD-VSS	- 0.3	–	7.0	V
Input Voltage	VI	- 0.3	–	VDD	V

NOTE: VSS = 0 Volt, VDD = 5.0 Volt

ELECTRICAL SPECIFICATIONS

ITEM	SYMBOL	CONDITION		STANDARD VALUE			UNIT
				MIN.	TYP.	MAX.	
Input Voltage	VDD	VDD = + 5V		4.7	5.0	5.3	V
		VDD = + 3V		2.7	3.0	5.3	V
Supply Current	IDD	VDD = 5V		–	1.2	3.0	mA
Recommended LC Driving Voltage for Normal Temp. Version Module	VDD - V0	- 20 °C		–	–	–	V
		0°C		4.2	4.8	5.1	
		25°C		3.8	4.2	4.6	
		50°C		3.6	4.0	4.4	
		70°C		–	–	–	
LED Forward Voltage	VF	25°C		–	4.2	4.6	V
LED Forward Current	IF	25°C	Array	–	130	260	mA
			Edge	–	20	40	
EL Power Supply Current	IEL	Vel = 110VAC:400Hz		–	–	5.0	mA

DISPLAY CHARACTER ADDRESS CODE:

Display Position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
DD RAM Address	00	01														0F
DD RAM Address	40	41														4F

10

Appendix B:-

Compare C programming with two other languages :-

C language *vs* **Assembly language**

- The c language provides portability and does not depend on the specific platform. It is the biggest advantage of C and this property make people helpless to use C. The code which was written in c could be easily reused on a different platform, beside it Assembly does not provide the portability and source code specific to a processor because assembly instruction depends on the processor architecture.

- Software which has written in assembly perform well as compared to C. Now's days C compiler generate more optimize assembly code.

- We cannot say compiler-generated assembly code always better, because when human writes the software in assembly then he thinks a lot of scenarios specific to the requirement and processor which did not handle by the compiler.

- In case of micro-controller IDE generate an assembly code (startup code) to initialize the stack, heap, and NVIC. And further, it is hard to maintain Assembly code.

- API, which has written in assembly would be fast. That is the biggest reason to write memset () and memcpy () routine in assembly.

- Executable generated by assembly language have smaller size compare to c language but not always true.

C language *vs* **Java language..**

- C is a middle-level language because binding of the gaps takes place between machine level language and high-level languages. While ,Java is a high-level

language because translation of code takes place into machine language using compiler or interpreter.

- C is a compiled language that is it converts the code into machine language so that it could be understood by the machine or system. But Java is an Interpreted language that is in Java, the code is first transformed into bytecode and that bytecode is then executed by the JVM (Java Virtual Machine).

- Generally, C breaks down to functions and Java breaks down to objects.

- Free is used for freeing the memory in C. In Java, a compiler will free up the memory internally by calling the garbage collector.

- C supports pointers, Java does not supports pointers.

- Exception handling cannot be directly achieved in C and thus it lacks the maintenance of normal flow of the program. While, Exception Handling is supported in Java.

- Overloading functionality is not supported by C. Java supports method overloading which helps in code readability.

References:-

1 Components101.com. (2019). [online] Available at: https://components101.com/sites/default/files/component_datasheet/LDR%20Datasheet.pdf [Accessed 30 Mar. 2019].

2 Alselectro.com. (2019). [online] Available at: http://www.alselectro.com/files/rfid-ttl-em18.pdf [Accessed 30 Mar. 2019].

3 Components101.com. (2019). [online] Available at: https://components101.com/sites/default/files/component_datasheet/SIM900A%20Datasheet.pdf [Accessed 30 Mar. 2019].

4 Vishay.com. (2019). [online] Available at: https://www.vishay.com/docs/37299/37299.pdf [Accessed 30 Mar. 2019].

5 Allied Market Research. (2019). *RFID Sensor Market by Product (Tags, Reader, and Software), Frequency Band (Low Frequency, High Frequency, and Ultrahigh Frequency) Type (Active and Passive), Application (Access Control, Livestock Tracking, Ticketing,*

Cashless Payment, and Inventory Management), and Industry Vertical (Transportation & Logistics, Healthcare, Hospitality, Food & Beverages, Retail, Manufacturing, and Government) - Global Opportunities Analysis and Industry Forecast, 2018-2024. [online] Available at: https://www.alliedmarketresearch.com/RFID-sensor-market [Accessed 30 Mar. 2019].