CHAPTER 1
INTRODUCTION

1.1 Introduction

Home Automation using cloud network is a system that uses computers or mobile devices to control basic home functions and features automatically through internet from anywhere around the world, an automated home is sometimes called a smart home. This network uses a consolidation of a mobile phone application and PC based program to provide the means of user interface to the consumer.[2] The home automation system differs from other system by allowing the user to operate the system from anywhere around the world through internet connection.

In this project we have developed a Home Automation system as shown in Fig.1.1, that employs the integration of multi-touch mobile devices, cloud networking, wireless communication, and power-line communication to provide the user with remote control of various lights and appliances within their home. This system uses a consolidation of a mobile phone application, handheld wireless remote, and PC based program to provide a means of user interface to the consumer.[5] The home automation system differs from other systems by allowing the user to operate the system without the dependency of a mobile carrier or Internet connection via the in-home wireless remote.

Automatic appliances are always in demand in today's world. There is an awareness of urgency for developing circuits that would simplify life because of to the increasing standard of living.[8]

1.2 Motivation

The inspiration behind this project was real life situations. With the growing need and increasing demand for vaccine, hospitals have become crowded. This might be a problem in the era of social distancing. Especially in vaccine rooms it is important to monitor the number of people in the room.

- Can be used in various places like seminar hall, where the capacity of the room is limited and should not be exceeded. This project can be used to display the actual number of persons inside the room.
- In case of fire emergencies, the fire brigade can obtain the number of persons inside so that they can prioritize their actions and as a result they will be quick in dealing with the situation.
- In museums we can restrict the number of people entering the museum, resulting in an increase of safety measures.

1.3 Objective

The objective of this project is a controller-based model to count number of persons visiting room and light ON the room. Here use Infrared IR sensor it counts the number of Persons in the room. In now a day all are like an automatic system. With standard of living also increases. Automated Light Controller with Visitor Counter system is controlling the room lights with count number of persons in the room. When anyone enters into the room then the counter will be incremented by one (+1) and the light will be switched ON and when any one person leaves from the room then the counter will be decremented by one (-1). The light will be switched OFF until all visitors or persons leaves from the room.

The total number of visitors or persons inside the room is displayed on the LCD. This system is designed to be low cost and expandable allowing a variety of devices to be controlled.

Fig.1.1 Smart Home [21]

Advances in computer vision present an opportunity to expand and enhance the practice of collecting waste from the medical hospitality system. Precise waste collection and to protect the ward workers from air -borne disease and extend the market of computer vision applications in the field of precision hospital management. Starting from gathering images in order to create a website to monitor the bin status level by the combination of line follower and smart bin system.[14]

This method is a new approach in collection of waste from hospitals with an atomized system without any human interaction by network system and using automation. An embedded system is a microprocessor-based computer hardware system with software that is designed to perform a dedicated function, either as an

independent system or as a part of a large system. Complexities range from a single microcontroller to a suite of processors with connected peripherals and networks; from no user interface to complex graphical user

interfaces. The complexity of an embedded system varies significantly depending on the task for which it is designed. As much as 98 percent of all microprocessors manufactured are used in embedded systems.

A smart home represents the future of modern living, integrating advanced technology to enhance convenience, security, and energy efficiency. By using internet-connected devices like smart lights, thermostats, security cameras, and voice assistants, homeowners can control their living environment remotely via smartphones or voice commands.[23]

CHAPTER 2
LITERATURE SURVEY

2.1 Literature Survey:

[1] Guruprasad Hebbar (2016) the model is an automated light controller with a visitor counter system, using an AT mega 328 microcontroller and IR sensors to control room lights and track visitor numbers. The system increments or decrements the counter based on movement, displays the count on an LCD, and switches lights on or off accordingly, ensuring energy efficiency.

[2] Anjali Sinha, Arpita Singh et.al (2017) the model is an automatic room light controller with a visitor counter, designed to enhance resource efficiency and reduce human effort. It utilizes an ARM7 LPC2148 microcontroller, sensors, an LCD display, and a DC motor to automatically control room lights and count visitors accurately. The system ensures energy conservation by turning lights on/off based on occupancy and helps avoid congestion by displaying the number of people in the room.

[3] Jitesh Kumar (2018) the model is a smart lighting control system built around Arduino, infrared sensors, light sensors, and Wi-Fi connectivity, aiming to achieve energy efficiency.

[4] Vidyullatha (2018) the model is a microcontroller-based visitor counter and power-saving system that uses IR sensors, an LCD display, and a relay driver circuit to automate lighting control and energy efficiency. It is a power-saving system that uses a microcontroller (89S52) as its main component and is based on a visitor counter. Infrared (IR) sensors are included into the system to identify when people are entering or leaving a room.

[5] Dr. Binod Kr Choudhary et.al (2019) the model is a smart street lighting system that uses LED lights and automated control mechanisms to reduce energy consumption and improve efficiency by adjusting light intensity based on time of day and vehicle presence. It includes a feature to reduce light intensity after midnight to save energy.

[6] Ryan Greene, Sohail Anwar et.al (2019) the model is the microcontroller-based automated room light control system with a visitor counter, designed to achieve energy savings in green buildings. It uses infrared sensors to detect entry/exit, counts occupants, and controls lights automatically, turning them off when the room is empty. The microcontroller used as a CPU for this system is an MSP430G2553 ultra-low power mixed signal controller.

[7] ISLAM Md. Saidu, DEBNATH Sumon Chandra et.al (2021) the model used in the base paper is an energy saving smart light controlling system that divides a room into zones and uses light sensors, motion sensors, a relay with a driver unit, and an LCD display to automatically adjust light intensity based on occupancy and desired illumination levels.

[8] Prof. Narendra Kumar, Shivam Aggarwal et.al (2023) the model is system uses an IR sensor and microcontroller/Arduino Uno to detect human presence and control room lights, ensuring they are only activated when needed. It also counts occupants, enhancing functionality. The primary goal is to reduce power wastage by preventing lights from staying on in unoccupied rooms.

[9] Dr. Deepak Sonker et.al (2023) the model is an automatic room light control system using Arduino and a PIR sensor to manage lighting based on human presence, reducing energy consumption. The system, applicable in various settings like classrooms and garages, utilizes a PIR sensor to detect movement and a relay module to control lights efficiently.

[10] Neeta Karhadkar, Akshay Sutar et.al (2024) an Automatic Light System (ALS) using a microcontroller and ambient light sensors to create an energy-efficient, responsive lighting environment. The system dynamically adjusts artificial lighting based on Realtime data, optimizing illumination for user comfort and sustainability across residential, commercial, and industrial spaces.

2.2 Comparison of Literature reviews:

The comparison of Literature reviews tables as given below:

Refn. No.	Researcher Name	Research Work on	Methodology	Findings
1.	Guruprasad Hebbar (2016)	Automatic room light control based on visitor counter	AT mega 328-based system with IR sensors for automated light control and visitor counting.	Ensures energy efficiency by switching lights based on occupancy and displaying visitor counts.
2.	Anjali Sinha (2017)	Automatic Room Light Controller with Visitor Counter	ARM7-based automatic light controller with visitor counter using sensors and LCD.	Improves resource efficiency and reduces human effort by automating light control and counting visitors.
3.	Jitesh Kumar (2018)	Survey of Intelligent Lighting System	Smart lighting system using Arduino, IR sensors, light sensors, and Wi-Fi for energy efficiency.	Achieves energy savings through automated lighting control and connectivity.

4.	Vidyullatha (2018)	Visitor number-based electricity saving using sensors	Microcontroller-based visitor counter with IR sensors, LCD, and relay driver for power-saving.	Reduces energy consumption by automating lights based on occupancy.
5.	Dr. Binod Kr Choudhary (2019)	A Review Study of Intelligent Street Light System	Smart street lighting using LEDs and automated control to adjust intensity based on time and vehicle presence.	Saves energy by reducing light intensity after midnight.
6.	Ryan Green (2019)	Microcontroller Based Automatic Room Light Controller and Visitor Counter: Design and Construction	Microcontroller-based system with IR sensors for automated light control and visitor counting. Findings	Achieves energy savings in green buildings by turning lights off when rooms are empty.
7.	ISLAM Md. Saidul (2021)	An Energy-Efficient Microcontroller-Based Smart Light Controlling System	Zone-based smart lighting using light sensors, motion sensors, and relays for automatic adjustment.	Enhances energy efficiency by optimizing light based on occupancy and illumination needs.
8.	Prof. Narendra Kumar (2023)	Automatic room light system for power saving	IR sensor and Arduino-based system for detecting human presence and controlling lights.	Reduces power wastage by ensuring lights are only on when rooms are occupied.
9.	Dr. Deepak Sonker et.al (2023)	Automatic Lights using PIR Sensor	Arduino and PIR sensor-based system for automatic light control based on human presence.	Efficiently reduces energy consumption in various settings like classrooms and garages.
10.	Neeta Karhadkar (2024)	Automatic room light control based on visitor counter	Microcontroller and ambient light sensor-based system for dynamic lighting adjustment.	Optimizes illumination for user comfort and sustainability across multiple spaces.

Table 2.1 Comparison of Literature Reviews

2.3 Problem Identification:

Incorrect counting caused by sensor limitations and environmental interference, frequent false triggers from pets or moving objects wasting energy, and issues reliably differentiating between entries and exits especially if groups have present are some of the main issues that automatic room light controllers with visitor counters face. In addition, integrating these systems into complex smart home setting usually results in software bugs and network connectivity problems that damage overall reliability and user happiness.

CHAPTER 3
EXISTING SYSTEM

3.1 Existing System

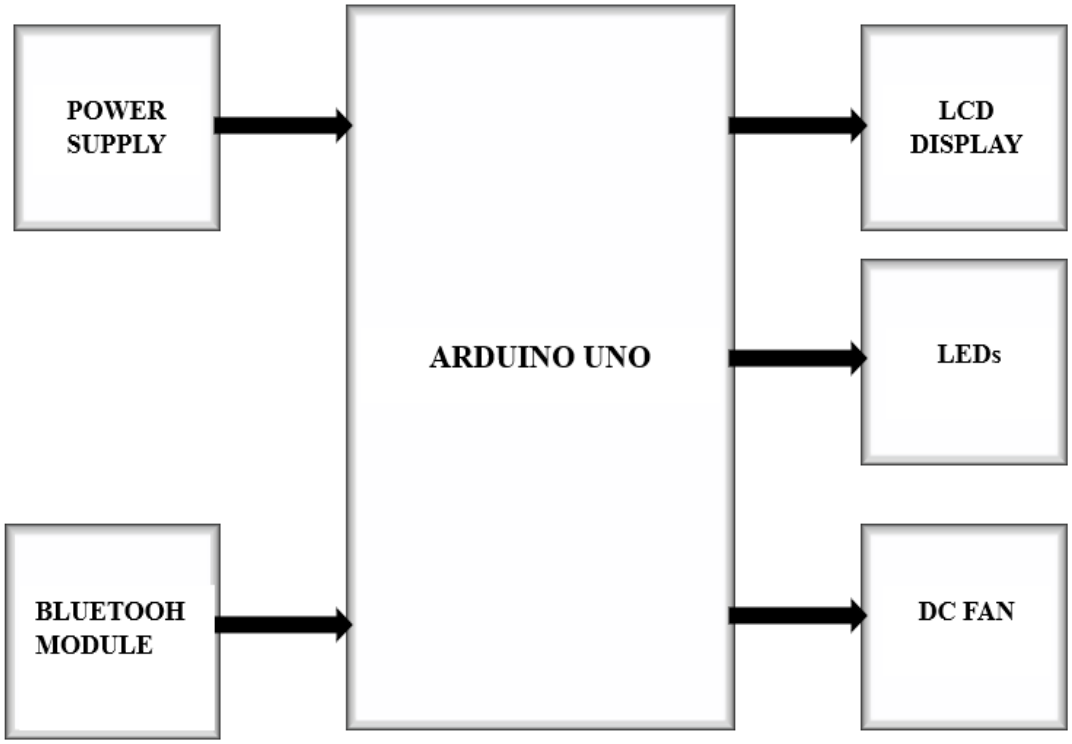


Fig.3.1 Block Diagram Existing System

Explanation:

- **Power Supply:** A device that converts AC power from the mains to DC power for electronic devices.
- **Bluetooth Module:** A small hardware component that enables wireless communication between devices using Bluetooth technology.
- **LCD (Liquid Crystal Display):** A type of display screen that uses liquid crystals to block or allow lights.
- **LED (Light Emitting Diode):** A semiconductor device that emits light when an electric current passes through it.
- **DC Fans:** Electric fans that use direct current (DC) power and are commonly used for cooling electronic devices.

3.2 Conventional Smart Home Automation System:

Construction of fully electro mated system The Arduino is open-source electronics prototyping platform based on flexible, easy-to-use hardware and software. The Arduino microcontroller board having 28 digital input/output pins. Low voltage switching relays were used to integrate the devices with the Arduino

for demonstrating the switching functionality in this proposed project a mobile app is created and it includes all the features of controlling the home appliances with the help of speech recognition and inter connectivity of devices. The mobile app that is created, contains all the commands like switching on/off the AC, Fan, Washing machine, etc. Thus, this concept basically contains the smart appliances in a home that can be controlled by Bluetooth and connected wirelessly with the mobile phones. The mobile app in the mobile phone will be containing the options to give different commands to the appliances and controlling it with our mobile app. The main page of the app will be having the login page that will be used to authenticate the user using the IP Address and the password. After successful login the user will be able to control all the appliances with the mobile app and the voice recognition.

Technology is a never-ending process. To be able to design a product using the current technology that will be beneficial to the lives of others is a huge contribution to the community. The presents the design and implementation of a low cost but yet flexible and secure cell phone-based home automation system. The design is based on a standalone Arduino BT board and the home appliances are connected to the input/ output ports of this board via relays. The communication between the cell phone and the Arduino BT board is wireless. This system is designed to be low cost and scalable allowing variety of devices to be controlled with minimum changes to its core. Password protection is being used to only allow authorized users from accessing the appliances at home.

3.3 Draw backs :

Bluetooth-based home automation systems, while offering convenience, have drawbacks like limited range, potential interference, security vulnerabilities, and cost, requiring careful consideration before implementation.

CHAPTER 4
PROPOSED SYSTEM

4.1 Proposed System

As we enter the twenty first century, the transaction among individuals and pc is breaking vintage confinements and coming into another domain. Inside the massively innovation driven worldwide of these days' phones have develop as a piece of our ways of life. Cell phones are not simply discussion device. Our endeavour attempts to infer arrangements furnishing better oversee on local machine with assistance of cell phone. The current contraption incorporates substantially machines in our home which can be been controlled through switches. Those gadgets can be turned ON and OFF physically at whatever point needed. This contraption is substantially less verified and subject to electric threats. Likewise, the wastage of vitality tends to a central point of subject.

The proposed task is considered systems administration our cell mobile to all machines through a smart trustworthiness circuit. The proposed gadget incorporates astute practical insight Circuit associated with the home hardware. Notoriety of every single home apparatus may be made do with the guide of buyer from distant with help of individual's cell phone Our endeavour attempts to infer arrangements furnishing better oversee on local machine with assistance of cell phone. The current contraption incorporates substantially machines in our home which can be been controlled through switches. Those gadgets can be turned ON and OFF physically at whatever point needed. This contraption is substantially less verified and subject to electric threats. Likewise, the wastage of vitality tends to a central point of subject.

The proposed gadget incorporates astute practical insight Circuit associated with the home hardware. Notoriety of every single home apparatus may be made do with the guide of buyer from distant with help of individual's cell phone.

4.2 Block Diagram

Fig.4.1 Block Diagram Proposed System

The visitor counter with load controller operates in such a way first we need to position IR Sensor A at the entry point and IR Sensor B at the exit point. The sensors are connected to the digital pins of Arduino UNO. When someone enters the room the (IR sensor-A) will get Triggered and sends the output value to the arduino. Then arduino read the value and count +1 as it programmed also sends the signal to the relay module connected to its another digital pins which will get triggered and leads to turning on lights and fans inside the room. Likewise, when IR Sensor A detects an additional visitor, the Arduino increases the count by one. This process continues, with the Arduino adding one to the total each time a visitor enters the room, thereby calculating the number of incoming visitors.

Similarly, when the visitors leave the room from the exit gate, equipped with IR Sensor B, detects any obstacles get triggered and sends the output to arduino. Then the arduino increment the number of exiting visitors count from this gate by +1. Each time a visitor exits the room; the Arduino increases the count by one and calculates the total number of occupants by subtracting the number of exiting visitors from the total number of entering visitors. When the count of individuals inside the room reaches zero, the Arduino sends a signal to a relay, which then turns off the lights and fan in the room.

4.3 Algorithm:

- Initialization: Initialize the number of visitors to 0, Initialize all the devices such as IR sensors, light, fan, and LCD.
- Counting logic.
- Whenever the entry sensor will be activated then visitor count will get increment.
- Whenever the exit sensor will be activated then visitor count will get decremented.
- The updated count will be shown on the LCD.
- Control logic
- If Visitor count is greater than 0 then turn ON the light.
- If the visitor count is above a predefined limit (e.g. 3 people), turn on fan.
- If visitor count is 0, turn off light and fan.

In our project, we have used multiple sensors IR sensor which is used to detect the human motion, LDR sensor which is used detect the light. All these sensors are connected to the main microcontroller which is Arduino UNO as shown in the above fig. The loads are connected to 2-channel relay. All the sensor output are sent to Arduino All the counted and calculated data regarding visitors in the room is transmitted to an LCD display. The LCD shows the total number of individuals entering the room, those exiting, and the current number of visitors present. The entire system is powered by a switched-mode power supply (SMPS), which converts 230V AC into a 5V, 5A DC supply.

4.4 Flow chart

The system can be used in classroom to automatically control lights and fans based on the number of students in class room. Monitor and manage energy usage in office space. Ensure that devices are only on when visitors are present, saving energy in homes.

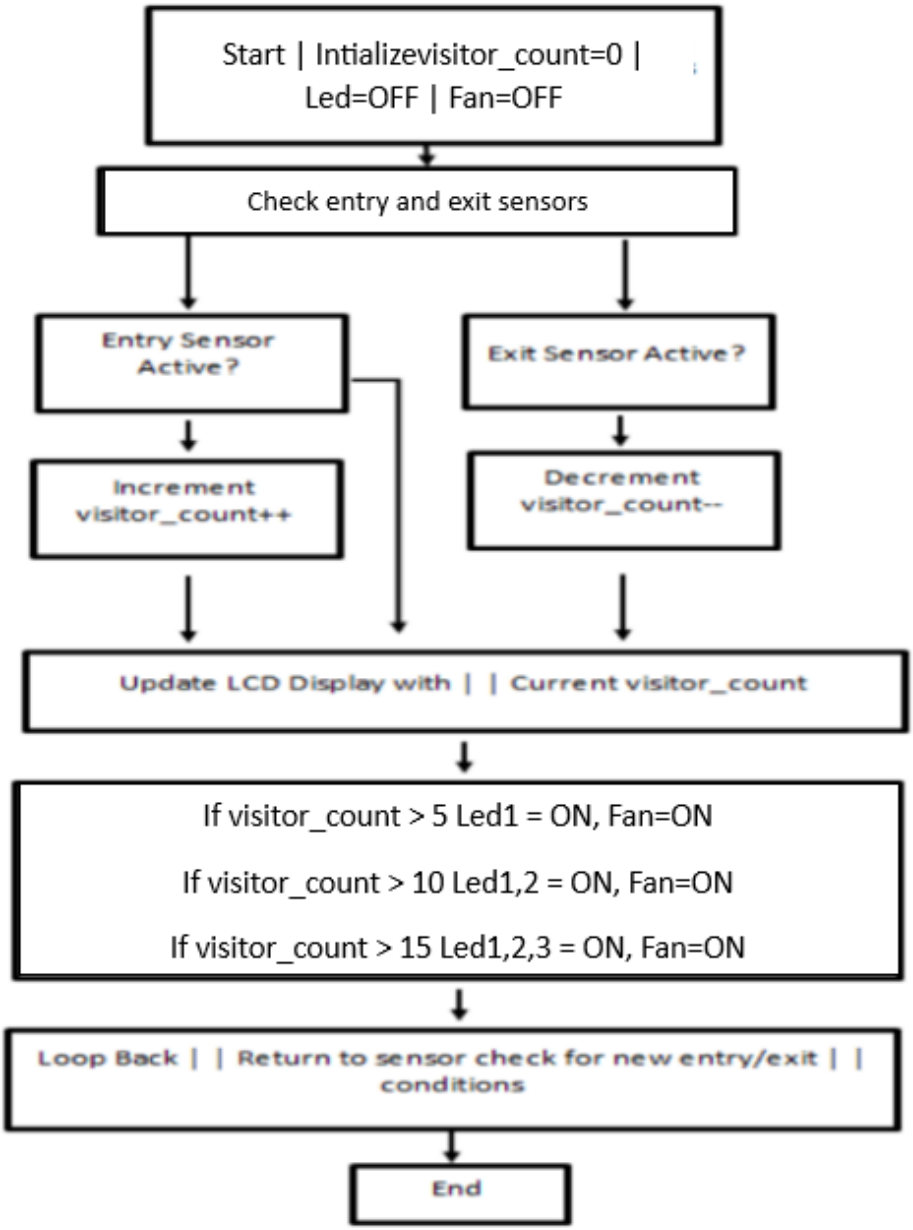


Fig.4.2 Flow Chart

4.5 Arduino Microcontroller:

The Arduino UNO is a widely used open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is 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 board features 14 Digital pins and 6 Analog pins. It is programmable with the Arduino IDE (Integrated Development Environment) via a type B USB cable.[4] It can be powered by a USB cable or by an external 9 volt battery, though it accepts voltages between 7 and 20 volts. It is also similar to the Arduino Nano and Leonardo. The hardware reference design is distributed under a Creative Commons Attribution Share-Alike 2.5 license and is available on the Arduino website.

Layout and production files for some versions of the hardware are also available. "Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0 The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform. The ATmega328 on the Arduino Uno comes preprogrammed with a bootloader that allows uploading new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol. The Uno also differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

4.5.1 Background

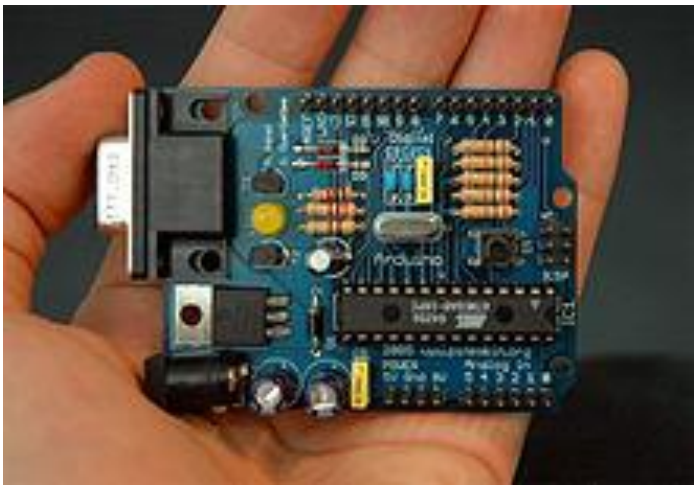


Fig.4.3 Arduino Controller

The Arduino project started at the Interaction Design Institute Ivrea (IDII) in Ivrea, Italy. At that time, the students used a BASIC Stamp microcontroller at a cost of $100, a considerable expense

for many students. In 2003 Hernando Barragán created the development platform Wiring as a Master's thesis project at IDII, under the supervision of Massimo Banzi and Casey Reas, who are known for work on the Processing language. The project goal was to create simple, low-cost tools for creating digital projects by non-engineers. The Wiring platform consisted of a printed circuit board (PCB) with an ATmega168 microcontroller, an IDE based on Processing and library functions to easily program the microcontroller.

In 2003, Massimo Banzi, with David Mellis, another IDII student, and David Cuartielles, added support for the cheaper ATmega8 microcontroller to Wiring. But instead of continuing the work on Wiring, they forked the project and renamed it Arduino. Early arduino boards used the FTDI USB-to-serial driver chip and an ATmega168. The Uno differed from all preceding boards by featuring the ATmega328P microcontroller and an ATmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

4.5.2 Technical Specifications:

- Microcontroller: Microchip ATmega328P
- Operating Voltage: 5 Volt
- Input Voltage: 7 to 20 Volts
- Digital I/O Pins: 14 (of which 6 provide PWM output)
- Analog Input Pins: 6
- DC Current per I/O Pin: 20 mA
- DC Current for 3.3V Pin: 50 mA
- Flash Memory: 32 KB of which 0.5 KB used by bootloader
- SRAM: 2 KB
- EEPROM: 1 KB
- Clock Speed: 16 MHz
- Length: 68.6 mm
- Width: 53.4 mm
- Weight: 25 g

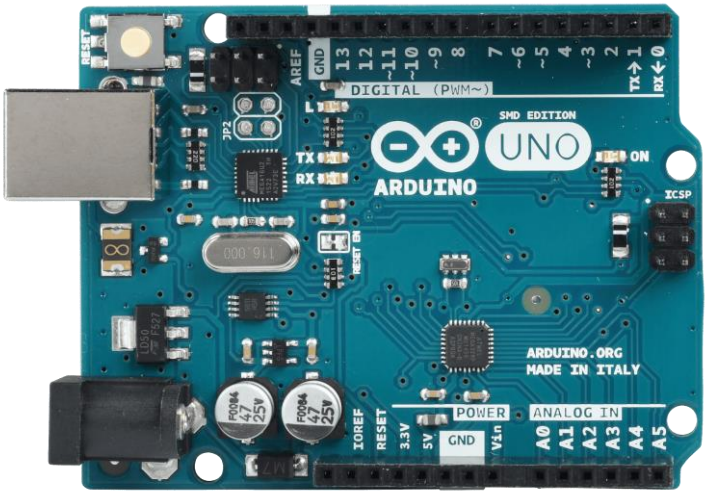


Fig.4.4 Arduino UNO Pins

4.5.3 General Pin functions:

- **LED:** There is a built-in LED driven by digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.
- **VIN:** The input voltage to the Arduino/Genuino 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.
- **5V:** This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 20V), the USB connector (5V), or the VIN pin of the board (7-20V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage the board.
- **3V3:** A 3.3-volt supply generated by the on-board regulator. Maximum current draw is 50 mA.
- **GND:** Ground pins.
- **IOREF:** This pin on the Arduino/Genuino board provides the voltage reference with which the microcontroller operates. A properly configured shield can read the IOREF pin voltage and select the appropriate power source or enable voltage translators on the outputs to work with the 5V or 3.3V.
- **Reset:** Typically used to add a reset button to shields which block the one on the board.[7]

4.5.4 Special Pin Functions:

Each of the 14 digital pins and 6 Analog pins on the Uno can be used as an input or output, using pinMode (), digitalWrite (), and digitalRead () functions. They operate at 5 volts. Each pin can provide or receive 20 mA as recommended operating condition and has an internal pull-up resistor (disconnected by default) of 20-50k ohm. A maximum of 40mA is the value that must not be exceeded on any I/O pin to avoid permanent damage to the microcontroller. The Uno has 6 analog inputs, labelled A0 through A5, each of which provide 10 bits of resolution (i.e. 1024 different values). By default, they measure from

ground to 5 volts, though is it possible to change the upper end of their range using the AREF pin and the analogReference () function.

In addition, some pins have specialized functions:

1. **Serial:** pins 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip.
2. **External Interrupts:** pins 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.
3. **PWM (Pulse Width Modulation):** 3, 5, 6, 9, 10, and 11 Can provide 8-bit PWM output with the analogWrite() function.
4. **SPI (Serial Peripheral Interface):** 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication using the SPI library.
5. **TWI (Two Wire Interface):** A4 or SDA pin and A5 or SCL pin. Support TWI communication using the Wire library.
6. **AREF (Analog Reference**): Reference voltage for the analog inputs.

4.5.5 Communication:

The Arduino Uno has a number of facilities for communicating with a computer, another Arduino board, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The 16U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, a .inf file is required. The Arduino Software (IDE) includes a serial monitor which allows simple textual data to be sent to and from the board. T

The RX and TX LEDs on the board will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computer (but not for serial communication on pins 0 and 1). A SoftwareSerial.h library allows serial communication on any of the Uno's digital pins.

4.5.6 Automatic (Software) Reset:

Rather than requiring a physical press of the reset button before an upload, the Arduino/Genuino Uno board is designed in a way that allows it to be reset by software running on a connected computer. One of the hardware flow control lines (DTR) of the ATmega8U2/16U2 is connected to the reset line of the ATmega328 via a 100 nano-farad capacitor. When this line is asserted (taken low), the reset line drops long enough to reset the chip.

This setup has other implications. When the Uno is connected to either a computer running Mac OS X or Linux, it resets each time a connection is made to it from software (via USB). For the following half-second or so, the bootloader is running on the Uno. While it is programmed to ignore malformed data (i.e. anything

besides an upload of new code), it will intercept the first few bytes of data sent to the board after a connection is opened.

4.5.7 Features:

- High-performance, Low-power AVR® 8-bit Microcontroller.
- Advanced RISC Architecture.
    - 131 Powerful Instructions – Most Single-clock Cycle Execution.
    - 32 x 8 General Purpose Working Registers.
    - Fully Static Operation.
    - Up to 16 MIPS Throughput at 16 MHz
    - On-chip 2-cycle Multiplier.
- High Endurance Non-volatile Memory segments
    - 32K Bytes of In-System Self-programmable Flash program memory.
    - 1024 Bytes EEPROM.
    - 2K Byte Internal SRAM.
    - Write/Erase Cycles: 10,000 Flash/100,000 EEPROM.
    - Data retention: 20 years at 85°C/100 years at 25°C.
    - Optional Boot Code Section with Independent Lock Bits In-System Programming by On-chip Boot Program True Read-While-Write Operation.
    - Programming Lock for Software Security.
- JTAG (IEEE std. 1149.1 Compliant) Interface
    - Boundary-scan Capabilities According to the JTAG Standard.
    - Extensive On-chip Debug Support.
    - Programming of Flash, EEPROM, Fuses, and Lock Bits through the JTAG Interface
- Peripheral Features
    - Two 8-bit Timer/Counters with Separate Prescalers and Compare Modes.
    - One 16-bit Timer/Counter with Separate Prescaler, Compare Mode, and Capture Mode
- Capture Mode
    - Real Time Counter with Separate Oscillator
    - Four PWM Channels
    - 8-channel, 10-bit ADC
    - 8 Single-ended Channels
    - 7 Differential Channels in TQFP Package Only

  - 2 Differential Channels with Programmable Gain at 1x, 10x, or 200x
  - Byte-oriented Two-wire Serial Interface
  - Programmable Serial USART
  - Master/Slave SPI Serial Interface
  - Programmable Watchdog Timer with Separate On-chip Oscillator
  - On-chip Analog Comparator
- Special Microcontroller Features
  - Power-on Reset and Programmable Brown-out Detection
  - Internal Calibrated RC Oscillator
  - External and Internal Interrupt Sources
  - Six Sleep Modes: Idle, ADC Noise Reduction, Power-save, Power-down, Standby and Extended Standby
- I/O and Packages
  - 32 Programmable I/O Lines
  - 40-pin PDIP, 44-lead TQFP, and 44-pad QFN/MLF
- Operating Voltages
  - 2.7 - 5.5V for ATmega32L
  - 4.5 - 5.5V for ATmega32
- Speed Grades
  - 0 - 8 MHz for ATmega32L
  - 0 - 16 MHz for ATmega32
- Power Consumption at 1 MHz, 3V, 25°C for ATmega32L
  - Active: 1.1 mA
  - Idle Mode: 0.35 mA
  - Power-down Mode: < 1 μA

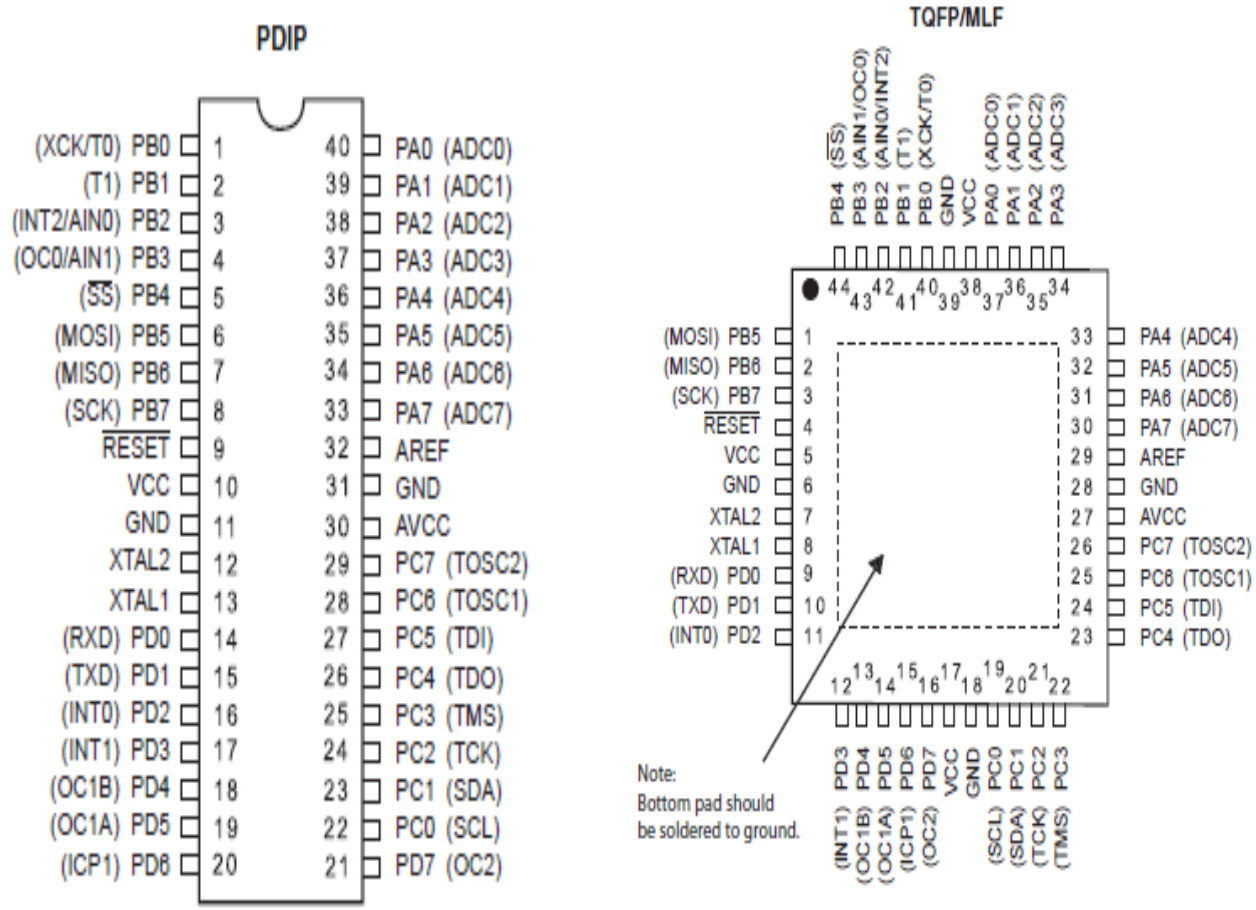


Fig.4.5 Pin Configurations

4.5.8 Pin Configurations:

1. **AVR CPU core:**

The ATmega32 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega32 achieves throughputs approaching 1 MIPS per MHz allowing the system designer to optimize power consumption versus processing speed.

The AVR core combines a rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in one single instruction executed in one clock cycle. The resulting architecture is more code efficient while achieving throughputs up to ten times faster than conventional CISC microcontrollers.

he AVR CPU core in the Arduino Uno, built around the ATmega328P microcontroller, is an efficient and well-optimized 8-bit RISC processor designed for embedded applications. Its Harvard architecture, featuring separate program (Flash) and data (SRAM) memory spaces, enhances performance by allowing simultaneous instruction fetching and data access. With a 16 MHz clock

speed, 32 general-purpose registers, and single-cycle execution for most instructions, the AVR core delivers a good balance of speed and power efficiency, making it ideal for real-time control and sensor-based projects.

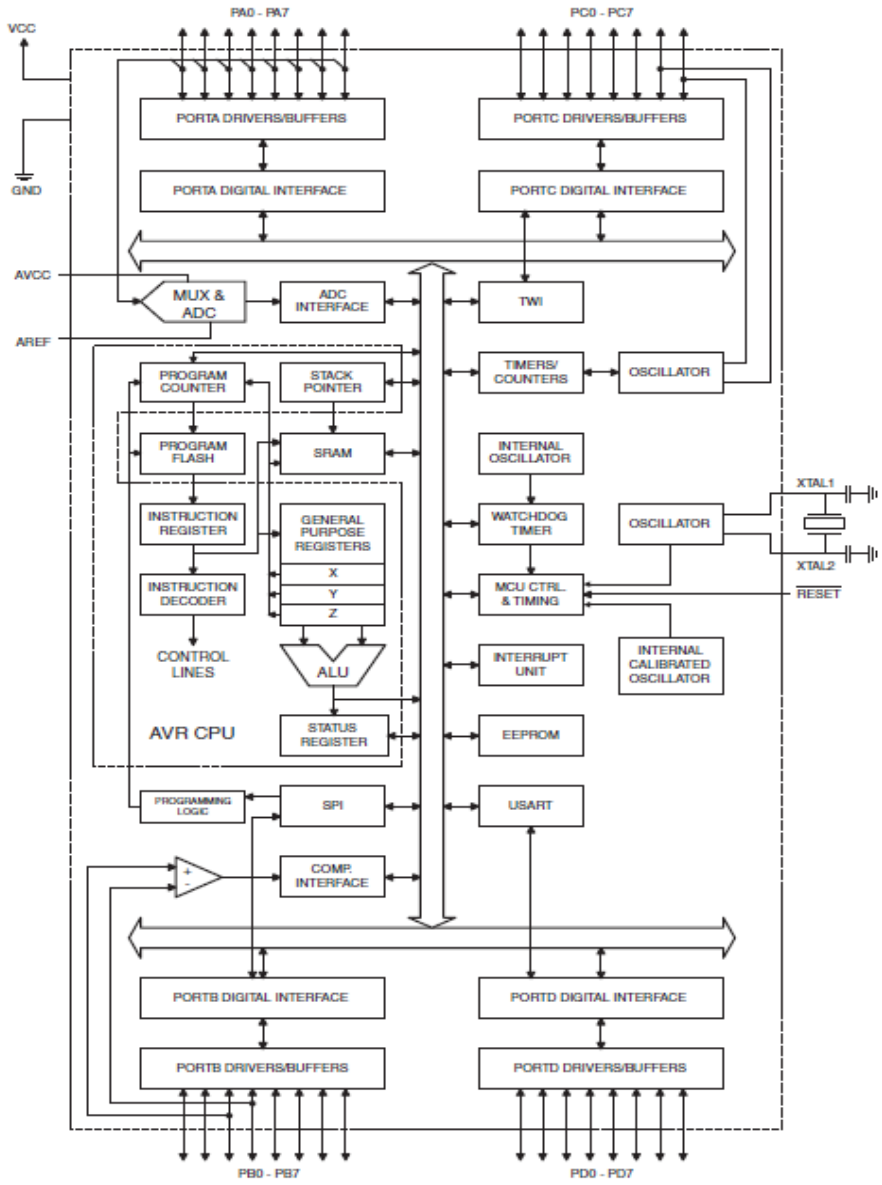


Fig.4.6 Internal Architecture

2. GND Ground:

- Port A (PA7.PA0) Port A serves as the analog inputs to the A/D Converter.
- Port A also serves as an 8-bit bi-directional I/O port, if the A/D Converter is not used. Port pins can provide internal pull-up resistors (selected for each bit). The Port A output buffers have symmetrical drive characteristics with both high sink and source capability. When pins PA0 to

PA7 are used as inputs and are externally pulled low, they will source current if the internal pull-up resistors are activated. The Port A pins are tri-stated when a reset condition becomes active, even if the clock is not running.

- Port B (PB7.PB0) Port B is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port B output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port B pins that are externally pulled low will source current if the pull-up resistors are activated. The Port B pins are tri-stated when a reset condition becomes active, even if the clock is not running.
- Port C (PC7.PC0) Port C is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port C output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port C pins that are externally pulled low will source current if the pull-up resistors are activated. The Port C pins are tri-stated when a reset condition becomes active, even if the clock is not running.
- If the JTAG interface is enabled, the pull-up resistors on pins PC5(TDI), PC3(TMS) and PC2(TCK) will be activated even if a reset occurs.
- The TD0 pin is tri-stated unless TAP states that shift out data are entered.
- Port C also serves the functions of the JTAG interface.
- Port D (PD7.PD0) Port D is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port D output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port D pins that are externally pulled low will source current if the pull-up resistors are activated. The Port D pins are tri-stated when a reset condition becomes active, even if the clock is not running.
- RESET Input. A low level on this pin for longer than the minimum pulse length will generate a reset, even if the clock is not running
- XTAL1 Input to the inverting Oscillator amplifier and input to the internal clock operating circuit.
- XTAL2 Output from the inverting Oscillator amplifier.
- AVCC is the supply voltage pin for Port A and the A/D Converter. It should be externally connected to VCC, even if the ADC is not used. If the ADC is used, it should be connected to VCC through a low-pass filter.
- AREF is the analog reference pin for the A/D Converter.

3. Registers AVR Core:

In order to maximize performance and parallelism, the AVR uses a Harvard architecture – with separate memories and buses for program and data. Instructions in the program memory are executed with a single level pipelining. While one instruction is being executed, the next instruction is pre-fetched from the program memory. This concept enables instructions to be executed in every clock cycle.

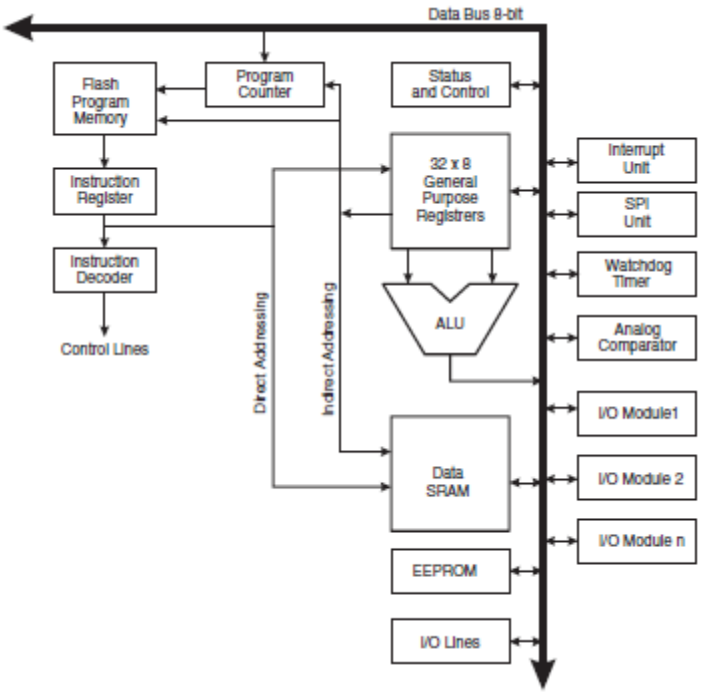


Fig.4.7 AVR Core

CHAPTER 5
HARDWARE COMPONENTS

5.1 Power Supply:

Power supply is a reference to a source of electrical power. A device or system that supplies electrical or other types of energy to an output load or group of loads is called a power supply unit or PSU. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others

This power supply section is required to convert AC signal to DC signal and also to reduce the amplitude of the signal. The available voltage signal from the mains is 230V/50Hz which is an AC voltage, but the required is DC voltage (no frequency) with the amplitude of +5V and +12V for various applications.

In this section we have Transformer, Bridge rectifier, are connected serially and voltage regulators for +5V and +12V (7805 and 7812) via a capacitor (1000µF) in parallel are connected parallel as shown in the circuit diagram below. Each voltage regulator output is again is connected to the capacitors of values (100µF, 10µF, 1 µF, 0.1 µF) are connected parallel through which the corresponding output (+5V or +12V) are taken into consideration.

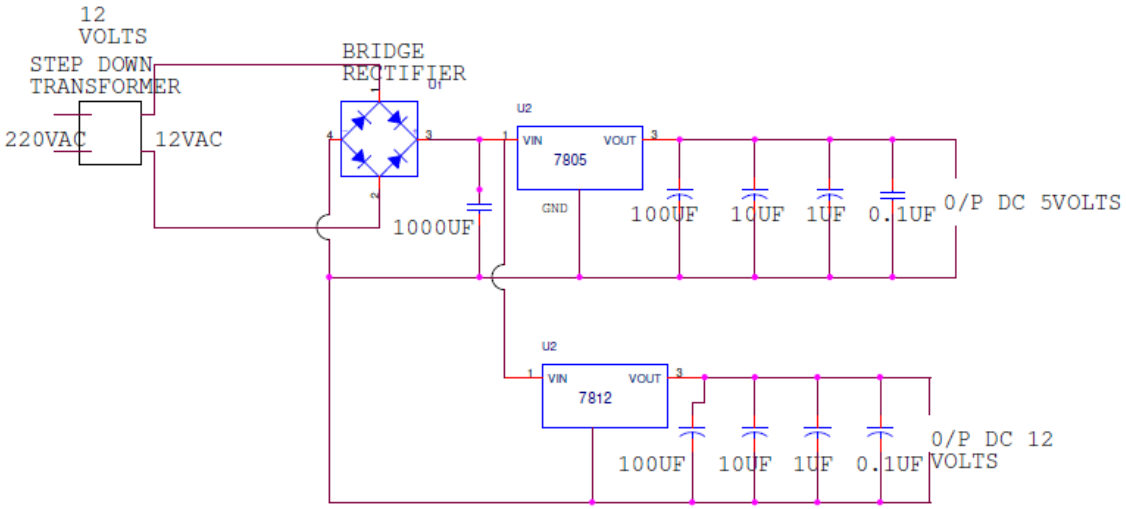


Fig.5.1 Circuit Diagram

5.1.1 Circuit Explanation:

1.Transformer:

A transformer is a device that transfers electrical energy from one circuit to another through inductively coupled electrical conductors. A changing current in the first circuit (the primary) creates

$$\frac{V_S}{V_P} = \frac{N_S}{N_P}$$

a changing magnetic field; in turn, this magnetic field induces a changing voltage in the second circuit (the secondary). By adding a load to the secondary circuit, one can make current flow in the transformer, thus transferring energy from one circuit to the other.

The secondary induced voltage V_S, of an ideal transformer, is scaled from the primary V_P by a factor equal to the ratio of the number of turns of wire in their respective windings:

The transformer is based on two principles: firstly, that an electric current can produce a magnetic field (electromagnetism) and secondly that a changing magnetic field within a coil of wire induces a voltage across the ends of the coil (electromagnetic induction). By changing the current in the primary coil, it changes the strength of its magnetic field; since the changing magnetic field extends into the secondary coil, a voltage is induced across the secondary.

A simplified transformer design is shown below. A current passing through the primary coil creates a magnetic field. The primary and secondary coils are wrapped around a core of very high magnetic permeability, such as iron; this ensures that most of the magnetic field lines produced by the primary current are within the iron and pass through the secondary coil as well as the primary coil.

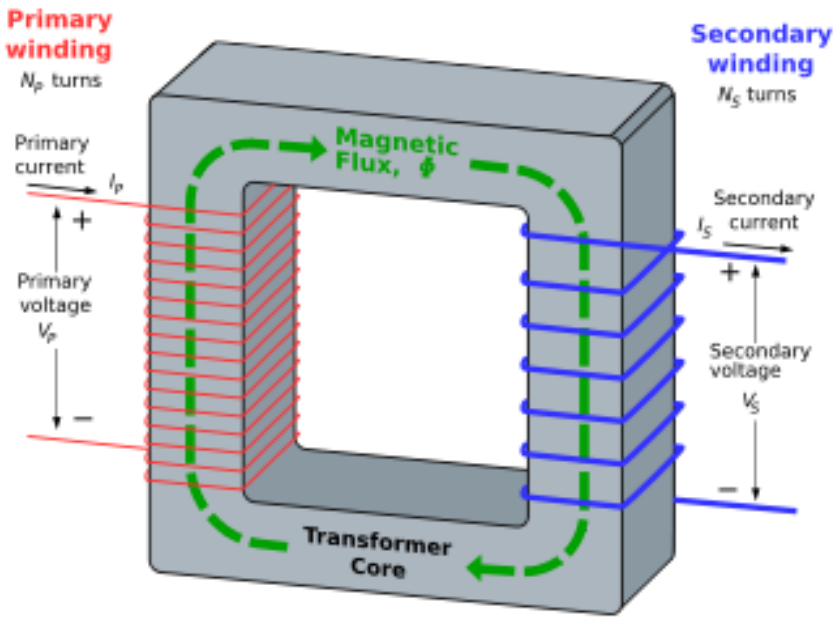


Fig.5.2 ideal step-down transformer an ideal step-down transformer showing magnetic flux in the core

The voltage induced across the secondary coil may be calculated from Faraday's law of induction, which states that:

$$V_S = N_S \frac{\mathrm{d}\Phi}{\mathrm{d}t}$$

Where V_S is the instantaneous voltage, N_S is the number of turns in the secondary coil and Φ equals the magnetic flux through one turn of the coil. If the turns of the coil are oriented perpendicular to the magnetic field lines, the flux is the product of the magnetic field strength B and the area A through which it cuts. The area is constant, being equal to the cross-sectional area of the transformer core, whereas the magnetic field varies with time according to the excitation of the primary. Since the same magnetic flux passes through both the primary and secondary coils in an ideal transformer, the instantaneous voltage across the primary winding equals.

$$V_P = N_P \frac{\mathrm{d}\Phi}{\mathrm{d}t}$$

Taking the ratio of the two equations for V_S and V_P gives the basic equation for stepping up or stepping down the voltage

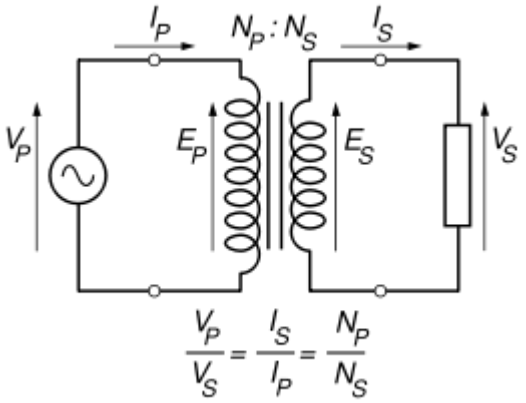
$$\frac{V_S}{V_P} = \frac{N_S}{N_P}$$

If the secondary coil is attached to a load that allows current to flow, electrical power is transmitted from the primary circuit to the secondary circuit. Ideally, the transformer is perfectly efficient; all the incoming energy is transformed from the primary circuit to the magnetic field and into the secondary circuit. If this condition is met, the incoming electric power must equal the outgoing power.

$$P_{incoming} = I_P V_P = P_{outgoing} = I_S V_S$$

Giving the ideal transformer equation

$$\frac{V_S}{V_P} = \frac{N_S}{N_P} = \frac{I_P}{I_S}$$



Giving the ideal transformer equation

$$\frac{V_S}{V_P} = \frac{N_S}{N_P} = \frac{I_P}{I_S}$$

If the voltage is increased (stepped up) ($V_S > V_P$), then the current is decreased (stepped down) ($I_S < I_P$) by the same factor. Transformers are efficient so this formula is a reasonable approximation.

If the voltage is increased (stepped up) ($V_S > V_P$), then the current is decreased (stepped down) ($I_S < I_P$) by the same factor. Transformers are efficient so this formula is a reasonable approximation.

The impedance in one circuit is transformed by the square of the turn's ratio. For example, if an impedance Z_S is attached across the terminals of the secondary coil, it appears to the primary circuit to have an impedance of

$$Z_S\left(\frac{N_P}{N_S}\right)^2$$

This relationship is reciprocal, so that the impedance Z_P of the primary circuit appears to the secondary to be

$$Z_P\left(\frac{N_S}{N_P}\right)^2$$

5.2 IR Sensor:

An infrared sensor is an electronic device, that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measure only infrared radiation, rather than emitting it that is called as a passive IR sensor.

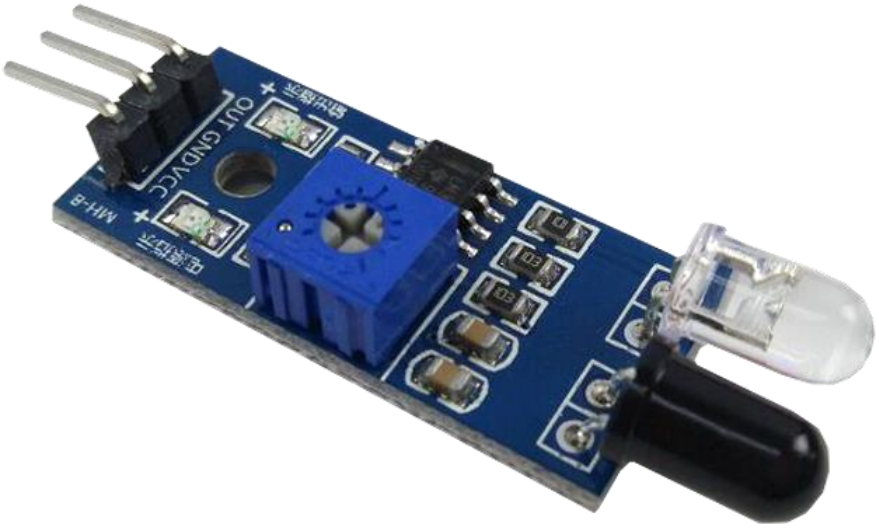


Fig.5.3 IR Sensor

An infrared sensor is an electronic device, that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measure only infrared radiation, rather than emitting it that is called as a passive IR sensor. Usually in the infrared spectrum, all the objects radiate some form of thermal radiations. These types of radiations are invisible to our eyes, that can be detected by an infrared sensor. The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, The resistances and these output voltages, change in proportion to the magnitude of the IR light received.

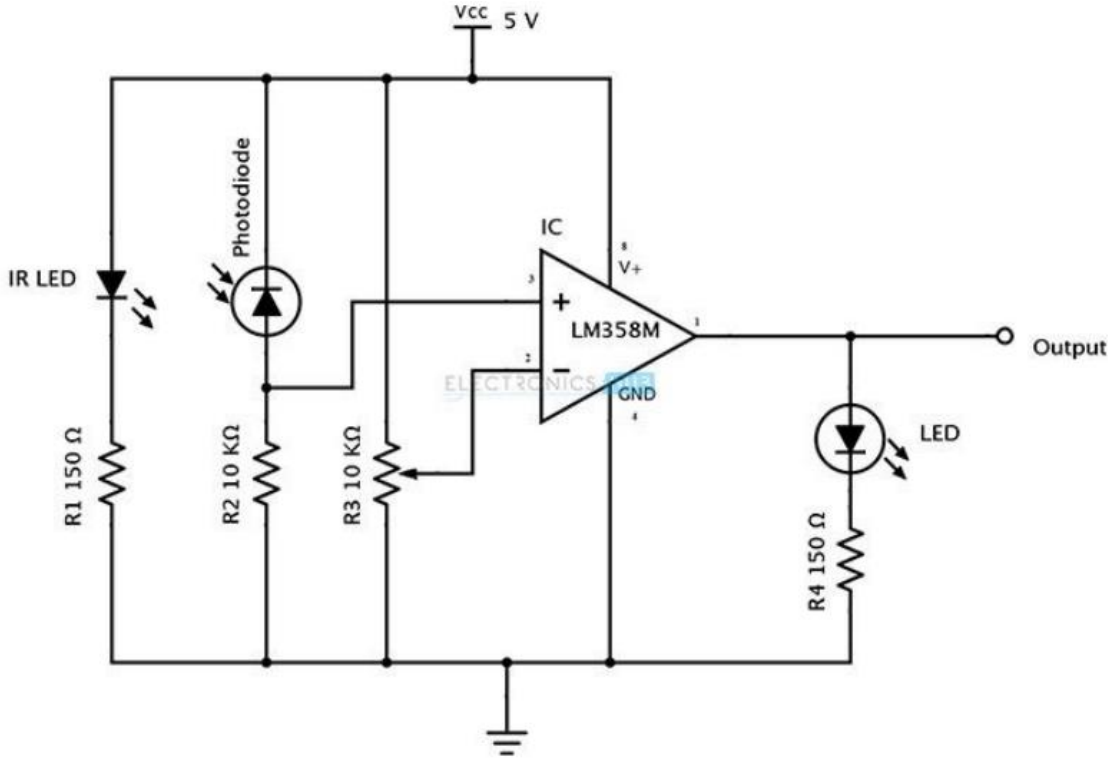


Fig.5.4 Circuit Diagram

- **Features:**
  - Input voltage: 3.3v
  - Output: analog

5.3 Light Dependent Resister (LDR):

An image resistor or CDS (Cadmium Sulphide) cell is a resistor that decreases resistance with increasing strength of incident light. It can be named a photo controller as well. A high-resistance semiconductor is constructed of a photo resistor. When the light on the unit is of adequate frequence, semi-conductor absorbed photons provide the bound electrons with sufficient energy to spring into the conduction band. Electricity is performed through the resulting free electron (and its hole partner), thereby minimising resistance.

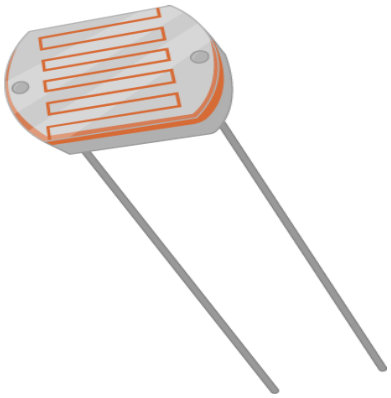


Fig.5.5 LDR Sensor

An intrinsic or extrinsic photoelectric system may be used. A semiconductor intrinsically requires its own charging carriers and is not a semiconductor that is effective such as silicone. The only electrons that are accessible in intrinsically are in the valence range, because the photon requires ample energy to excite the electron through the range distance. Extrinsic systems have impurities, often called dopants, which have ground state energy near to the conduction band, which are inadequate to activate the system because electrons have not so far to sail. If a silicone sample has phosphorus atoms substituted by its atoms (impurities), additional electrons would be required for conduction. This is an example of a semiconductor extrinsic.

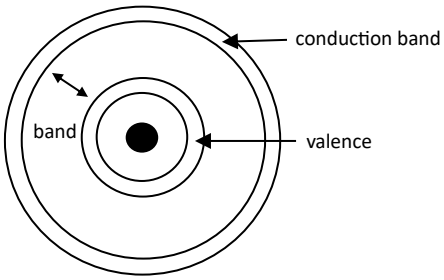


Fig.5.6 Sensor Layers

Cadmium sulphide cells:

Cadmium sulphide cells rely on the capacity of the material to vary its tolerance to the amount of cell light. The sun, the less resistance strikes the cell. While unreliable, a large range of resistors will rank from below 100 livres in light to more than 10 metres in darkness even with a simple C cell. Normal LDRs with cadmium differ according to light, but standard fall times vary between 15ms and 25ms, standard rise times between 50ms and 70ms, such that data links and imagery scanning cannot operate. The most prominent LDR is undoubtedly the ORP12. Today's more common are smaller, cheaper devices. A sample LDR light sensor circuit:

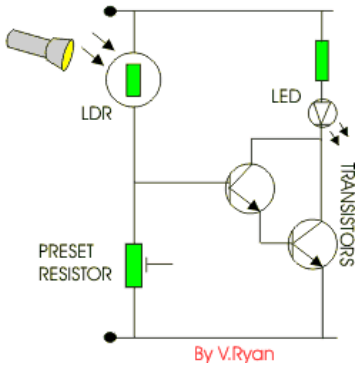


Fig.5.7 Sample LDR light sensor circuit

The resistance of the LDR is strong while the light level is poor. This inhibits the transfer of current to the transistor foundation. The Lead would not light however. However. However, the resistance decreases as light reflects through the LDR and the current fluctuates in the base of the first transistor and the second transistor. The lamps on the LED. It is possible to switch the preset resistor up or down to raise or decrease resistance, rendering the circuit more or less receptive. Applications: Applications: In several different forms, picture resistors arrive. In several consumer goods including camera light metres, radios of the clock, fire detectors, street light and exterior clocks unfavourable cadmium sulphide cells can be contained.

5.4 LED Lights:

Light Emitting Diodes (LEDs) are semiconductor devices that emit light when an electric current passes through them. They are highly energy-efficient and have a longer lifespan compared to traditional lighting. LEDs work on the principle of electroluminescence, where electrons recombine with electron holes, releasing energy as photons. This technology has revolutionized lighting in various industries.

LEDs are available in different colours, including red, green, blue, and white, making them versatile for multiple applications. Their compact size allows them to be used in displays, indicators, and even large screens. Unlike incandescent bulbs, LEDs produce very little heat, reducing energy waste. They are also environmentally friendly, as they contain no harmful chemicals like mercury.

The use of LEDs has expanded beyond lighting to include TVs, smartphones, traffic signals, and automotive lighting. Their low power consumption makes them ideal for portable and battery-operated devices. Advances in LED technology have led to the development of smart lighting systems with adjustable brightness and colour. This adaptability has made LEDs a preferred choice for modern lighting solutions.

Fig.5.8 LED Light

5.5 DC Motors:

Vehicle Unit According to the process, every vehicle must have a vehicle unit. The vehicle unit is made up of A DC motor with gear box attached to the shaft, which is mechanically commutated electric motor powered from direct current (DC). Generally used in DIY projects, Battery operated toys, Radio controlled vehicles, Robotic projects etc. DC motors consist of one set of coils, called armature winding, inside another set of coils or a set of permanent magnets, called the stator. Applying a voltage to the coils produces a torque in the armature, resulting in motion. It contains three major parts

1. Stator
2. Rotor
3. Winding

5.5.1 CONSTRUCTION:

DC motors consist of one set of coils, called armature winding, inside another set of coils or a set of permanent magnets, called the stator. Applying a voltage to the coils produces a torque in the armature, resulting in motion.

- **STATOR:**
  - The stator is the stationary outside part of a motor.
  - The stator of a permanent magnet dc motor is composed of two or more permanent magnet pole pieces.
  - The magnetic field can alternatively be created by an electromagnet. In this case, a DC coil (field winding) is wound around a magnetic material that forms part of the stator.
- **ROTOR:**
  - The rotor is the inner part which rotates.
  - The rotor is composed of windings (called armature windings) which are connected to the external circuit through a mechanical commutator.
  - Both stator and rotor are made of ferromagnetic materials. The two are separated by air gap.
- **WINDING:** A winding is made up of series or parallel connection of coils.
  - Armature winding - The winding through which the voltage is applied or induced.
  - Field winding - The winding through which a current is passed to produce flux (for the electromagnet)
  - Windings are usually made of copper.

- **SPECIFICATIONS:**
  - Permanent Magnet DC Gear Motor BO (Battery Operated)
  - Volt: DC 3-9V
  - SPEED(RPM): 60RPM+-10% (no load)
  - Torque:0.5Kg-cm
  - Current: 0.01A(no load);0.07A (at max. eff.)
  - Protect Feature: Enclosed
  - Speed: Constant Speed
  - Function: Control
  - Mounting type: Horizontal or Vertical

5.5.2 PRINCIPLE OF OPERATION:

Consider a coil in a magnetic field of flux density B (figure 4). When the two ends of the coil are connected across a DC voltage source, current I flow through it. A force is exerted on the coil as a result of the interaction of magnetic field and electric current. The force on the two sides of the coil is such that the coil starts to move in the direction of force.

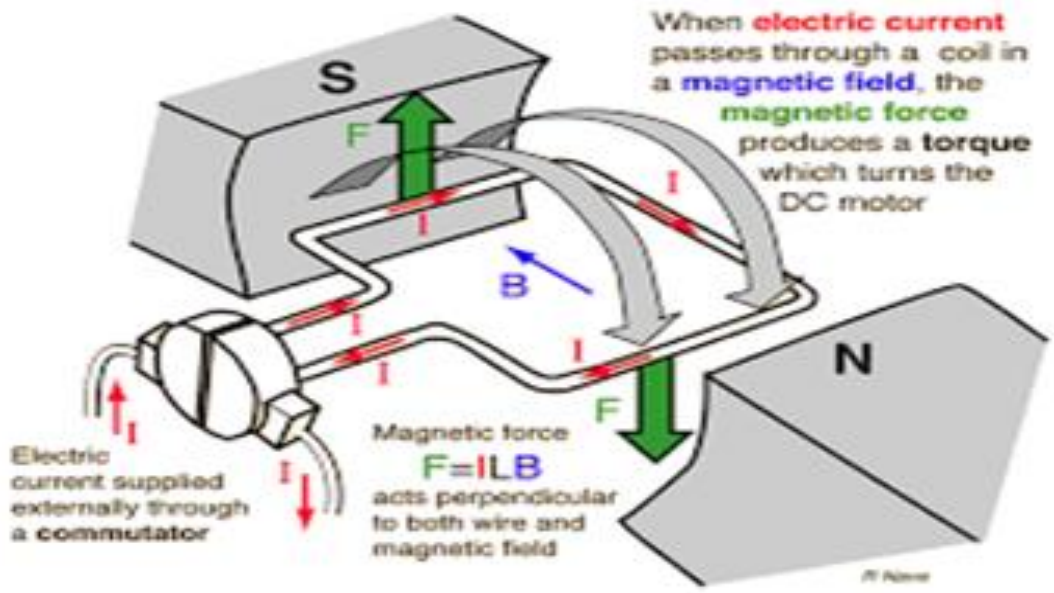


Fig.5.9 Torque production in a DC motor

In an actual DC motor, several such coils are wound on the rotor, all of which experience force, resulting in rotation. The greater the current in the wire, or the greater the magnetic field, the faster the wire

moves because of the greater force created. At the same time this torque is being produced, the conductors are moving in a magnetic field. At different positions, the flux linked with it changes, which causes an emf to be induced (e = dv/dt) as shown in figure 5. This voltage is in opposition to the voltage that causes current flow through the conductor and is referred to as a counter-voltage or back emf.

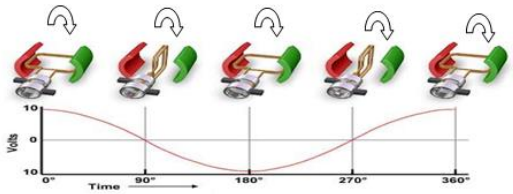


Fig.5.10 Induced voltage in the armature winding of DC motor

The value of current flowing through the armature is dependent upon the difference between the applied voltage and this counter-voltage. The current due to this counter-voltage tends to oppose the very cause for its production according to Lenz's law. It results in the rotor slowing down. Eventually, the rotor slows just Induced emf Flux enough so that the force created by the magnetic field (F = Bil) equals the load force applied on the shaft. Then the system moves at constant velocity.

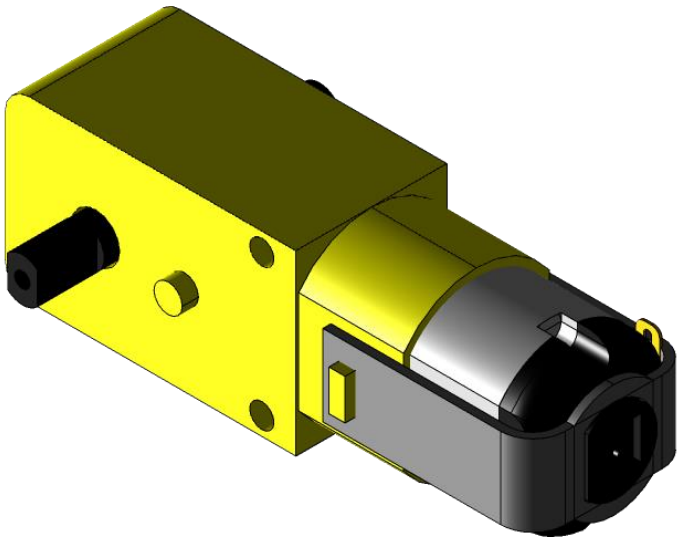


Fig.5.11 Shape of DC Motor

5.6 MOTOR DRIVER L293D:

The L293D is an integrated circuit motor driver that can be used for simultaneous, bi-directional control of two small motors. Small means small. The L293D is limited to 600mA, but in reality, can only

handle much small currents unless you have done some serious heat sinking to keep the case temperature down. Unsure about whether the L293 will work with your motor? Hook up the circuit and run your motor while keeping your finger on the chip. If it gets too hot to touch, you can't use it with your motor. (Note to ME2011 students: The L293 should be OK for your small motor but is not OK for your gear motor.)

The L293 comes in a standard 16-pin, dual-in line integrated circuit package. There is an L293 and an L293D part number. Pick the "D" version because it has built in fly back diodes to minimize inductive voltage spikes.

The pin out for the L293 in the 16-pin package is shown below in top view. Pin 1 is at the top left when the notch in the package faces up. Note that the names for pin functions may be slightly different than what is shown in the following diagrams.

L293d IC is known as a motor driver. It is a low voltage operating device like other ICs. The other ICs could have the same functions like L293d but they cannot provide the high voltage to the motor. L293d provides the continuous bidirectional Direct Current to the Motor. The Polarity of current can change at any time without affecting the whole IC or any other device in the circuit. L293d has an internal H-bridge installed for two motors.

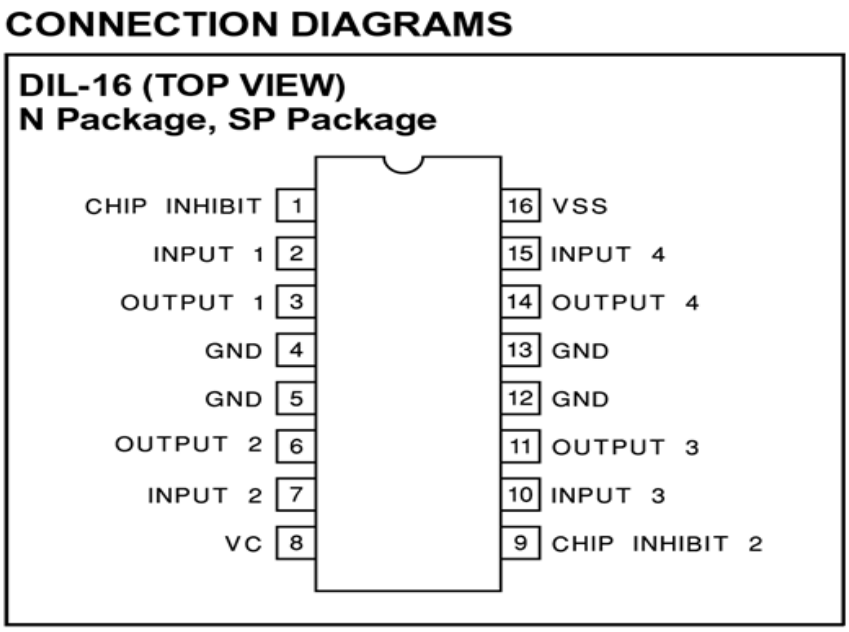


Fig.5.12 Pin out of L293D

The following schematic shows how to connect the L293 to your motor and the Stamp. Each motor takes 3 Stamp pins. If you are only using one motor, leave pins 9, 10, 11, 12, 13, 14, and 15 empty.

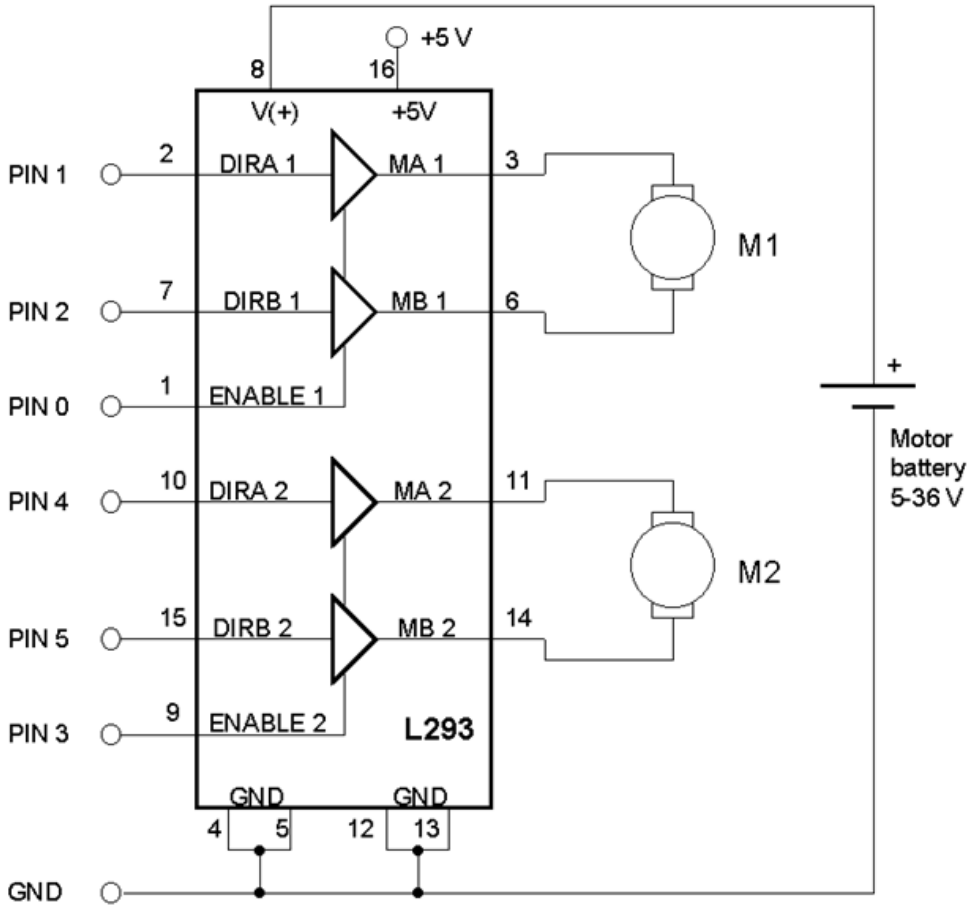


Fig.5.13 Internal diagram of L293D

Assume you have only one motor connected with the enable tied to Stamp Pin 0, and the two direction controls tied to Stamp Pins 1 and 2. The Advantage is the You can control 2 motors in both directions instead of 4 in only one direction.

5.7 LCD (Liquid Cristal Display):

A liquid crystal display (LCD) is a thin, flat display device made up of any number of color or monochrome pixels arrayed in front of a light source or reflector. Each pixel consists of a column of liquid crystal molecules suspended between two transparent electrodes, and two polarizing filters, the axes of polarity of which are perpendicular to each other. Without the liquid crystals between them, light passing through one would be blocked by the other. The liquid crystal twists the polarization of light entering one filter to allow it to pass through the other.

A program must interact with the outside world using input and output devices that communicate directly with a human being. One of the most common devices attached to a controller is an LCD display. Some of the most common LCDs connected to the controllers are 16X1, 16x2 and 20x2 displays. This means 16 characters per line by 1 line 16 characters per line by 2 lines and 20 characters per line by 2 lines,

respectively. **Shapes and S** available. Line lengths of 8, 16, 20, 24, 32 and 40 characters are all standard, in one and two.

Many microcontroller devices use 'smart LCD' displays to output visual information. LCD displays designed around LCD NT-C1611 module, are inexpensive, easy to use, and it is even possible to produce a readout using the 5X7 dots plus cursor of the display. They have a standard ASCII set of characters and mathematical symbols. For an 8-bit data bus, the display requires a +5V supply plus 10 I/O lines (RS RW D7 D6 D5 D4 D3 D2 D1 D0). For a 4-bit data bus it only requires the supply lines plus 6 extra lines (RS RW D7 D6 D5 D4). When the LCD display is not enabled, data lines are tri-state and they do not interfere with the operation of the microcontroller.

5.7.1 FEATURES:

- Interface with either 4-bit or 8-bit microprocessor.
- Display data RAM
- 80x8 bits (80 characters).
- Character generator ROM
- 160 different 57 dot-matrix character patterns.
- Character generator RAM
- 8 different users programmed 57 dot-matrix patterns.
- Display data RAM and character generator RAM may be
- Accessed by the microprocessor.
- Numerous instructions
- Clear Display, Cursor Home, Display ON/OFF, Cursor ON/OFF,
- Blink Character, Cursor Shift, Display Shift.
- Built-in reset circuit is triggered at power ON.
- Built-in oscillator.

Data can be placed at any location on the LCD. For 16×1 LCD, the address locations are:

POSITION		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
ADDRESS	LINE1	00	01	02	03	04	05	06	07	40	41	42	43	44	45	46	47

Fig.5.14 Address locations for a 1x16 line LCD

Fig.5.15 Size and Shapes of the LCD Display

Even limited to character-based modules, there is still a wide variety of shapes and sizes available. Line lengths of 8,16,20,24,32 and 40 characters are all standard, in one, two and four-line versions.

Several different LC technologies exist. “supertwist” types, for example, offer Improved contrast and viewing angle over the older “twisted nematic” types. Some modules are available with back lighting, so that they can be viewed in dimly-lit conditions. The back lighting may be either “electro-luminescent”, requiring a high voltage inverter circuit, or simple LED illumination.

5.7.2 PIN DESCRIPTION:

Most LCDs with 1 controller have 14 Pins and LCDs with controllers has 16 Pins (two pins are extra in both for back-light LED connections).

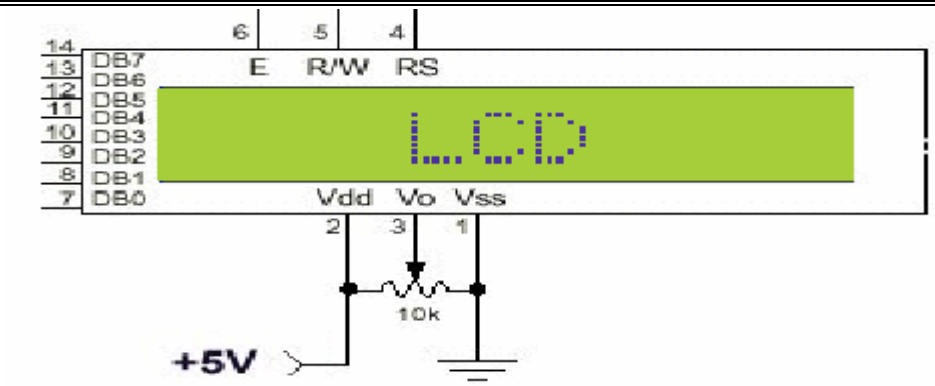


Fig.5.16 Pin diagram of 1x16 lines lcd

PIN	SYMBOL	FUNCTION
1	Vss	Power Supply(GND)
2	Vdd	Power Supply(+5V)
3	Vo	Contrast Adjust
4	RS	Instruction/Data Register Select
5	R/W	Data Bus Line
6	E	Enable Signal
7-14	DB0-DB7	Data Bus Line
15	A	Power Supply for LED B/L(+)
16	K	Power Supply for LED B/L(-)

Table.5.17 Functions of LCD

5.7.3 CONTROL LINES:

- **EN:**

  Line is called "Enable." This control line is used to tell the LCD that you are sending it data. To send data to the LCD, your program should make sure this line is low (0) and then set the other two control lines and/or put data on the data bus. When the other lines are completely ready, bring EN high (1) and wait for the minimum amount of time required by the LCD datasheet (this varies from LCD to LCD), and end by bringing it low (0) again.

- **RS**:

  Line is the "Register Select" line. When RS is low (0), the data is to be treated as a command or special instruction (such as clear screen, position cursor, etc.). When RS is high (1), the data being sent is text data which should be displayed on the screen. For example, to display the letter "T" on the screen you would set RS high.

- **RW**:

Line is the "Read/Write" control line. When RW is low (0), the information on the data bus is being written to the LCD. When RW is high (1), the program is effectively querying (or reading) the LCD. Only one instruction ("Get LCD status") is a read command. All others are write commands, so RW will almost always be low.

Finally, the data bus consists of 4 or 8 lines (depending on the mode of operation selected by the user). In the case of an 8-bit data bus, the lines are referred to as DB0, DB1, DB2, DB3, DB4, DB5, DB6, and DB7.

5.7.4 Logic status on control lines:

- E - 0 Access to LCD disabled
- 1 Access to LCD enabled
- R/W - 0 Writing data to LCD
- 1 Reading data from LCD
- RS - 0 Instructions
- 1 – Character

5.7.5 Writing data to the LCD:

- Set R/W bit to low
- Set RS bit to logic 0 or 1 (instruction or character)
- Set data to data lines (if it is writing)
- Set E line to high
- Set E line to low

5.7.6 Read data from data lines (if it is reading) on LCD:

- Set R/W bit to high
- Set RS bit to logic 0 or 1 (instruction or character)
- Set data to data lines (if it is writing)
- Set E line to high
- Set E line to low

5.7.7 Entering Text:

First, a little tip: it is manually a lot easier to enter characters and commands in hexadecimal rather than binary (although, of course, you will need to translate commands from binary couple of sub-miniature hexadecimal rotary switches is a simple matter, although a little bit into hex so that you know which bits you are setting). Replacing the D.H.L. switch pack with a of re-wiring is necessary.

The switches must be the type where On = 0, so that when they are turned to the zero position, all four outputs are shorted to the common pin, and in position “F”, all four outputs are open circuit.

All the available characters that are built into the module are shown in Table 3. Studying the table, you will see that codes associated with the characters are quoted in binary and hexadecimal, most significant bits (“left-hand” four bits) across the top, and least significant bits (“right-hand” four bits) down the left.

Most of the characters conform to the ASCII standard, although the Japanese and Greek characters (and a few other things) are obvious exceptions. Since these intelligent modules were designed in the “Land of the Rising Sun,” it seems only fair that their Katakana phonetic symbols should also be incorporated. The more extensive Kanji character set, which the Japanese share with the Chinese, consisting of several thousand different characters, is not included!

Using the switches, of whatever type, and referring to Table 3, enter a few characters onto the display, both letters and numbers. The RS switch (S10) must be “up” (logic 1) when sending the characters, and switch E (S9) must be pressed for each of them. Thus, the operational order is: set RS high, enter character, trigger E, leave RS high, enter another character, trigger E, and so on.

The first 16 codes in Table 3, 00000000 to 00001111, ($00 to $0F) refer to the CGRAM. This is the Character Generator RAM (random access memory), which can be used to hold user-defined graphics characters. This is where these modules really start to show their potential, offering such capabilities as bar graphs, flashing symbols, even animated characters. Before the user-defined characters are set up, these codes will just bring up strange looking symbols.

Codes 00010000 to 00011111 ($10 to $1F) are not used and just display blank characters. ASCII codes “proper” start at 00100000 ($20) and end with 01111111 ($7F). Codes 10000000 to 10011111 ($80 to $9F) are not used, and 10100000 to 11011111 ($A0 to $DF) are the Japanese chara.

CHAPTER 6

RESULTS

6.1 RESULTS:

The seamless integration of light and fan controls with visitor counting data represents a significant advancement in smart building technologies. By employing Arduino-based systems, the method enhances energy efficiency and comfort within spaces that experience varying occupancy levels. The data collected by bidirectional visitor counters can be programmatically analysed to adjust light and fan according to real-time occupancy, thereby optimizing energy use. When visitor counts are low, for instance, lights and fans can be turned off entirely, leading to substantial energy savings and lower operational costs. This dynamic interaction not only elevates user experience but also contributes to sustainable building practices.

This project describes its circuit which is used for counting the number of people entering or leaving from the room and automatically control room load such as lights and fans. When someone enters the room, the counter will be incrementing accordingly the lights and fans in the room will be turn on and after the room become empty it will automatically turn off. Count of the people will be displayed on LCD display.

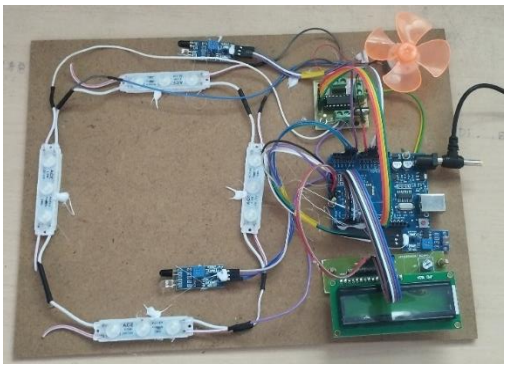


Fig 6.1 Basic Circuit Diagram in OFF Condition

Fig 6.2 If the Persons enters the room (below 5)

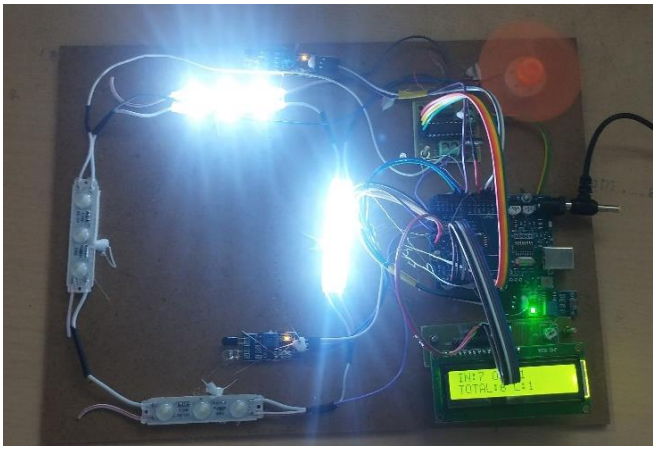


Fig 6.3 If the Persons enters the room (below 10)

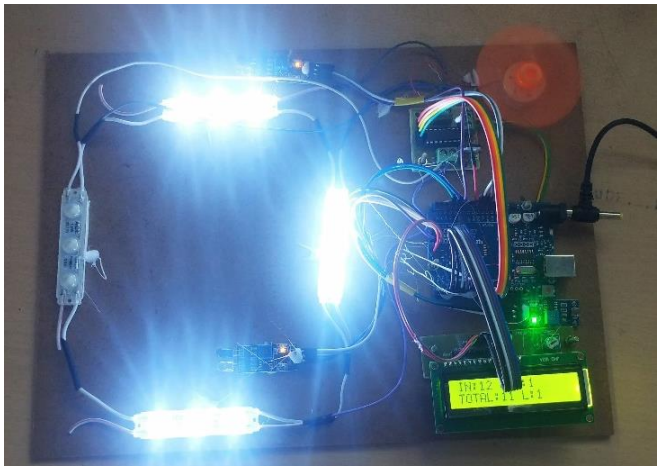


Fig 6.4 If the Persons enters the room (below 15)

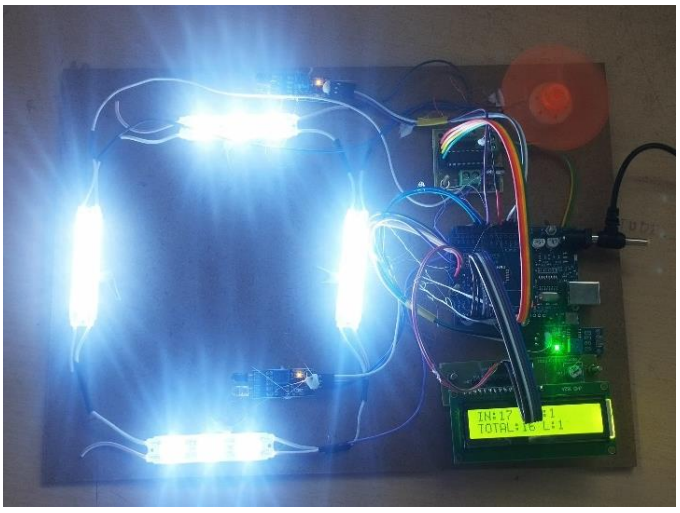


Fig 6.5 If the Persons enters the room (above 15)

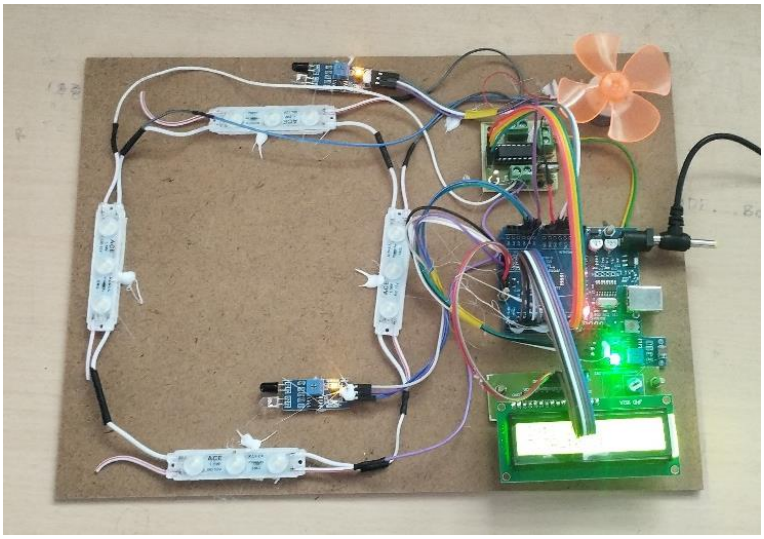


Fig 6.6 If the all the Persons leaves the room

If the Figure 6.1 shows basic circuit diagram of the Automatic room light and fan controller with visitor counter Figure 6.2 explains the when below six persons enters the room when LED and Fan is ON and Figure 6.3 shows the below eleven persons enters the room when two LEDs is ON and figure 6.4 shows below sixteen persons enters the room when three LEDs is ON. Figure 6.5 shows above twenty persons enters the room when four LEDs is ON and figure 6.6 explains all the persons leaves the room.

CHAPTER 7

CONCLUSION AND REFERENCE

7.1 CONCLUSION:

This project mainly focuses to the design and construction of automatic light and Fan control system circuit. The Circuit works properly to turn ON/OFF the Light based on the entering and leaving the persons. The lights and fans have been controlled by the Microcontroller of the arduino Uno. The lights and fan controlled by the instructions of the microcontroller if the person enters the room turn ON lights and fan and turn OFF lights when person leaves the room. If all the persons exit the room automatically turn OFF the lights and fan to reduce the use of electricity. So, this control circuit can be used in various purposes in various fields. In this digital world Technology is very advanced and we prefer things to be Done automatically without human involvement.

7.2 FUTURE SCOPE:

The combination of smart home technologies and the growing focus on energy saving will likely result in major improvements in automatic room light and fan controller with visitor counters in the future.

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