ABSTRACT

Because of urbanization, a lot of waste accumulates in major metropolitan towns and developed regions, and strong waste control is a major challenge confronted by municipalities, wherein the accumulated dirt must be well disposed of as soon as possible to keep the environment clean. When done manually, this work requires a large amount of manpower. So, if you want to solve this problem, we use an IoT technology-based project in which the device detects the amount of waste amassed within the bins and drainage. when the bin is full or drainage is full, it indicates to the concerned government to ease the packing containers and respective workers to keep the environment clean. This undertaking describes the advent of a smart garbage and drainage monitoring system that measures waste tiers in garbage and drainage levels in actual time and signals the municipality, specifically through IOT. An ultrasonic sensor for measuring bin degrees and a water level sensor for measuring drainage level were implemented. A GPS module for retrieving data of fully occupied bin and drainage blocked line, this information is used in this task. GSM module to send the message to the concerned government, with a Node MCU to control the entire process. When the waste bin is completely or almost filled, and even when the drainage water level crossed the threshold limit, it will send caution messages to the municipality so that the rubbish may be accumulated immediately. This could help the concerned government clean up the environment and keep it simple and tidy.

In India, SWACCHA BHARAT ABHIYAN is a mission started by our P.M, which aims to clean up the roads, streets and to develop the infrastructure digitally of India's cities and rural areas. Focusing towards the clean India mission, we have provided an efficient solution for monitoring the garbage and drainage level on the real time basis. Whole system is IOT based. The level sensors in the garbage bin and drainage detect the garbage and drainage level continuously and accordingly the system provides the information to the municipality office. This will avoid the overflowing of the garbage bins and blockage of drainage. Ultimately it will help us to keep our environment clean and also reduces the health issues

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CHAPTER-1

INTRODUCTION

Cleanliness is one of the important issues in the modern society. Solid waste is the sole factor which has negative impacts on the health and hygienic aspects of people and environment. Even though many efforts have been taken to handle the trash efficiently, it is a challenging dispute for all countries. The Internet of Things (IoT) is a boon to solve this ever-growing problem. To make a clean atmosphere, IoT based automated process in waste management is necessary. IoT makes the real-world objects to communicate each other and also connect to the global network using various protocols and standard. Whenever there is any need for disposing the trash in the dustbins, the notification will be given to the corresponding authorities. The rising population, continuous growth of industrialization and urbanization have led the country like India towards voluminous generation of garbage and polluted environment. Overflowing landfills due to the unorganized.

Now days, waste management is a major challenge in developed cities for most of the countries around the world. An efficient and operative waste monitoring is essential to maintain a clean and safe environment. Whenever waste disposals increase, there is a chance of an increase in health disorders. Cleaning and maintaining waste is one of the toughest tasks in urban areas where the population count is more. An efficient and well-organized waste collection system is required to keep the environment clean and green. Waste recycling is one of the useful technologies which is maintained well. In urban areas, environmental protection plays an important role where its demand is high and it has become the competitive framework for waste management. Many available embedded systems having different design sand patterns according to the requirements, utilities, and functions. In this paper, the systems we are discussing is mainly composed of IoT devices like GPS, GPRS and some sensors like an ultrasonic sensor, etc.

IOT based smart garbage monitoring system usingESP8266 is very simple and real time. Basically, the process starts from the garbage bin. IR sensors are fixed on each level of the garbage bin. Here we are taking the 5 levels of the garbage bin for our project demonstration. We are providing the unique ID for each garbage bin. Also we are selecting the threshold level for alerting purpose. Garbage level is sensed by the IR sensors. As soon as the garbage in the garbage bin crosses the threshold level, the alerting text message will

get provided to the concerned person or in the municipality office. This message contains the garbage bin ID along with the GPS link.

CHAPTER-2

LITERATURE SURVEY

During this literature survey, seven research papers related with Garbage Monitoring are studied. These papers are published during last two years - 2016 and 2017. Most of these papers focus only on functionality of Garbage Monitoring and these papers are discussed in the first section of literature survey. Only two papers include additional functionalities such as Garbage Compression and Location Tracking along with Garbage Monitoring as a main function, and these papers are discussed in second section of literature survey. In the first paper, the garbage containers are interfaced with a microcontroller -Advanced RISC Machines (ARM) 7 having Infra Red (IR)sensors along with central system showing filled up-level of garbage, on mobile web browser with html page through Wi-Fi communication [8]. Hence, the level status is updated on to the html page, but it doesn't inform about real-time location of containers. In the second paper, the garbage containers are again interfaced with a microcontroller - ARM7 having ultrasonic sensors along with the system sending an alert text message through Short Message Service (SMS) on Global System for Mobile Communications (GSM) technology. This message is directed to the truck drivers about availability of filled containers for garbage collection [3]. In the third paper, similar system interfaced with Link It .ONE Arduino board is used to send an alert text message about filled up-level of garbage through Ubidots [2]. In the next paper, related system interfaced with Peripheral Interface Controller (PIC) microcontroller is used to send an alert text message about filled up-level of garbage through Zigbee technology [4]. In the last paper of the first section, similar system is interfaced with Arduino UNO board to send an alert text message about filled up-level of garbage through GSM technology. This system also indicates filled up-levels through color Light Emitting Diodes (LED) [11]. In the first paper of the second section, a central system is used for Garbage Monitoring about filled up-levels of containers using general Packet Radio Service (GPRS) technology. It also provides compression mechanism to handle overflowing

S.S.Navghane, M.S.Killedar 2017 These dustbins are interface with microcontroller based system having IR wireless systems along with central system showing current status of garbage, on mobile web browser with HTML page by Wi-Fi module. . The main aim of this project is to reduce human resources and efforts along with the enhancement of a clean city vision.

Ashima Bajaj 2017 this method is advance in which garbage monitoring system management is automated. This project Garbage Monitoring system using Internet of things is a very innovative system which will help to keep the cities clean.

Kasliwal Manasi H proposed a system for organizing the collection of the garbage in the commercial and residential areas of the cities. In this system, the level of garbage in the bin was detected by the sensor which will send the data to the corporation room using the GSM module.

Sahil Mirchandani proposed an Internet of things enabled bin, which uses RFID tags to identify the bins with a web-based online system approach and identifies the weight of the garbage that is added, all this data is calculated and added a host server to the parent database. Also, it has a mechanism that gives the level of the bins and updates the data of each bin on the parent server. It notifies the authority when the bin is full and provides the shortest route to the collection a truck to empty all the bins.

A Anitha this system, the ultrasonic sensor detects the level of garbage and sends the value to control room through the GSM module. A GUI based on MATLAB was developed to check the information related to the garbage for different locations. Two units were present in the system; slave unit was placed in the bin whereas the master unit was there in the control room.

Sneha Patil proposed a smart waste dustbin which uses a cloud based system which is connected to a raspberry pi which can identify when the garbage dustbin levels by the help of a sensor which measures the volume occupied and the left volume in the smart garbage dustbin. If the volume is full then there is a trigger generated that sends an alert message through raspberry pi and also sends an alert and location of the dustbin to the authority to collect the waste.

Problem Statement

A big challenge in the urban cities is solid waste management. The garbage collecting authority in traditional waste management system doesn't know about the level of garbage in dustbin, if the dust bin gets full by garbage, then it gets overflowed as well as spelled out from the dustbin leading to unhygienic condition in cities. People throw garbage on that dustbin which is already overflowed. Sometimes due to unclean garbage bins bad smell arises also toxic and unhygienic gases are produced which is way to support to the air pollution and to some harmful diseases which are easily spreadable. It is very bad

look of the city. Use of traditional system result in inefficient and time and money spending system.

CHAPTER-3

EXISTING SYSTEM

In the existing system, the garbage is collected by the municipality servants on the scheduled routine basis i.e., weekly or 2-3 times within the months. As we see many times that garbage bins are placed in the public places in the cities are overflowing due to increase in the waste every day.

Due to this, the garbage shrinks and produces the bad smell which will tends to cause the air pollution and spread diseases. That can cause the harm to human health. Thus, cleaning is the big issue. Also finding the path of garbage bin is one of the tasks specially for new driver. Thus, to avoid such conditions we have designed the improved system.

Disadvantages of existing system

- ➢ Cleaning of bins is not done properly
- ➢ It causes the Unhygienic condition and spoil the environment.
- ➢ Bad smell spreads and may cause illness to human beings

CHAPTER-4

PROPOSED SYSTEM

In our proposed system, which is the IOT based smart garbage monitoring system along with the GPS link, there is the real time monitoring with alerting facility. Earlier systems which was design was not cost efficient also they are bulky in size, as they were using Raspberry-Pi module, GSM module, also some using GPS antenna, etc. Here in our purpose system, we have removed all the hardware part to reduce the size of circuitry this will also reduce the cost of the system. Additionally, we are using Solar panel here for power supply with the battery backup for cloudy situations.

Block Diagram

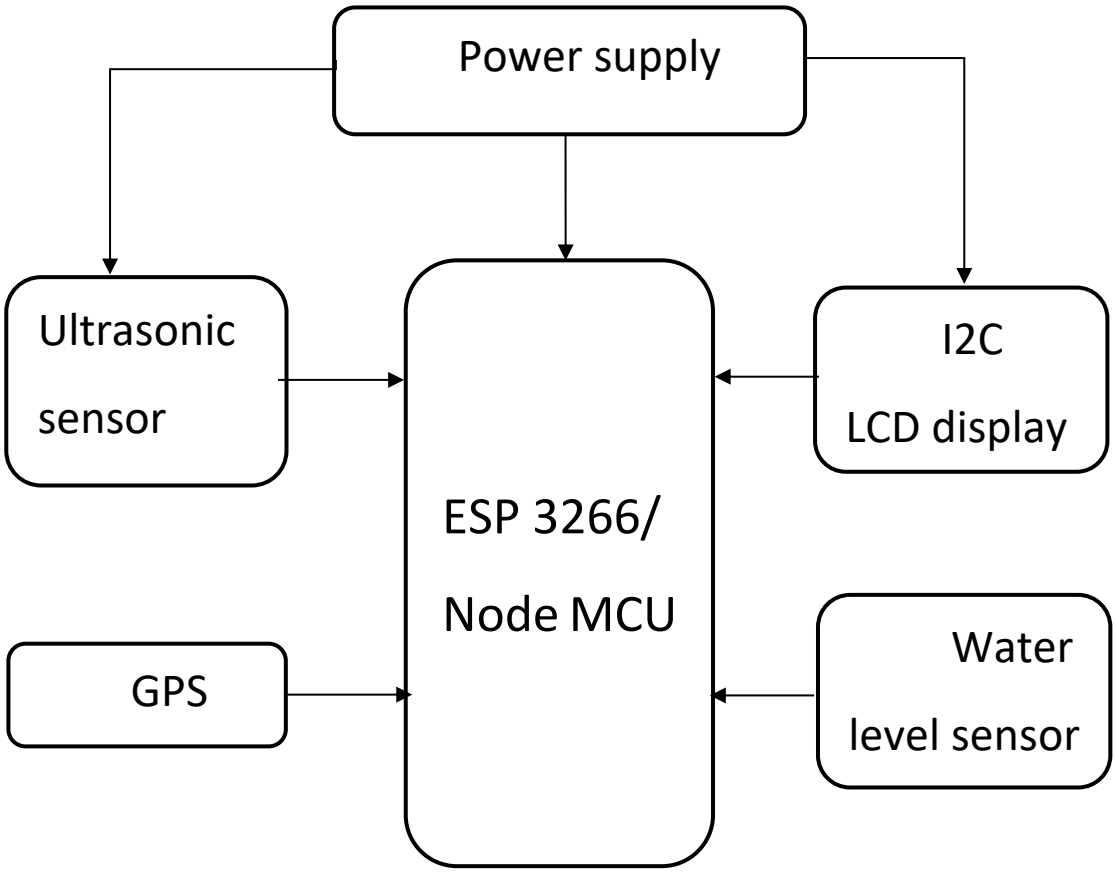


Fig.4.1 Block diagram

Description:

Hardware

- NodeMCU/ESP32
- 16x2 LCD Display with I^2C Driver
- Ultrasonic Sensor
- GPS Module
- 12V/1A Supply Adaptor
- Water level sensor

Software:

- Arduino IDE
- Embedded C Programming Language.

CHAPTER-5

INTRODUCTION TO EMBEDDED SYSEMS

5.1 Introduction:

An embedded system is a computer system with a dedicated function within a larger, often with, real-time mechanical or electrical system constraints. It is incorporated as part of a complete device that often includes hardware and mechanical parts. Integrated systems today control many commonly used devices. 92% of all microprocessors are produced as embedded system components.

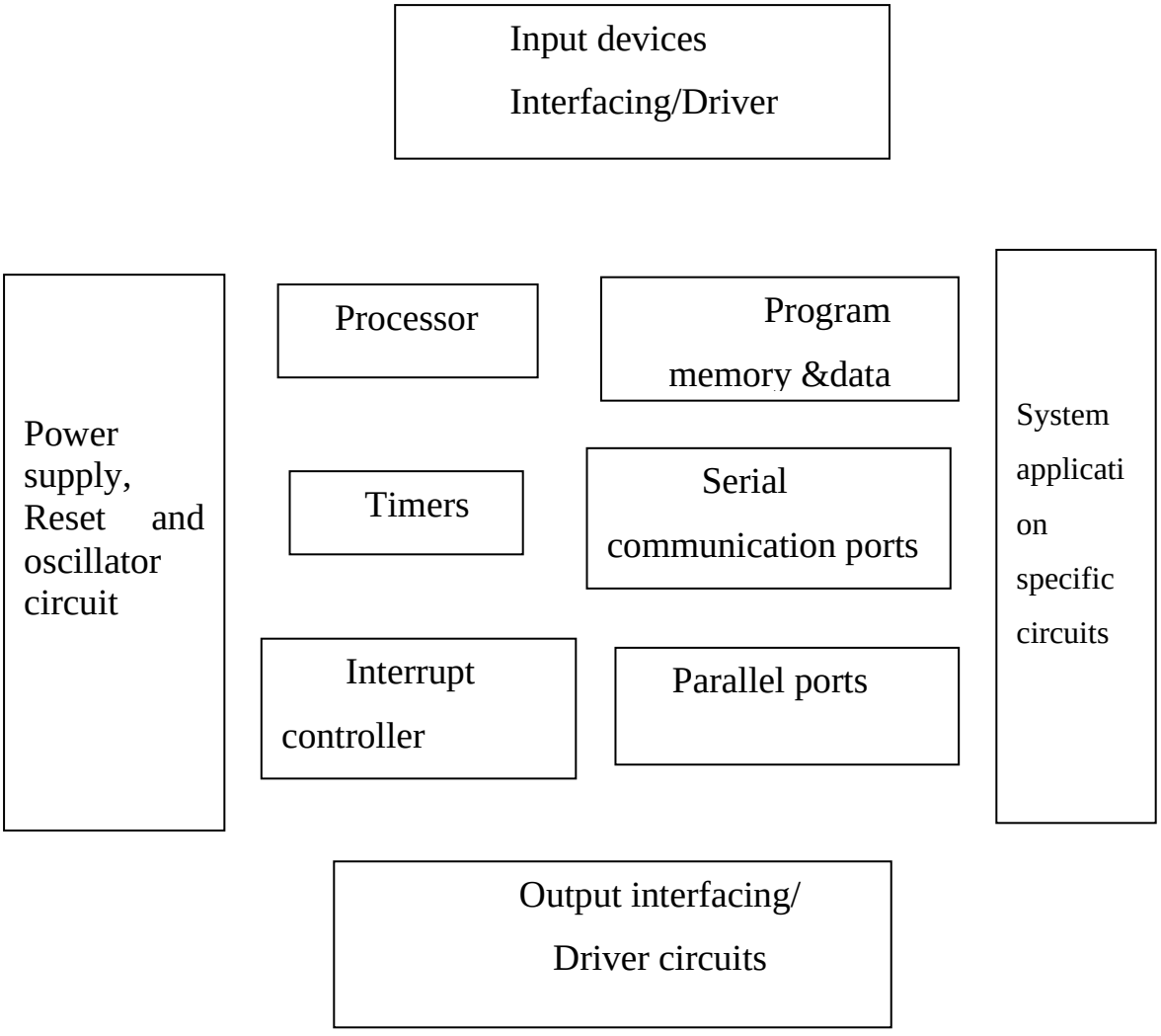


Fig 5.1. Embedded Systems Design

However, by building intelligence mechanisms at the top of the hardware, taking advantage of any existing sensors and the existence of a built-in network can best manage the available network and unit resources. For example, intelligent techniques can be designed to manage the energy consumption of embedded systems.

Modern embedded systems often incorporate microcontrollers (i.e. CPUs with memory or peripheral interfaces) but common microprocessors are also commonly used (using external memory chips and peripheral circuitry interfaces), especially in more complex systems. In any case, the processor or processors can be used typed ranging from general-purpose specialized in some kind of calculations, or even designed for the application. A common standard of dedicated processors is the digital signal processor (DSP).

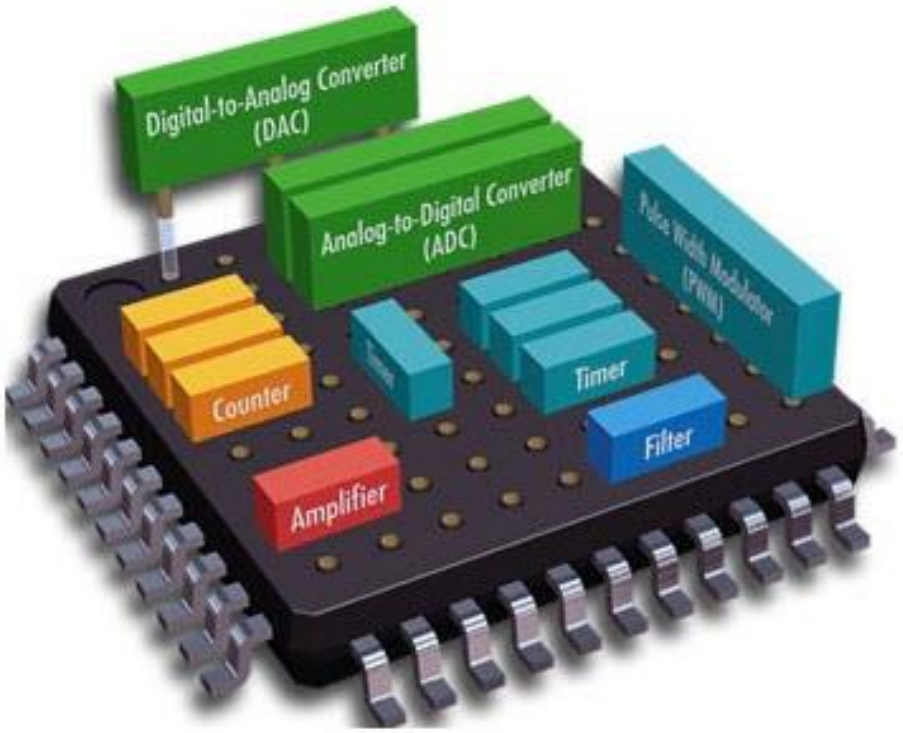


Fig 5.2: Embedded System Hardware

Since the integrated system is dedicated to specific tasks, designers can optimize in order to reduce the size and cost of the product and increase reliability and performance. Some embedded systems are serially produced, benefiting from economies of scale.

Integrated systems range from portable devices, such as digital clocks and MP3 players, to large stationary systems such as traffic lights, factory controllers and large

complex systems such as hybrid vehicles, magnetic resonances, and avionics. The complexity varies from low to high, with a single microcontroller chip, with the highest number of units, peripherals, and networks mounted within a large frame or enclosure.

5.2 History:

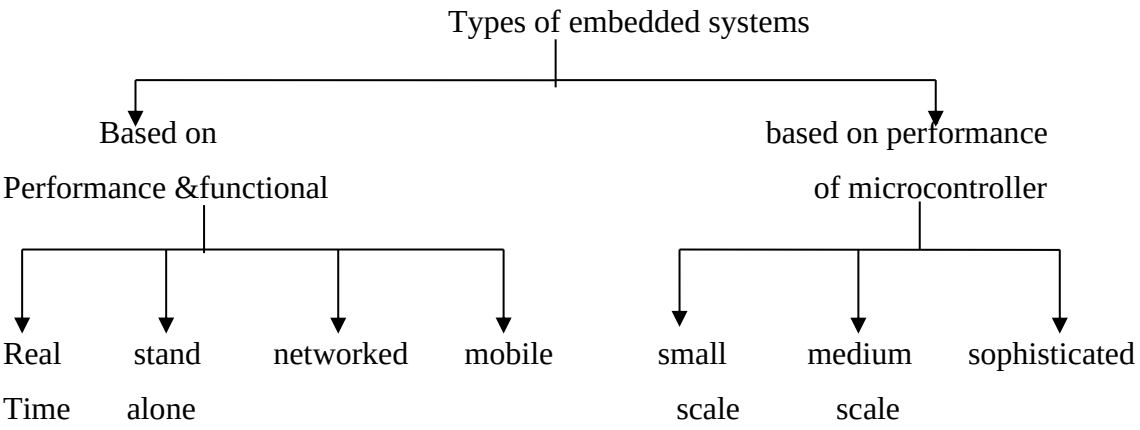
One of the very first recognizably modern embedded systems was the Apollo Guidance Computer, developed by Charles Stark Draper at the MIT Instrumentation Laboratory. At the project's inception, the Apollo guidance computer was considered the riskiest item in the Apollo project as it employed the then newly developed monolithic integrated circuits to reduce the size and weight. An early mass-produced embedded system was the Automatics D-17 guidance computer for the Minuteman missile, released in 1961. When the Minuteman II went into production in 1966, the D-17 was replaced with a new computer that was the first high-volume use of integrated circuits.

Since these early applications in the 1960s, embedded systems have come down in price and there has been a dramatic rise in processing power and functionality. An early microprocessor for example, the Intel 4004, was designed for calculators and other small systems but still required external memory and support chips. In 1978 National Engineering Manufacturers Association released a "standard" for programmable microcontrollers, including almost any computer-based controllers, such as single board computers, numerical, and event-based controllers.

As the cost of microprocessors and microcontrollers fell it became feasible to replace expensive knob-based analog components such as potentiometers and variable capacitors with up/down buttons or knobs read out by a microprocessor even in consumer products. By the early 1980s, memory, input and output system components had been integrated into the same chip as the processor forming a microcontroller. Microcontrollers find applications where a general-purpose computer would be too costly.

A comparatively low-cost microcontroller may be programmed to fulfill the same role as a large number of separate components. Although in this context an embedded system is usually more complex than a traditional solution, most of the complexity is contained within the microcontroller itself. Very few additional components may be needed and most of the design effort is in the software. Software prototype and test can be quicker compared with the design and construction of a new circuit not using an embedded processor.

5.2.1 Embedded System Classification:



5.2.2 Classification of Embedded Systems

Embedded systems are primarily classified into different types based on complexity of hardware & software and microcontroller (8 or 16 or 32-bit). Thus, based on the performance of the microcontroller, embedded systems are classified into three types such as:

- Small scale embedded systems
- Medium scale embedded systems
- Sophisticated embedded systems

Further, based on performance and functional requirements of the system embedded system classified into four types such as:

- Real time embedded systems
- Standalone embedded systems
- Networked embedded systems
- Mobile embedded systems

5.2.3 Applications:

Embedded systems are commonly found in consumer, cooking, industrial, automotive, medical, commercial and military applications.

Telecommunications systems employ numerous embedded systems from telephone switches for the network to cell phones at the end user. Computer networking uses dedicated routers and network bridges to route data.

Consumer electronics include MP3 players, mobile phones, videogame consoles, digital cameras, GPS receivers, and printers. Household appliances, such as microwave ovens, washing machines and dishwashers, include embedded systems to provide flexibility, efficiency and features. Advanced HVAC systems use networked thermostats to more accurately and efficiently control temperature that can change by time of day and season. Home automation uses wired- and wireless-networking that can be used to control lights, climate, security, audio/visual, surveillance, etc., all of which use embedded devices for sensing and controlling.

Fig.5.3 Real-life examples of Embedded System

Transportation systems from flight to automobiles increasingly use embedded systems. New airplanes contain advanced avionics such as inertial guidance systems and GPS receivers that also have considerable safety requirements. Various electric motors brushless DC motors, induction motors and DC motors use electric/electronic motor controllers. Automobiles, electric vehicles, and hybrid vehicles increasingly use embedded systems to maximize efficiency and reduce pollution. Other automotive safety systems include anti-lock braking system (ABS), Electronic Stability Control (ESC/ESP), traction control (TCS) and automatic four-wheel drive.

Medical equipment uses embedded systems for vital signs monitoring, electronic stethoscopes for amplifying sounds, and various medical imaging (PET, SPECT, CT, and MRI) for non-invasive internal inspections. Embedded systems within medical equipment are often powered by industrial computers.

Embedded systems are used in transportation, fire safety, safety and security, medical applications and life critical systems, as these systems can be isolated from hacking and thus, be more reliable. For fire safety, the systems can be designed to have greater ability to handle higher temperatures and continue to operate. In dealing with security, the embedded systems can be self-sufficient and be able to deal with cut electrical and communication systems.

A new class of miniature wireless devices called motes is networked wireless sensors. Wireless sensor networking, WSN, makes use of miniaturization made possible by advanced IC design to couple full wireless subsystems to sophisticated sensors, enabling people and companies to measure a myriad of things in the physical world and act on this information through IT monitoring and control systems. These motes are completely self-contained, and will typically run off a battery source for years before the batteries need to be changed or charged.

Embedded Wi-Fi modules provide a simple means of wirelessly enabling any device which communicates via a serial port.

5.2.4 Characteristics:

Embedded systems are designed to do some specific task, rather than be a general-purpose computer for multiple tasks. Some also have real-time performance constraints that must be met, for reasons such as safety and usability; others may have low or no performance requirements, allowing the system hardware to be simplified to reduce costs.

Embedded systems are not always standalone devices. Many embedded systems consist of small parts within a larger device that serves a more general purpose. For example, the Gibson Robot Guitar features an embedded system for tuning the strings, but the overall purpose of the Robot Guitar is, of course, to play music. Similarly, an embedded system in an automobile provides a specific function as a subsystem of the car itself.

The program instructions written for embedded systems are referred to as firmware, and are stored in read-only memory or flash memory chips. They run with limited computer hardware resources: little memory, small or non-existent keyboard or screen.

5.2.5 User interface:

Embedded systems range from no user interface at all, in systems dedicated only to one task, to complex graphical user interfaces that resemble modern computer desktop operating systems. Simple embedded devices use buttons, LEDs, graphic or character LCDs (HD44780 LCD for example) with a simple menu system.

More sophisticated devices which use a graphical screen with touch sensing or screen-edge buttons provide flexibility while minimizing space used: the meaning of the buttons can change with the screen, and selection involves the natural behavior of pointing at what is desired. Handheld systems often have a screen with a "joystick button" for a pointing device.

Some systems provide user interface remotely with the help of a serial (e.g. RS-232, USB, I²C, etc.) or network (e.g. Ethernet) connection. This approach gives several advantages: extends the capabilities of embedded system, avoids the cost of a display, simplifies BSP and allows one to build a rich user interface on the PC. A good example of this is the combination of an embedded web server running on an embedded device (such as an IP camera) or a network router. The user interface is displayed in a web browser on a PC connected to the device, therefore needing no software to be installed.

5.2.6 Processors in embedded systems:

Embedded processors can be broken into two broad categories. Ordinary microprocessors (μP) use separate integrated circuits for memory and peripherals. Microcontrollers (μC) have on-chip peripherals, thus reducing power consumption, size and cost. In contrast to the personal computer market, many different basic CPU architectures are used, since software is custom-developed for an application and is not a commodity product installed by the end user. Both Von Neumann as well as various degrees of Harvard architectures are used. RISC as well as non-RISC processors are found. Word lengths vary from 4-bit to 64-bits and beyond, although the most typical remain 8/16-bit. Most architecture comes in a large number of different variants and shapes, many of which are also manufactured by several different companies.

Numerous microcontrollers have been developed for embedded systems use. General-purpose microprocessors are also used in embedded systems, but generally require more support circuitry than microcontrollers.

5.2.7 Peripherals:

Embedded systems talk with the outside world via peripherals, such as:

- Serial Communication Interfaces (SCI): RS-232, RS-422, RS-485, etc.

- Synchronous Serial Communication Interface: I2C, SPI, SSC and ESSI (Enhanced Synchronous Serial Interface)
- Universal Serial Bus (USB)
- Multi Media Cards (SD cards, Compact Flash, etc.)
- Networks: Ethernet, Lon Works, etc.
- Fieldbuses: CAN-Bus, LIN-Bus, PROFIBUS, etc.
- Timers: PLL(s), Capture/Compare and Time Processing Units
- Discrete IO: aka General Purpose Input/Output (GPIO)
- Analog to Digital/Digital to Analog (ADC/DAC)
- Debugging: JTAG, ISP, ICSP, BDM Port, BITP, and DB9 ports

5.3 Design and Analysis

In many countries, waste management has become a great challenge. An efficient and operative waste management is required to safeguard the green environment that should decrease the waste disposal in the current days. In many smart cities, the main challenging work is to clear the waste disposals from time to time. Many organizations have developed many applications to control waste management effectively. Today's technology is helping out to come over this issue of waste management, mainly Internet of Things that contributing more to society. To control and monitor the waste in bins we are using ultrasonic sensors and force sensors. The quantity of waste in bins is calculated by the ultrasonic sensor and the weight of the bin is calculated by a force sensor. To identify whether the bin is filled or not, red and green LEDs are implemented. When the bin is filled, it sends the information to the authorized person or to an authorized department with GPS location of the bin located through GPRS directly with Amazon cloud webserver.

In this project methodology model takes the fundamental process activities of Project Plan, specification, Analysis, hardware and software Design, development, validation and represents them as separate process phases.

The working objects of the slave unit are NodeMCU, ultrasonic sensor, water level sensor Potentiometer, & GPS module. The garbage unit is kept at the top of the bin and water level sensor is fixed at drainage pipeline. The trigger pulse is sent from the ultrasonic sensor into the bin and as a result, the echo pulse will be received back by it. Thus, the time lagging between the sent and received sound signal is used to determine the distance to the object. Through this it continuously checks the level of garbage in the bin. Once the garbage reaches the specified threshold values, sensor gives indication to the NodeMCU. Similarly,

water level sensor detects moisture level based on level which water sensor is dipped it will be calculating the water level it intimates the information to the NodeMCU.

The system architecture consists of a microcontroller unit, Ultrasonic sensor, water level, force sensor, GPS, LCD, and Website. In this system, the ultrasonic sensor helps to identify the level of waste in the bins as it reads the distance, Similar the water sensor will be read the level of water and it send information to the nearest authorized department will be receiving the information when the bin is filled or drainage is overflowed and amazon device helps to read the information from the server where the bin or drainage line is located using a GPS system. Then the information is sent to the nearest vehicle to collect the waste from the respective bin and also to clean the blocked drainage line. Here, a microcontroller is required to interface the sensors with the GPS system.

This working system is going to eliminate the present status about the bins which are laying most of the time in a position regarding full of garbage without being cleaned from time to time. This system creates a clean and green environment where very citizen is directly interacting and doing his job perfectly. As discussed earlier, municipality officers will be informed about bins within their surrounding by web servers.

CHAPTER-6

HARDWARE DESCRIPTION

6.1 Node MCU:

NodeMCU is an open source IOT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espress if Systems, and hardware which is based on the ESP-12 module. The term "NodeMCU" by default refers to the firmware rather than the development kits. The firmware uses the Lua scripting language. It is based on the eLua project, and built on the Espress if Non-OS SDK for ESP8266. It uses many open-source projects, such as lua-cjson, and spiffs.

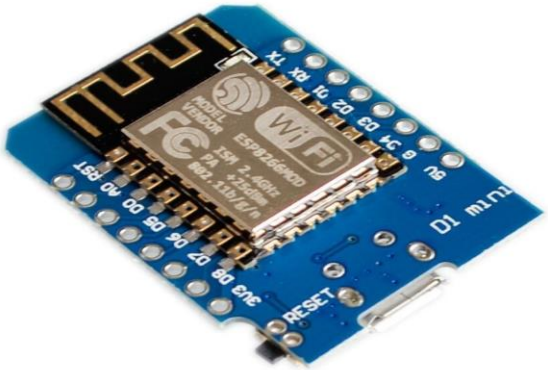


Fig.6.1 NodeMCU D1 Mini

6.1.1 History:

NodeMCU was created shortly after the ESP8266 came out. On December 30, 2013, Express if Systems began production of the ESP8266. The ESP8266 is a Wi-Fi SoC integrated with a Tensilica Xtensa LX106 core, widely used in IOT applications. NodeMCU started on 13 Oct 2014, when Hong committed the first file of NodeMCU-firmware to GitHub. Two months later, the project expanded to include an open-hardware platform when developer Huang R committed the gerber file of an ESP8266 board, named devkit v0.9. Later that month, Tuan PM ported MQTT client library from Contiki to the ESP8266 SoC platform, and committed to NodeMCU project, then NodeMCU was able to

support the MQTT IOT protocol, using Lua to access the MQTT broker. Another important update was made on 30 Jan 2015, when Devsaurus ported the u8glib to NodeMCU project, enabling NodeMCU to easily drive LCD, Screen, OLED, even VGA displays.

In summer 2015 the creators abandoned the firmware project and a group of independent but dedicated contributors took over. By summer 2016 the NodeMCU included more than 40 different modules. Due to resource constraints users need to select the modules relevant for their project and build a firmware tailored to their needs.

6.1.2 Specifications:

NodeMCU Dev Board is based on widely explored esp8266 System on Chip from Express if. It combined features of WIFI access point and station + microcontroller and uses simple LUA based programming language. ESP8266NodeMCU offers-

-- Arduino-like hardware IO

-- Event-driven API for network applications

--10 GPIOs D0-D10, PWM functionality, IIC and SPI communication, 1-Wire and ADC A0 etc. all in one board

--Wi-Fi networking (can be uses as access point and/or station, host a webserver), connect to internet to fetch or upload data.

--excellent few $ system on board for Internet of Things (IOT) projects.

Recently, there has been interest in programming ESP8266 systems using Arduino IDE. Programming, of ESP8266 using Arduino IDE is not very straight forward, until it is properly configured. Especially because, the Input and output pins have different mapping on NodeMCU than those on actual ESP8266 chip.

I had request about showing how to program ESP-12E NodeMCU using Arduino IDE. I struggled myself earlier in the beginning, so thought of making this Instruct able for beginners. This is quick guide/tutorial for getting started with Arduino and ESP8266 NodeMCU V2 ESP-12Ewifi module. (I think, this method can be used for other NodeMCU boards too. (or only ESP8266 boards, but with necessary hardware modifications and using FTDI modules for programming- not covered in this tutorial because, this is only for NodeMCU development boards).

This Instruct able gives quick intro to-

1) Installing Arduino core for ESP8266 Wi-Fi chip in Arduino IDE and Getting started with sketches written using Latest stable Arduino IDE 1.6.7.

2) Run/modify basic LED blink sketch to blink onboard LED and/or externally connected LED at pin D0 or GPIO-16 as per the pin configuration mentioned here and here.

NOTE- To use NodeMCU V1 or V2 or V3 development boards using Arduino IDE, we do not need to flash it with firmware using NodeMCU flasher. It is required only if we intend to program NodeMCU using Lua script with esplorer etc.

First and foremost word of - CAUTION!

- The ESP8266 chip requires 3.3V power supply voltage. It should not be powered with 5 volts like other Arduino boards.
- NodeMCU ESP-12E development board can be connected to 5Vusing **micro USB** connector or **Vin** pin available on board.
- The I/O pins of ESP8266 communicate or input/output max 3.3V only. The pins are **NOT** 5V tolerant inputs.

NodeMCU Pin out:

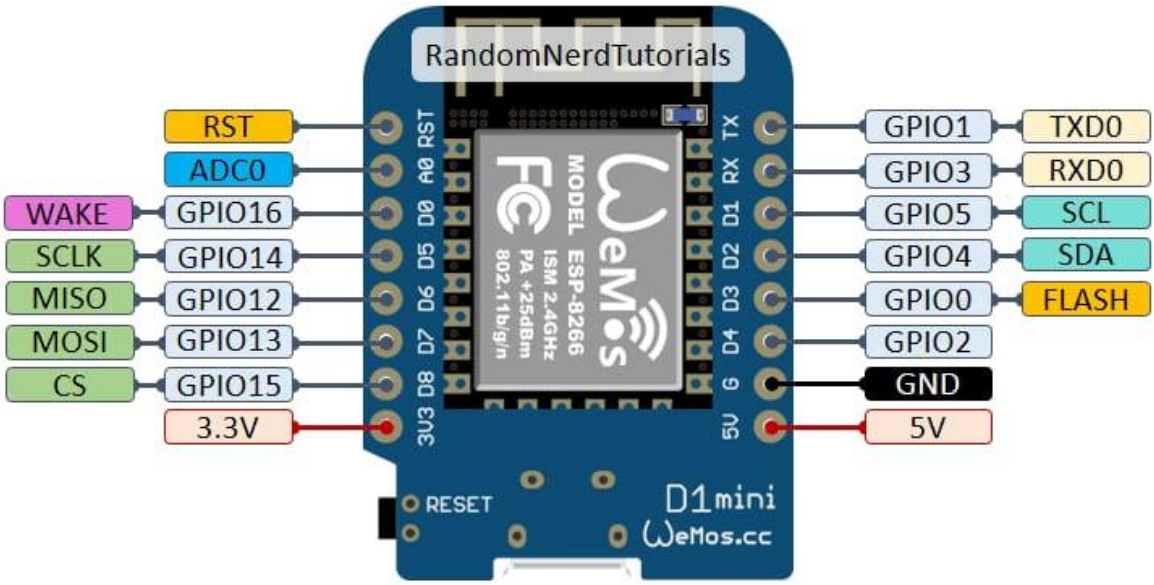


Fig.6.2 pin diagram

Esp8266 D1 Mini NodeMCU Wifi Development Board is an Arduino Compatible mini Wi-Fi board with 4MB flash based on ESP8266EX. The board is with 11 digital input/output pins, all pins have interrupt/PWM/I2C/one-wire supported (except D0) 1 analog input(3.3V max input) and a Micro USB connection.

The development board features WiFi-SoC ESP8266 and is made for fast Internet-of-Things (IoT) prototyping. It is flashed with the latest firmware version and can be set up and programmed right away with the onboard micro USB connection. With only a few lines of code, the NodeMCU Dev Kit connects to your local network and ready for control by other network members like computers and smartphones.

The D1 mini is an ESP8266 development board that is compact, versatile and very easy to use with the Arduino IDE. It supports natively by the Expressive SDK.

Features of Esp8266 D1 Mini Node MCU Wifi Development Board:

- Use BRT (Bias Resistor Transistor)
- Easier into flash mode.
- 30% increase in radiating area
- Good stability.
- 11 digital input/output pins, all pins have interrupt/pwm/I2C/one-wire supported(except for D0)
- 1 analog input(3.2V max input)
- Micro USB connection
- Compatible with Arduino
- Compatible with nodeMCU
- Support OTA wireless uploading
- 11 x I/O pins,1 x ADC pin

Specifications of Esp8266 D1 Mini Node MCU Wifi Development Board:

- Microcontroller ESP-8266EX
- Operating Voltage 3.3 V
- Digital I/O Pins 11
- Analog Input Pins 1(Max input: 3.2V)
- Clock Speed 80MHz/160MHz
- Flash 4M bytes
- Length 34.2mm and Width 25.6mm

6.2 Regulator Power Supply:

All digital circuits require regulated power supply. In this article we are going to learn how to get a regulated positive supply from the mains supply.

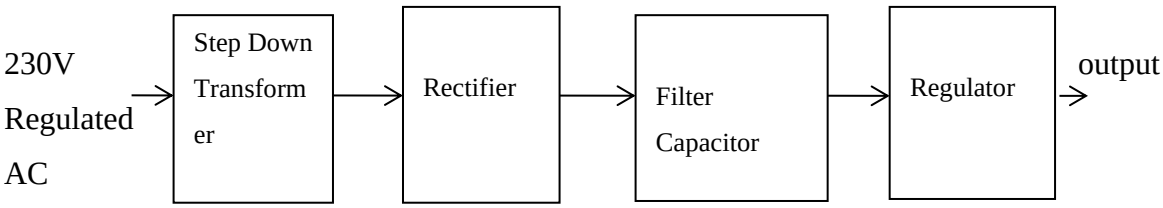


Fig: 6.3. shows the basic block diagram of a fixed regulated power supply. Let us go through each block.

6.2.1 Transformer:

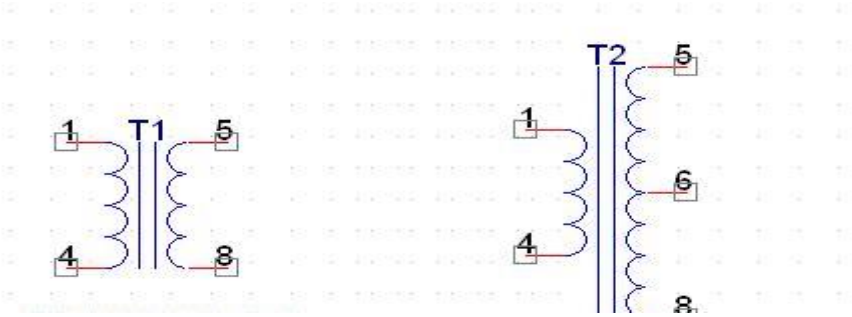


Fig 6.4 Transformer Fig 6.5 Center tapped Transformer

A transformer consists of two coils also called as “WINDINGS” namely PRIMARY & SECONDARY.

They are linked together through inductively coupled electrical conductors also called as CORE. A changing current in the primary causes a change in the Magnetic Field in the core & this in turn induces an alternating voltage in the secondary coil. If load is applied to the secondary then an alternating current will flow through the load. If we consider an ideal condition then all the energy from the primary circuit will be transferred to the secondary circuit through the magnetic field.

$$P_{Primary} = P_{secondary}$$

So

$$I_pV_p = IsVs$$

The secondary voltage of the transformer depends on the number of turns in the Primary as well as in the secondary.

$$Vs/V_p = N_S/N_p$$

6.2.2 Rectifier:

A rectifier is a device that converts an AC signal into DC signal. For rectification purpose we use a diode, a diode is a device that allows current to pass only in one direction i.e. when the anode of the diode is positive with respect to the cathode also called as forward biased condition & blocks current in the reversed biased condition.

Rectifier can be classified as follows:

A. Half Wave rectifier
B. Full wave rectifier
C. Bridge Rectifier

A) Half Wave rectifier.

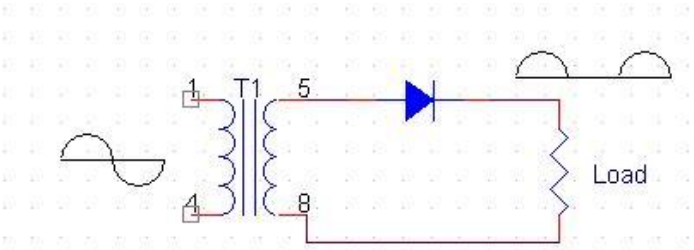


Fig 6.6 Half wave rectifier

This is the simplest type of rectifier as you can see in the diagram a half wave rectifier consists of only one diode. When an AC signal is applied to it during the positive half cycle the diode is forward biased & current flows through it. But during the negative half cycle diode is reverse biased & no current flows through it. Since only one half of the input reaches the output, it is very inefficient to be used in power supplies.

B) Full wave rectifier:

Half wave rectifier is quite simple but it is very inefficient, for greater efficiency we would like to use both the half cycles of the AC signal. This can be achieved by using a center tapped transformer i.e., we would have to double the size of secondary winding & provide connection to the center. So, during the positive half cycle diode D1 conducts & D2 is in reverse biased condition. During the negative half cycle diode D2 conducts & D1 is reverse biased. Thus, we get both the half cycles across the load.

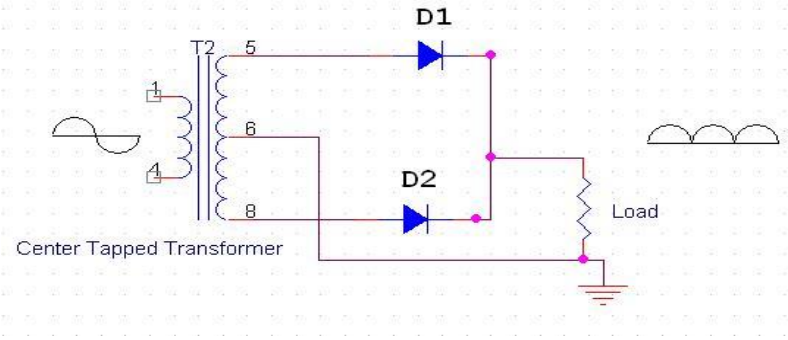


Fig 6.7 Full wave Rectifier

One of the disadvantages of Full Wave Rectifier design is the necessity of using a center tapped transformer, thus increasing the size & cost of the circuit. This can be avoided by using the Full Wave Bridge Rectifier.

C) Bridge Rectifier:

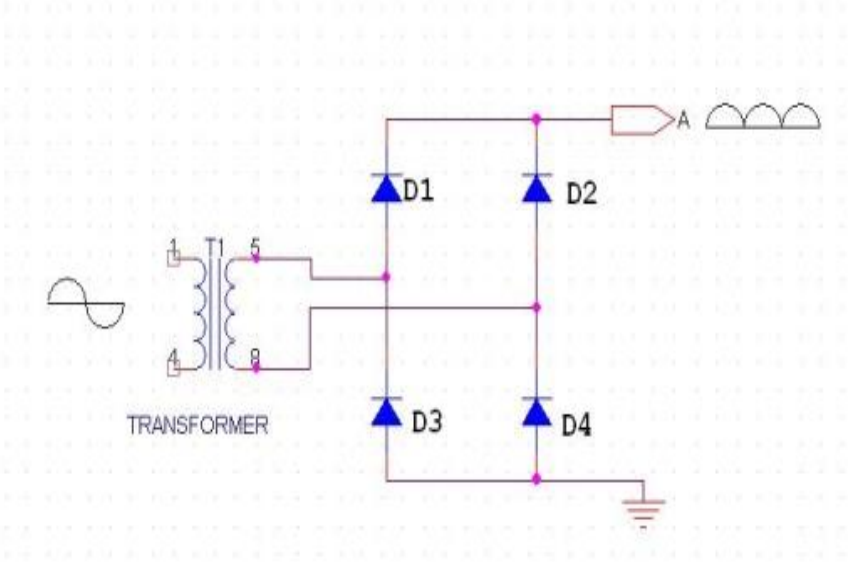


Fig 6.8 Bridge Rectifier with transformer

As the name suggests it converts the full wave i.e. both the positive & the negative half cycle into DC thus it is much more efficient than Half Wave Rectifier & that too without using a center tapped transformer thus much more cost effective than Full Wave Rectifier.

Full Bridge Wave Rectifier consists of four diodes namely D1, D2, D3 and D4. During the positive half cycle diodes D1 & D4 conduct whereas in the negative half cycle diodes D2 & D3 conduct thus the diodes keep switching the transformer connections so we get positive half cycles in the output.

If we use a center tapped transformer for a bridge rectifier we can get both positive & negative half cycles which can thus be used for generating fixed positive & fixed negative voltages

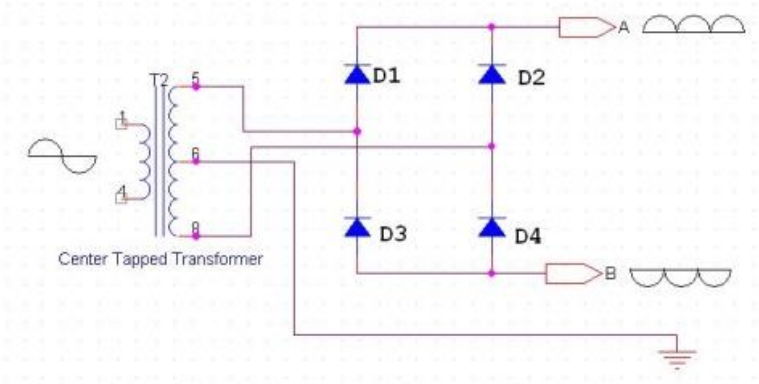


Fig 6.9 Bridge Rectifier with center tapped transformer

6.2.3 Filter Capacitor:

Even though half wave & full wave rectifier give DC output, none of them provides a constant output voltage. For this we require to smoothen the waveform received from the rectifier. This can be done by using a capacitor at the output of the rectifier this capacitor is also called as “FILTER CAPACITOR” or “SMOOTHING CAPACITOR” or “RESERVOIR CAPACITOR”. Even after using this capacitor a small amount of ripple will remain.

We place the Filter Capacitor at the output of the rectifier the capacitor will charge to the peak voltage during each half cycle then will discharge its stored energy slowly

through the load while the rectified voltage drops to zero, thus trying to keep the voltage as constant as possible.sss

If we go on increasing the value of the filter capacitor then the Ripple will decrease. But then the costing will increase. The value of the Filter ca0pacitor depends on the current consumed by the circuit, the frequency of the waveform & the accepted ripple.

$$C = V_r F / I$$

Where,

Vr= accepted ripple voltage.(should not be more than 10% of the voltage)

I= current consumed by the circuit in Amperes.

F= frequency of the waveform. A half wave rectifier has only one peak in one cycle so F=25 Hz

Whereas a full wave rectifier has Two peaks in one cycle so F= 100hz.

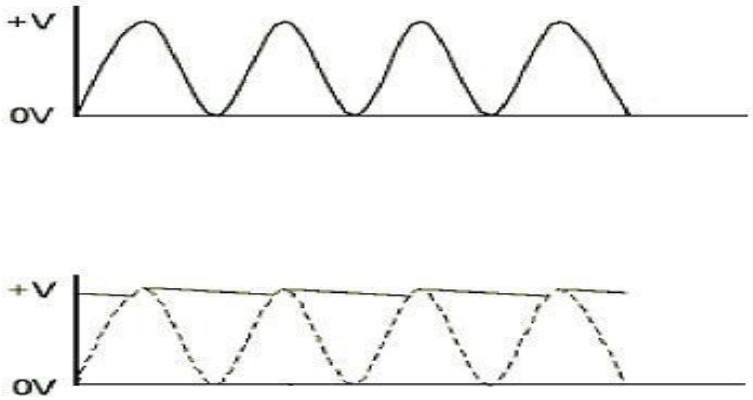


Fig 6.10 Output of Rectifier due to filter capacitor

6.2.4. Voltage Regulator:

A Voltage regulator is a device which converts varying input voltage into a constant regulated output voltage. Voltage regulator can be of two types

1) Linear Voltage Regulator also called as Resistive Voltage regulator because they dissipate the excessive voltage resistively as heat.

2) Switching Regulators:

They regulate the output voltage by switching the Current ON/OFF very rapidly. Since their output is either ON or OFF it dissipates very low power thus achieving higher efficiency as compared to linear voltage regulators. But they are more complex & generate high noise due to their switching action. For low level of output power switching regulators tend to be costly but for higher output wattage they are much cheaper than linear regulators.

The most commonly available Linear Positive Voltage Regulators are the 78XX series where the XX indicates the output voltage. And 79XX series is for Negative Voltage Regulators.

After filtering the rectifier output the signal is given to a voltage regulator. The maximum input voltage that can be applied at the input is 35V.Normally there is a 2-3 Volts drop across the regulator so the input voltage should be at least 2-3 Volts higher than the output voltage. If the input voltage gets below the Vmin of the regulator due to the ripple voltage or due to any other reason the voltage regulator will not be able to produce the correct regulated voltage.

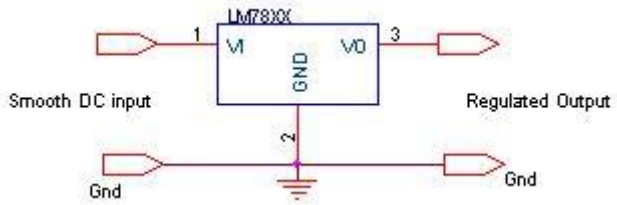


Fig 6.11 Voltage regulator

IC 7805:

7805 is an integrated three-terminal positive fixed linear voltage regulator. It supports an input voltage of 10 volts to 35 volts and output voltage of 5 volts. It has a current rating of 1 amp although lower current models are available. Its output voltage is fixed at 5.0V. The 7805 also has a built-in current limiter as a safety feature. 7805 is manufactured by many companies, including National Semiconductors and Fairchild Semiconductors.

The 7805 will automatically reduce output current if it gets too hot .The last two digits represent the voltage; for instance, the 7812 is a 12-volt regulator. The 78xx series of regulators is designed to work in complement with the 79xx series of negative voltage regulators in systems that provide both positive and negative regulated voltages, since the 78xx series can't regulate negative voltages in such a system.

The 7805 & 78 is one of the most common and well-known of the 78xx series regulators, as it's small component count and medium-power regulated 5V make it useful for powering TTL devices.

Table.6.1. Specifications of IC7805

SPECIFICATIONS	IC 7805
V_{out}	5V
V_{ein} - V_{out} Difference	5V - 20V
Operation Ambient Temp	0 - 125°C
Output I_{max}	1A

.

6.3 Liquid Crystal Display

LCD stands for liquid crystal display. Character and graphical LCDs are most common among hobbyist and DIY electronic circuit/project makers. Since their interface serial/parallel pins are defined so it’s easy to interface them with many microcontrollers. Many products we see in our daily life have LCDs with them. They are used to show status of the product or provide interface for inputting or selecting some process. Washing machine, microwave, air conditioners and mat cleaners are few examples of products that

have character or graphical LCDs installed in them. In this tutorial i am going to discuss about the character LCD's. How they work? Their pin out and initialization commands etc.

Character LCD's come in many sizes 8x1, 8x2, 10x2, 16x1, 16x2, 16x4, 20x2, 20x4, 24x2, 30x2, 32x2, 40x2 etc. Many multinational companies like Philips, Hitachi, and Panasonic make their own custom type of character LCD's to be used in their products. All character LCDs performs the same functions (display characters numbers special characters, asci characters etc.). Their programming is also same and they all have same 14 pins (0-13) or 16 pins (0 to 15).

In an LCD. M denotes number of coulombs and n represents number of rows. Like if the LCD is denoted by 16x2 it means it has 16 coulombs and 2 rows. Few examples are given below. 16x2, 8x1 and 8x2 LCD are shown in the picture below. Note the difference in the rows and coulombs.

On a character LCD a character is generated in a matrix of 5x8 or 5x7. Where 5 represents number of coulombs and 7/8 represent number of rows. Maximum size of the matrix is 5x8. You cannot display character greater then 5x8 dimension matrix. Normally we display a character in 5x7 matrixes and left the 8th row for the cursor.

If we use the 8th row of the matrix for the character display, then there will be no room for cursor. The picture on the right side shows the 5x8 dot matrix pixels arrangement. To display character greater than this dimension you have to switch to graphical LCD's.

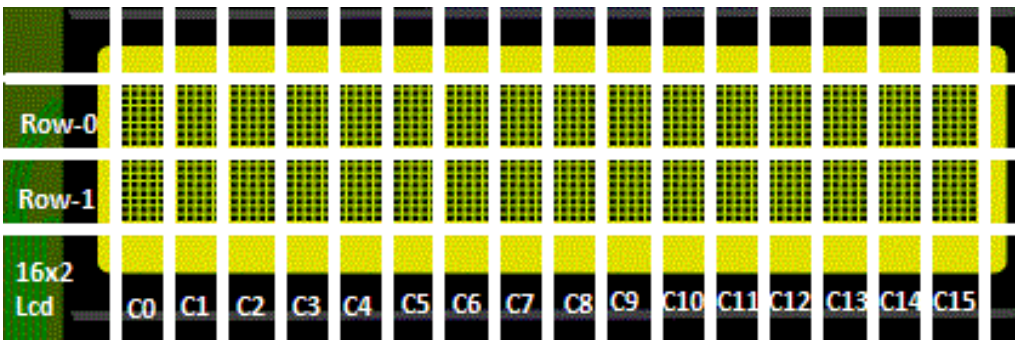


Fig.6.12 Schematic diagram of LCD

All character LCD's have

- Eight (8) data pins D0-D7
- Vcc (Apply +5 volt here)
- Gnd (Ground this pin)
- Rc (Register select)
- Rw (read - write)
- En (Enable)
- V0 (Set LCD contrast)

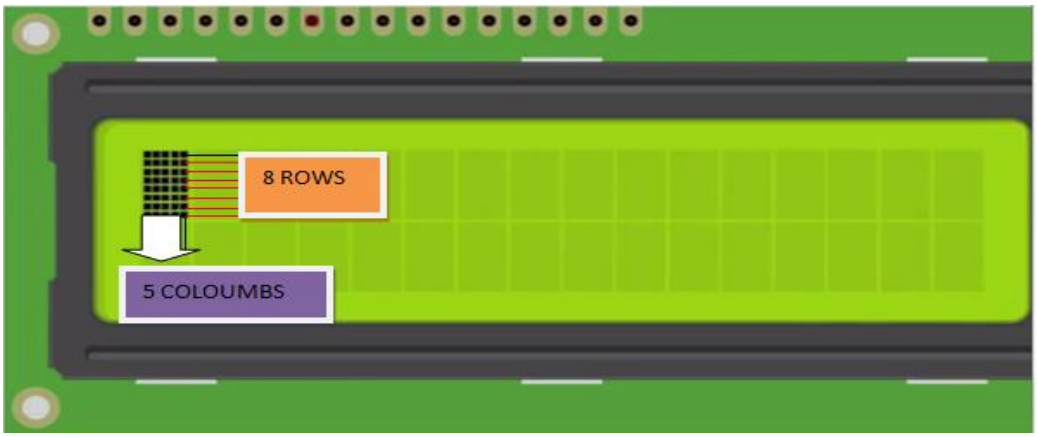


Fig.6.13 ----------

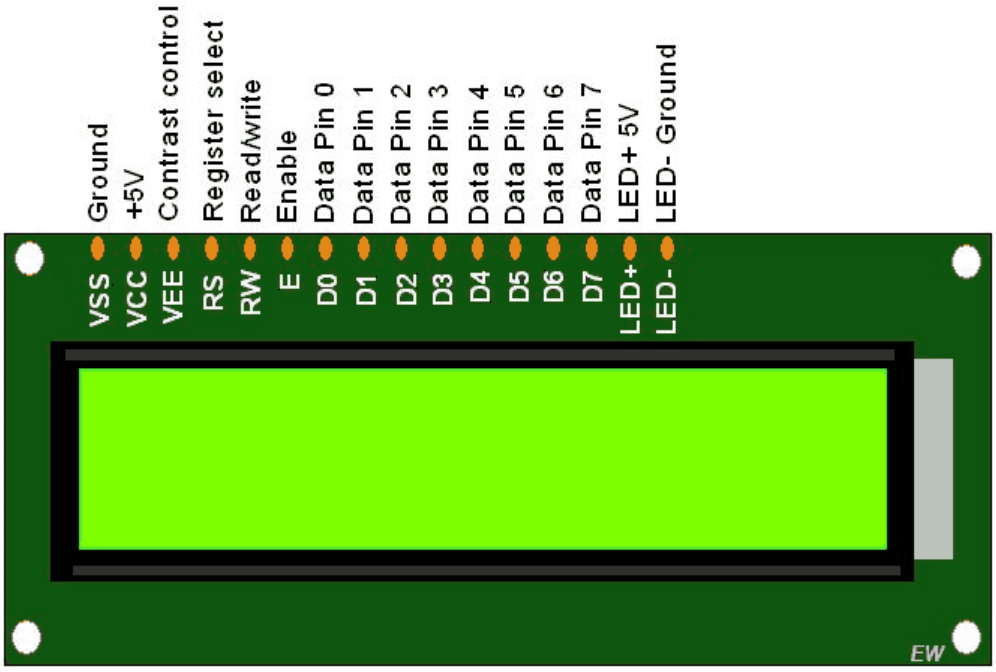


Fig.6.14 Pin diagram of LCD

The picture on the left side shows the pin out of the character LCD. Almost all the character LCD's are composed of the same pin out. LCD's with total pin count equal to 14 does not have back light control option. They might have back light always on or does not have a back light. 16 total pin count LCD's have 2 extra A and K pins. A means anode and K cathode use these pins to control the back light of LCD.

Character LCD's have a controller build in to them named HD44780. We actually talk with this controller in order to display character on the LCD screen. HD44780 must be properly handled and initialized before sending any data to it. HD44780 has some registers which are initialized and manipulated for character displaying on the LCD. These registers are selected by the pins of character LCD.

Rs(Register select)

Register select selects the HD44780 controller registers. It switches between Command and data register.

- Command Register
- Data Register

Command Register

When we send commands to LCD these commands go to Command register and are processed there. Commands with their full description are given in the picture below. When Rs=0 command register is selected.

Data Register

When we send Data to LCD it goes to data register and is processed there. When Rs=1 data register is selected.

Rw (Read - Write)

Rw pin is used to read and write data to HD44780 data and command registers. When Rw=1 we can read data from LCD. When Rw=0 we can write to LCD.

En (Enable signal)

When we select the register Rs(Command and Data) and set Rw(read - write) and placed the raw value on 8-data lines, now it's time to execute the instruction. By instruction i mean the 8-bit data or 8-bit command present on Data lines of LCD. For sending the final data/command present on the data lines we use this enable pin. Usually it remains en=0 and when we want to execute the instruction we make it high en=1 for some mills seconds. After this we again make it ground en=0.

V0 (Set LCD contrast)

To set LCD display sharpness use this pin. Best way is to use variable resistor such as potentiometer a variable current makes the character contrast sharp. Connect the output of the potentiometer to this pin. Rotate the potentiometer knob forward and backward to adjust the LCD contrast.

NOTE: we cannot send an integer, float, long, double type data to LCD because LCD is designed to display a character only. Only the characters that are supported by the HD44780 controller. See the HD44780 data sheet to find out what characters can we display on LCD. The 8 data pins on led carries only Ascii 8-bit code of the character to LCD. However, we can convert our data in character type array and send one by one our data to LCD. Data can be sent using LCD in 8-bit or 4-bit mode. If 4-bit mode is used, two nibbles of data (First high four bits and then low four bits) are sent to complete a full eight-bit transfer. 8-bit mode is best used when speed is required in an application and at least ten I/O pins are available. 4-bit mode requires a minimum of seven bits. In 4-bit mode, only the top 4 data pins (4-7) are used.

6.4 Ultrasonic Sensor:

The ultrasonic sensor is used for obstacle detection. Ultrasonic sensor transmits the ultrasonic waves from its sensor head and again receives the ultrasonic waves reflected from an object.

There are many applications use ultrasonic sensors like instruction alarm systems, automatic door openers etc. The ultrasonic sensor is very compact and has a very high performance.

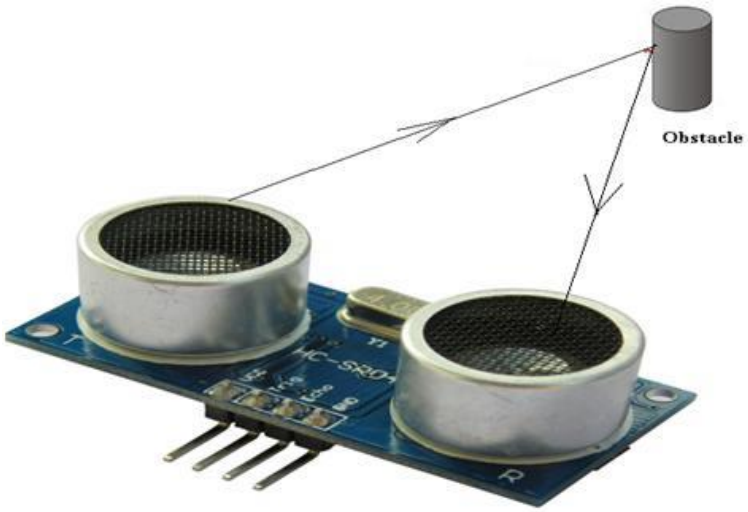


Fig.6.15 Ultrasonic sensor

6.4.1 Working Principle:

The ultrasonic sensor emits the short and high frequency signal. These propagate in the air at the velocity of sound. If they hit any object, then they reflect back echo signal to the sensor. The ultrasonic sensor consists of a multi vibrator, fixed to the base. The multi vibrator is combination of a resonator and vibrator. The resonator delivers ultrasonic wave generated by the vibration. The ultrasonic sensor actually consists of two parts; the emitter which produces a 40 kHz sound wave and detector detects 40 kHz sound wave and sends electrical signal back to the microcontroller.

The ultrasonic sensor enables the robot to virtually see and recognize object, avoid obstacles, measure distance. The operating range of ultrasonic sensor is 10 cm to 30 cm.

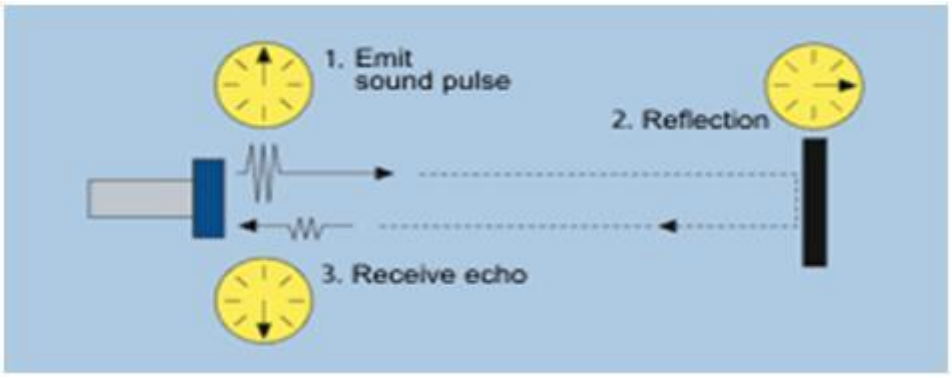


Fig.6.16 Ultrasonic sensor

6.4.2 Operation of the ultrasonic sensor:

When an electrical pulse of high voltage is applied to the ultrasonic transducer it vibrates across a specific spectrum of frequencies and generates a burst of sound waves. Whenever any obstacle comes ahead of the ultrasonic sensor the sound waves will reflect back in the form of echo and generates an electric pulse. It calculates the time taken between sending sound waves and receiving echo. The echo patterns will be compared with the patterns of sound waves to determine detected signal's condition.

Note: The ultrasonic receiver shall detect signal from the ultrasonic transmitter while the transmit waves hit on the object. The combination of these two sensors will allow the robot to detect the object in its path. The ultrasonic sensor is attached in front of the robot and that sensor will also help the robot navigate through the hall of any building.

Applications of Ultrasonic Sensor:

- Automatic change overs of traffic signals
- Intruder alarm system
- Counting instruments access switches parking meters
- Back sonar of automobiles

Features of Ultrasonic Sensor:

- Compact and light weight
- High sensitivity and high pressure
- High reliability
- Power consumption of 20mA
- Pulse in/out communication
- Narrow acceptance angle
- Provides exact, non-contact separation estimations within 2cm to 3m
- The explosion point LED shows estimations in advancement
- 3-pin header makes it simple to connect utilizing a servo development link.

6.5 Water Level Sensor

The water level sensor is a device that measures the liquid level in a fixed container that is too high or too low. According to the method of measuring the liquid level, it can be divided into two types: contact type and non-contact type. The input type water level transmitter we call is a contact measurement, which converts the height of the liquid level into an electrical signal for output. It is currently a widely used water level transmitter.

This water level sensor provides an analog output of 0v to 2.3V DC relative to the resistance change of the sensing pad due to either amount of raindrops or immersion depth in water. If the board has water or another fluid covering all the wire, then it will output a maximum analog value reading. Since analog values have a range from 0 (lowest reading) to 1023 (highest reading), a board completely submerged with a liquid will have a reading of 1023 by a microcontroller. If the board is halfway covered, a reading of about 512 will be read and If the boar if 1/4 covered by a liquid, then will read about 256.If no liquid is on it at all, then a near 0 reading should be obtained.

Benefits of water level sensor

- Simple structure: There are no movable or elastic elements, so the reliability is extremely high, and there is no need for regular maintenance during use. The operation is simple and convenient.

- Convenient installation: When using, first connect one end of the wire correctly, and then put the other end of the water level probe into the solution to be measured.
- Ranges are optional: you can measure the water level in the range of 1-200 meters, and other measurement ranges can also be customized.
- Wide range of applications: suitable for liquid level measurement of high temperature and high pressure, strong corrosion, high pollution, and other media. Building an electronic water level gauge on the river bank can be used for tide monitoring.
- Wide range of measuring medium: High-precision measurement can be carried out from the water, oil to paste with high viscosity, and wide-range temperature compensation is not affected by the foaming, deposition, and electrical characteristics of the measured medium.
- Long service life: Generally, the liquid level sensor can be used for 4-5 years in a normal environment, and it can also be used for 2-3 years in a harsh environment.
- Strong function: It can be directly connected to the digital display meter to display the value in real-time, or it can be connected to a variety of controllers and set the upper and lower limits to control the water volume in the container.
- Accurate measurement: The built-in high-quality sensor has high sensitivity, fast response, and accurately reflects the subtle changes of the flowing or static liquid level, and the measurement accuracy is high.
- Variety of types: liquid level sensors have various structural designs such as input type, straight rod type, flange type, thread type, inductive type, screw-in type, and float type. It can meet the measurement needs of all different places.

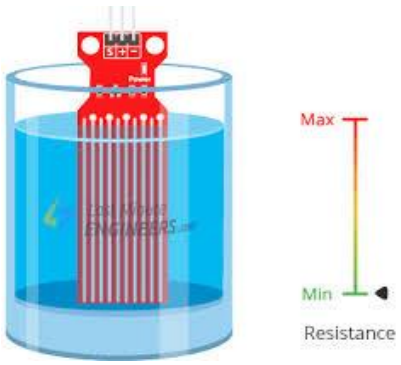


Fig.6.17 Water Level Sensor

Specialisation of water level sensor

- Operating voltage: DC 3v to 5V
- Operating current: less than 20mA
- Sensor Type: Analog
- Detection Area: 40mm x 16mm
- Production process: FR4 double-sided HASL
- VCC: Connected to the power supply positive 3v to 5V
- GND: Connected to the power supply negative
- AO: Analog 0-2.3V DC
- Size: 32mm x 14mm (1.26inch x 0.55inch)

Working:

The working principle of the water level sensor is that when the sensor is put into a certain depth in the liquid to be calculated, the pressure on the sensor's front surface is converted into the water level height.

The formula is

P-p.g.H+Po,

where P is the pressure on the water surface of the sensor p is the density of the water that is to be measured Po is the atmospheric pressure on the water's surface g is the acceleration of gravity H is the depth at which the sensor drops into the liquid. The level sensor is a device designed to monitor and calculate liquid levels. When the liquid level is detected, the sensor converts the sensed data into an electrical signal that can be propagated and displayed.

CHAPTER-7

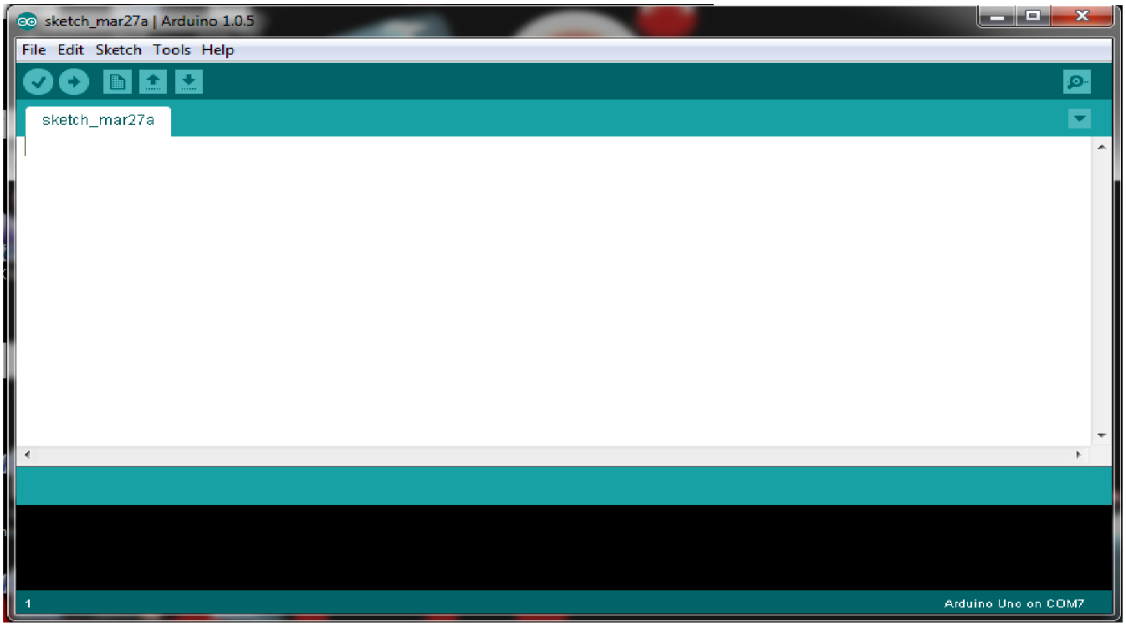
SOFTWARE DESCRIPTION

7.1 Arduino IDE

The Arduino integrated development environment (IDE) is a cross-platform application written in Java, and is derived from the IDE for the Processing programming language and the Wiring projects. It includes a code editor which is capable of compiling and uploading programs to the board with a single click. A program or code written for Arduino is called a "sketch".

Following are the steps involved:

1. Open Arduino IDE as shown below

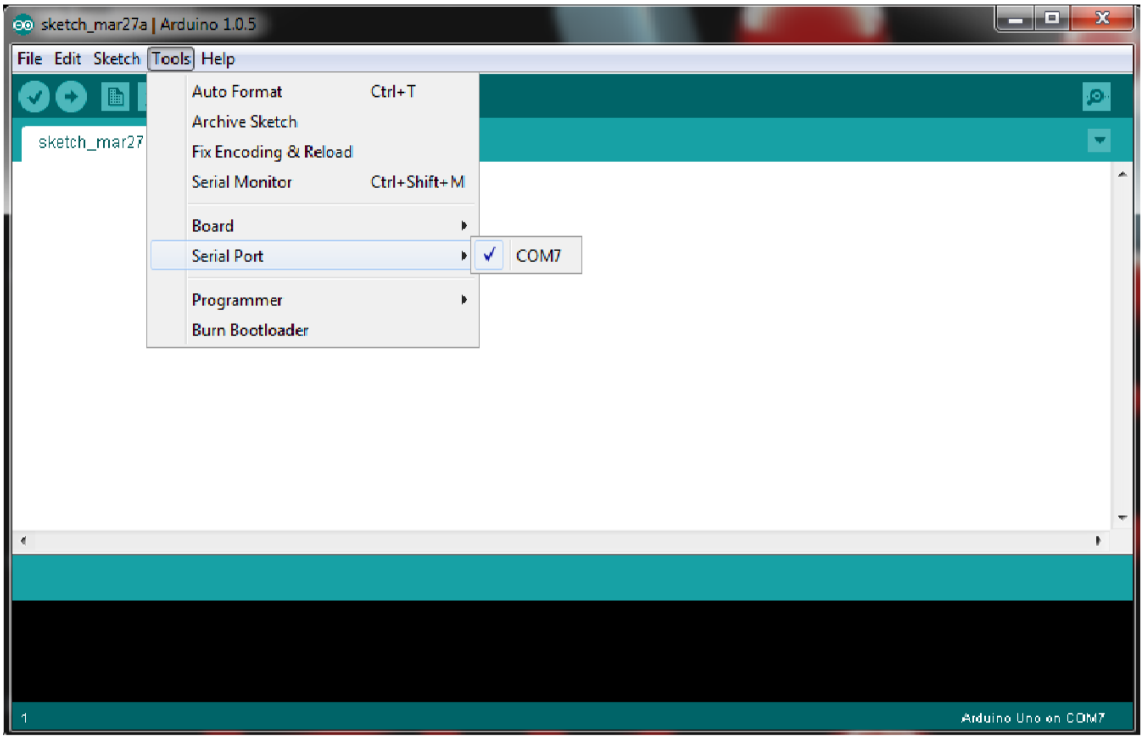


Arduino programs are written in C or C++. The Arduino IDE comes with a software library called "Wiring" from the original Wiring project, which makes many common input/output operations much efficient. Users only need define two functions to make a runnable cyclic executive program:

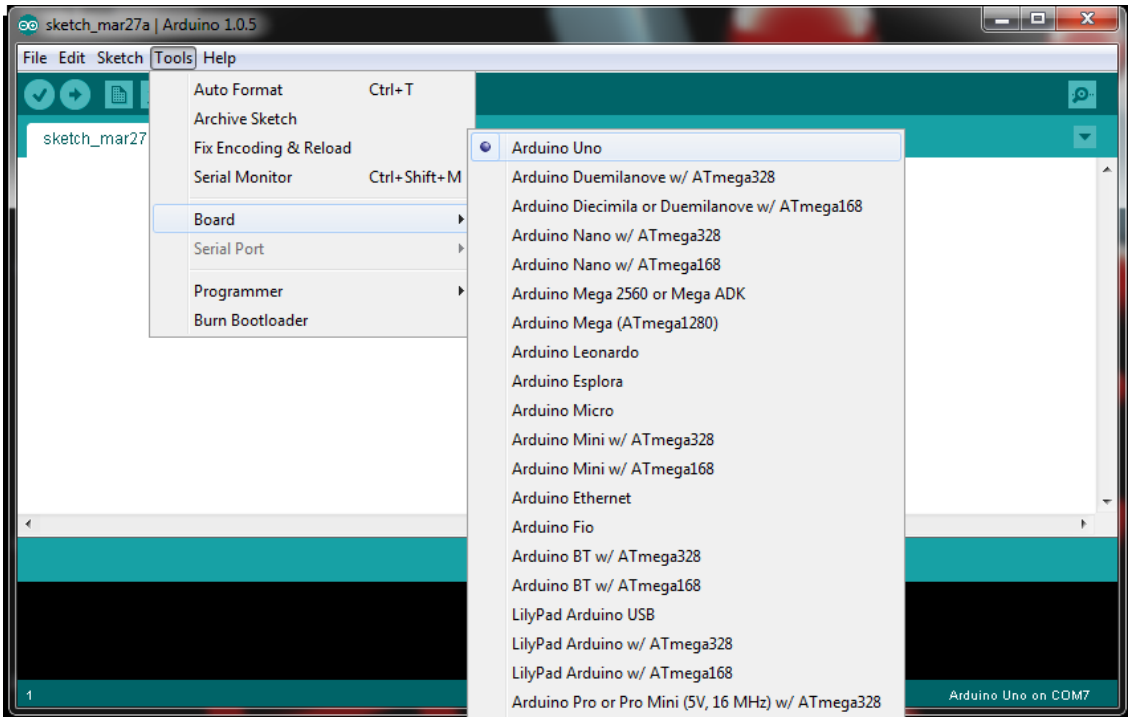
setup(): a function run once at the start of a program that can initialize settings

loop(): a function called repeatedly until the board powers off

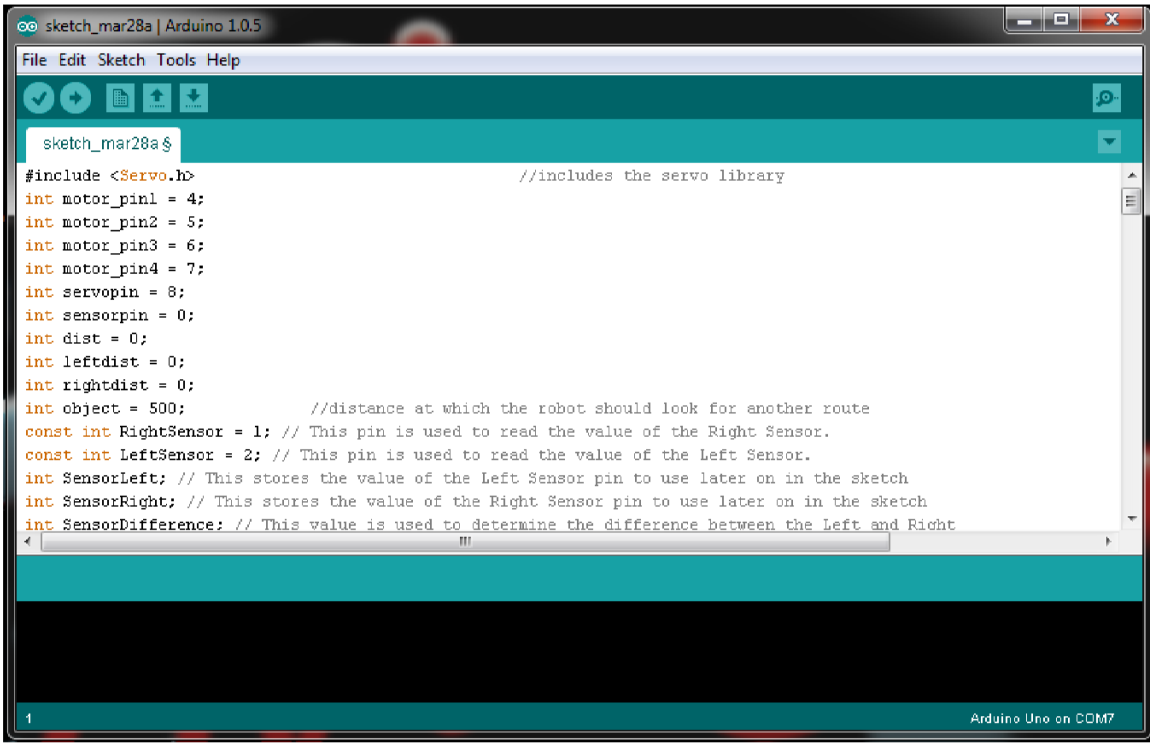
2. Select the COM Port from tools



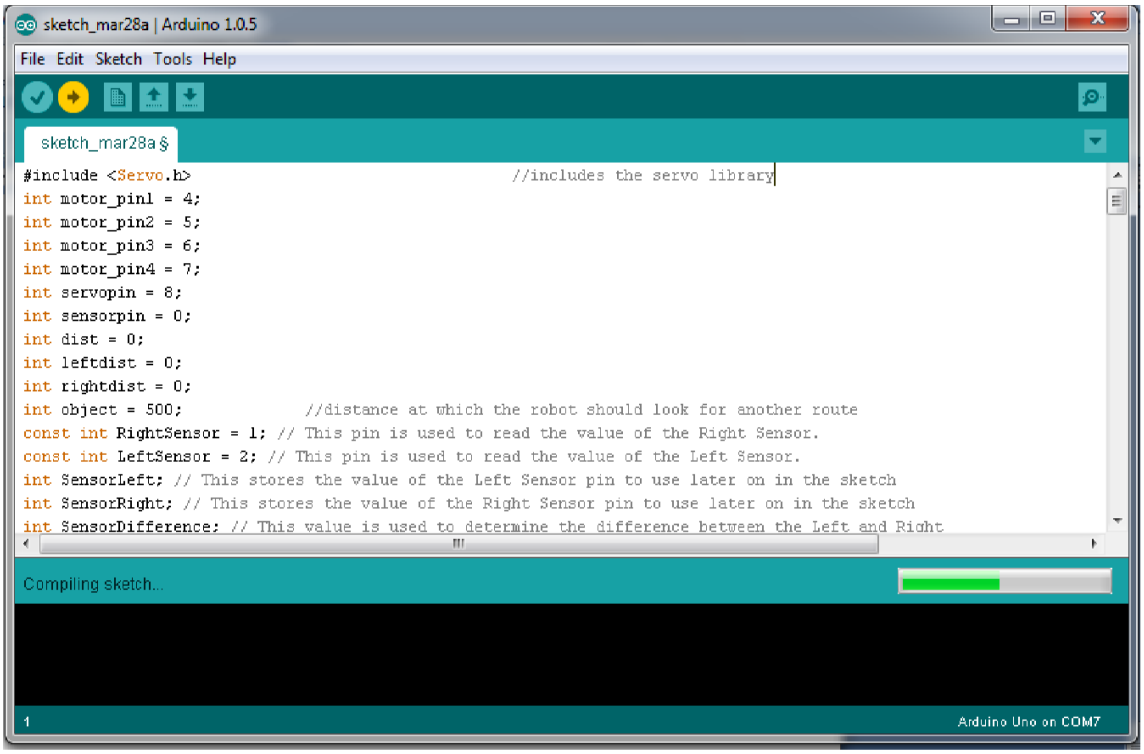
3. Select the required Arduino board from Tools



4. Write the sketch in Arduino IDE



5.Compile and upload the Sketch to Arduino board



7.2 NODEMCU USING ARDUINO IDE:

Introduction:

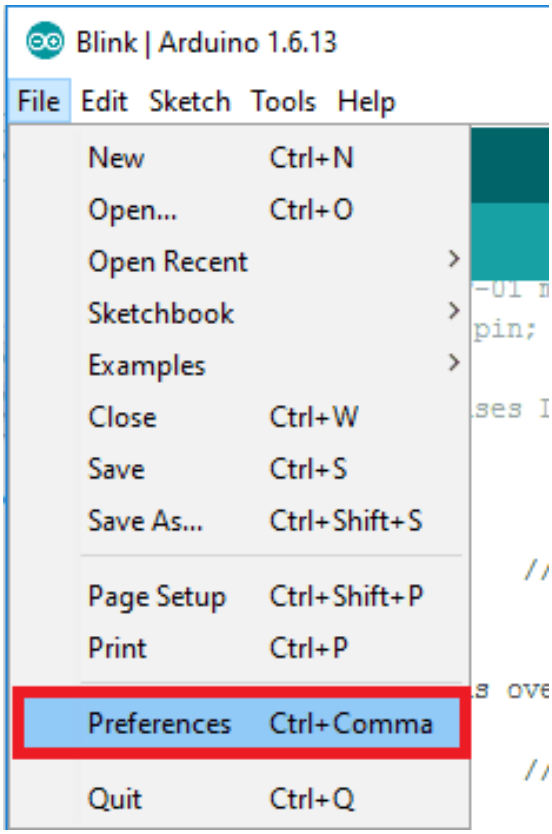
NodeMCU is Lua based firmware of ESP8266. Generally, ESPlorer IDE is referred for writing Lua scripts for NodeMCU. It requires to get familiar with ESPlorer IDE and Lua scripting language.

There is another way of developing NodeMCU with a well-known IDE i.e. Arduino IDE. We can also develop NodeMCU applications using Arduino development environment. This makes things easy for Arduino developers than learning new language and IDE for NodeMCU.

Let's see about setting up Arduino IDE with NodeMCU.

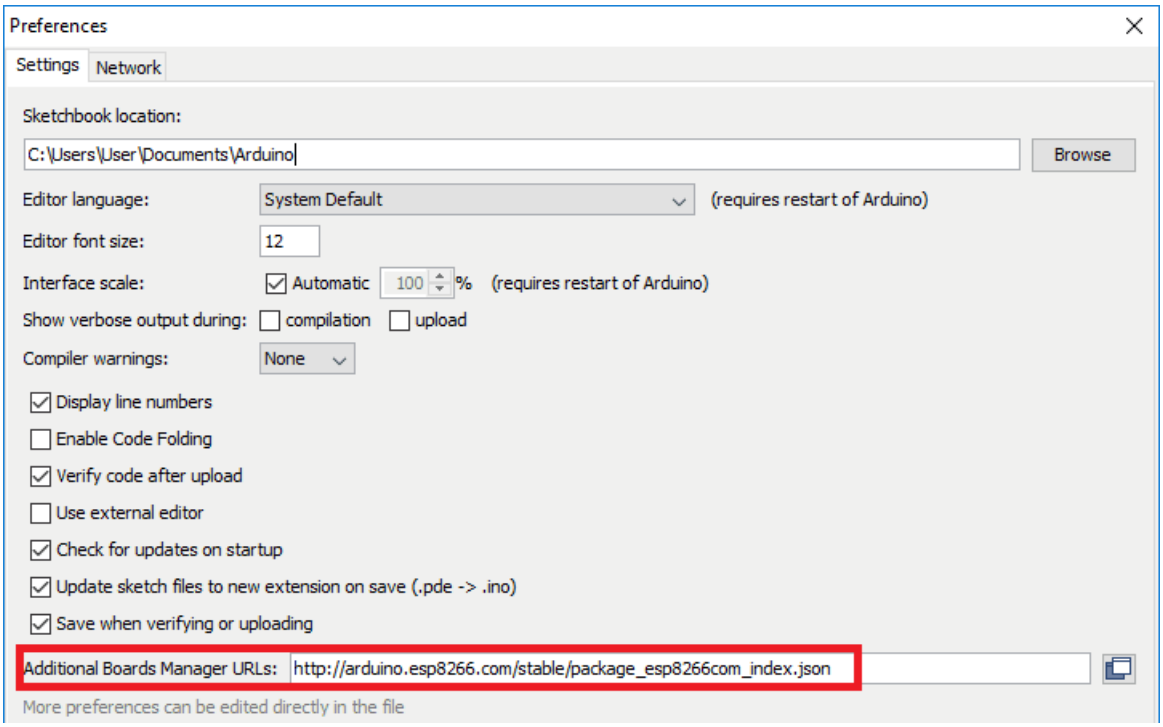
First **Download Arduino IDE (version 1.6+)** https://www.arduino.cc/en/Main/Software

- **Open Arduino IDE** and **Go to File -> Preference**.

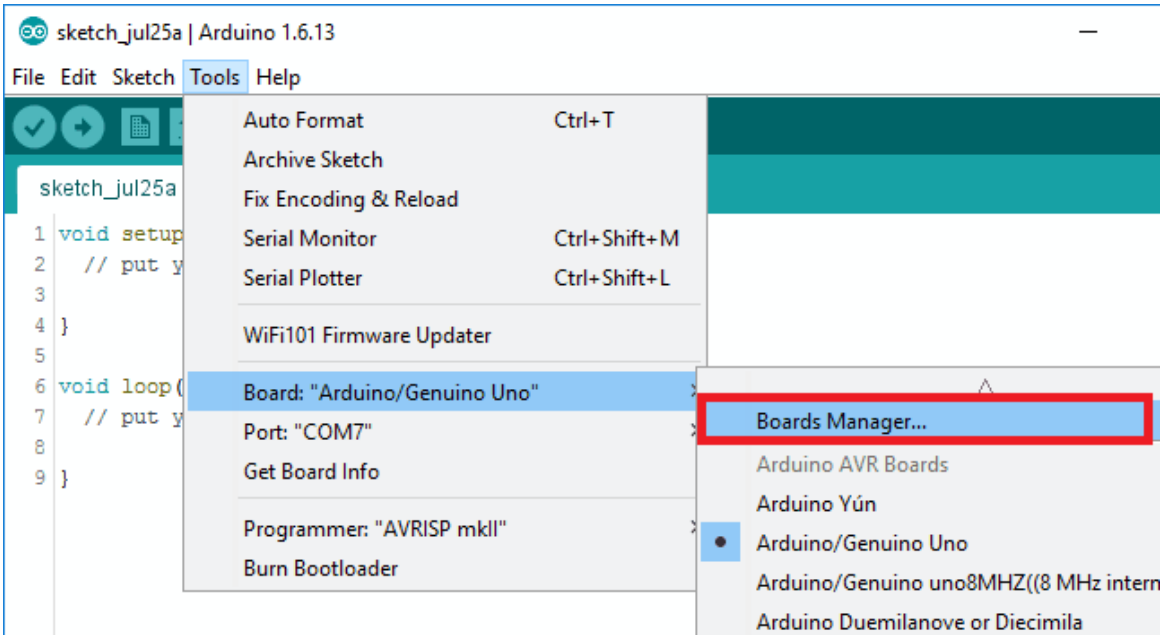


- Now on Preference window, **Enter below link in Additional Boards Manager URLs**

  http://arduino.esp8266.com/stable/package_esp8266com_index.json

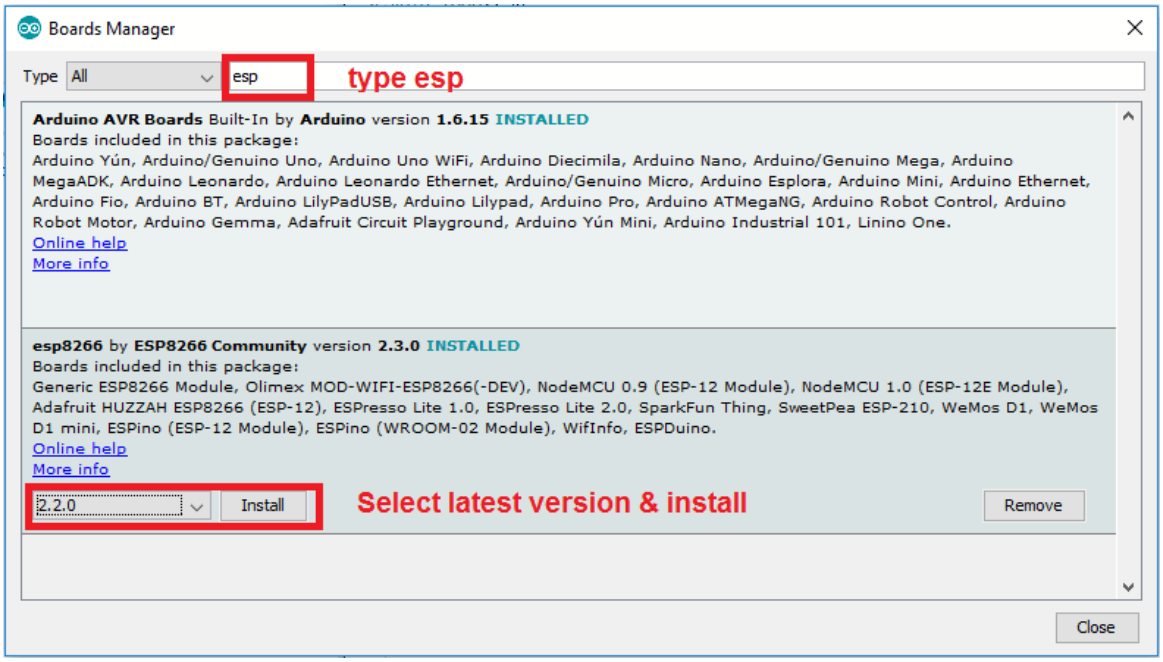


- Now close Preference window and **go to Tools -> Board -> Boards Manager**

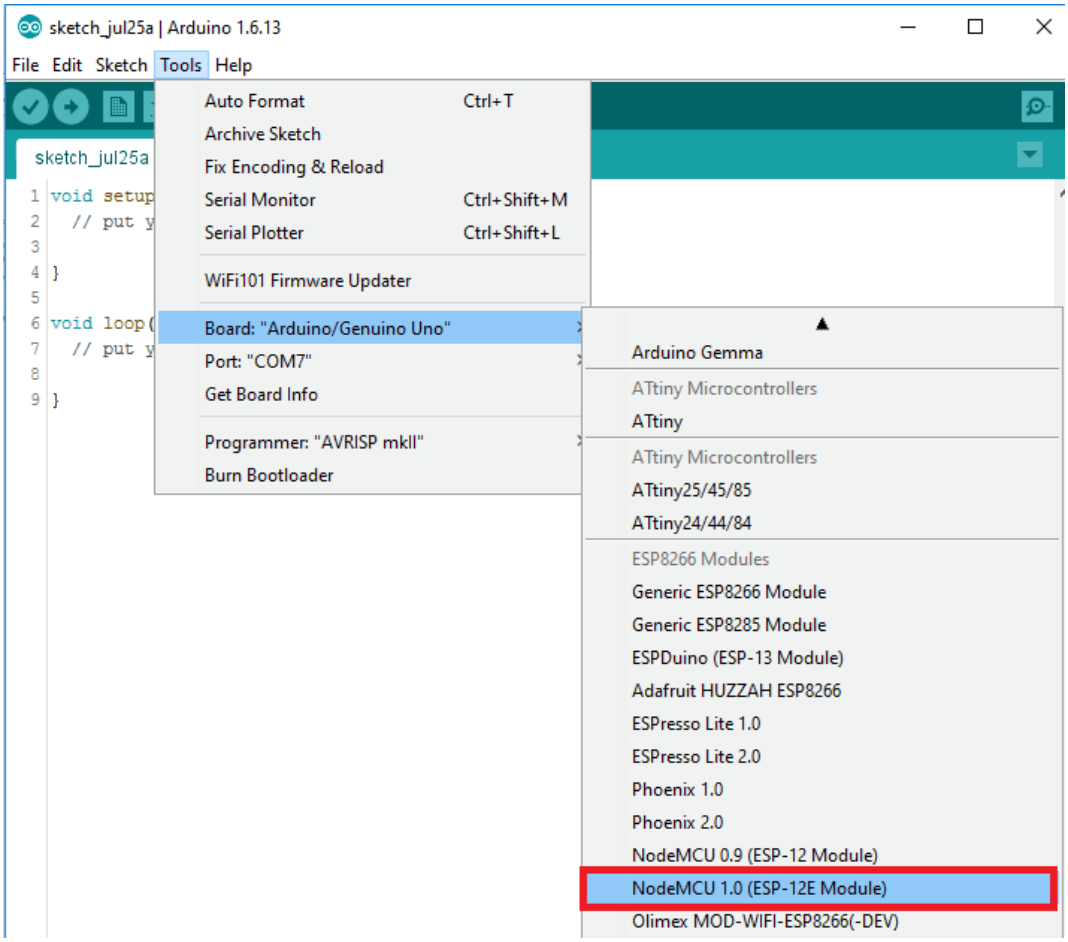


- In Boards Manager window**, Type esp in the search box, esp8266 will be listed there below.**

  Now select latest version of board and click on install.



- After installation of the board is complete, **open Tools->Board->and select NodeMCU 1.0 (ESP-12E Module).**



- **Now Your Arduino IDE is ready for NodeMCU**

Example:

Let’s see how to write simple serial print sketch using Arduino IDE for NodeMCU.

First connect NodeMCU Development Kit with PC as shown in below figure.

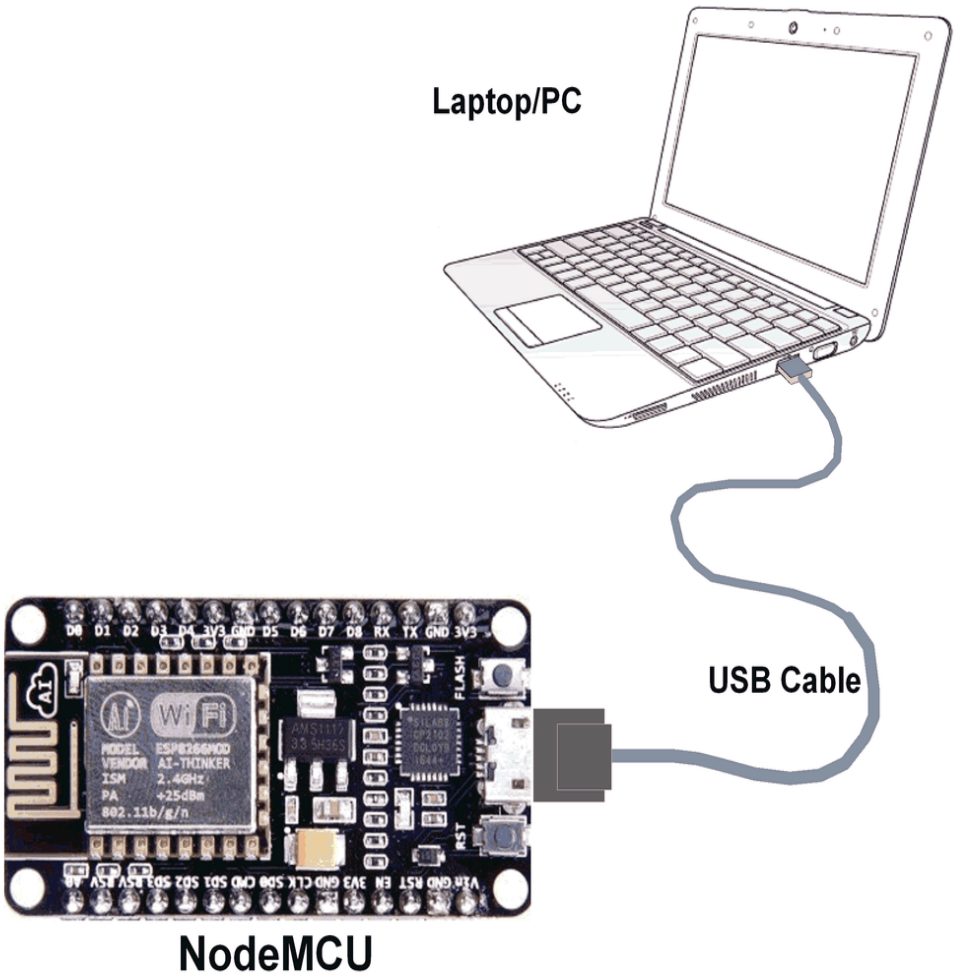


Fig7.1 ----------

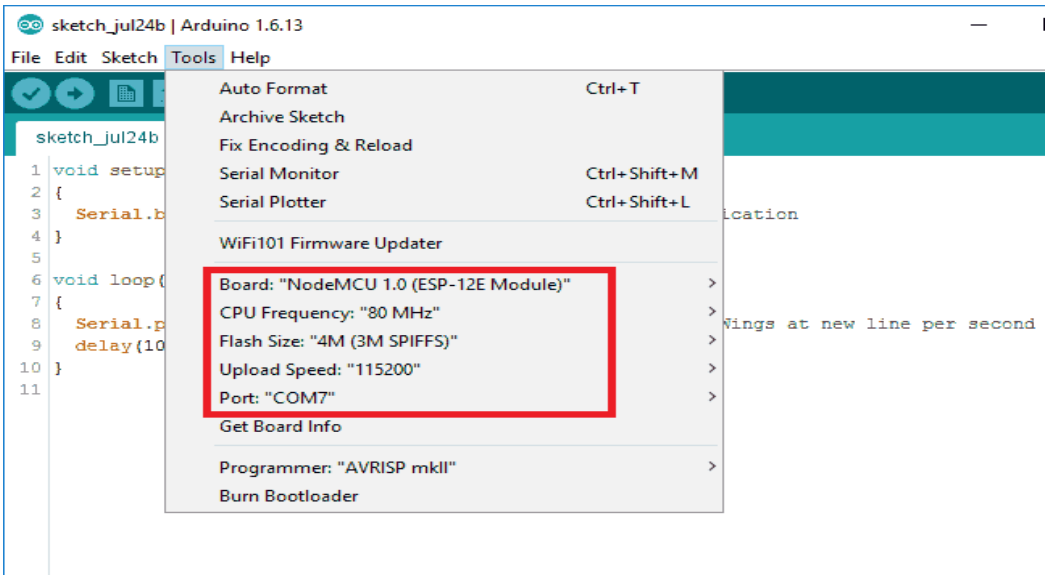
NodeMCU connection with PC

- After setting up Arduino IDE for NodeMCU, **open Arduino IDE and write simple sketch of serial print** as shown in below figure.

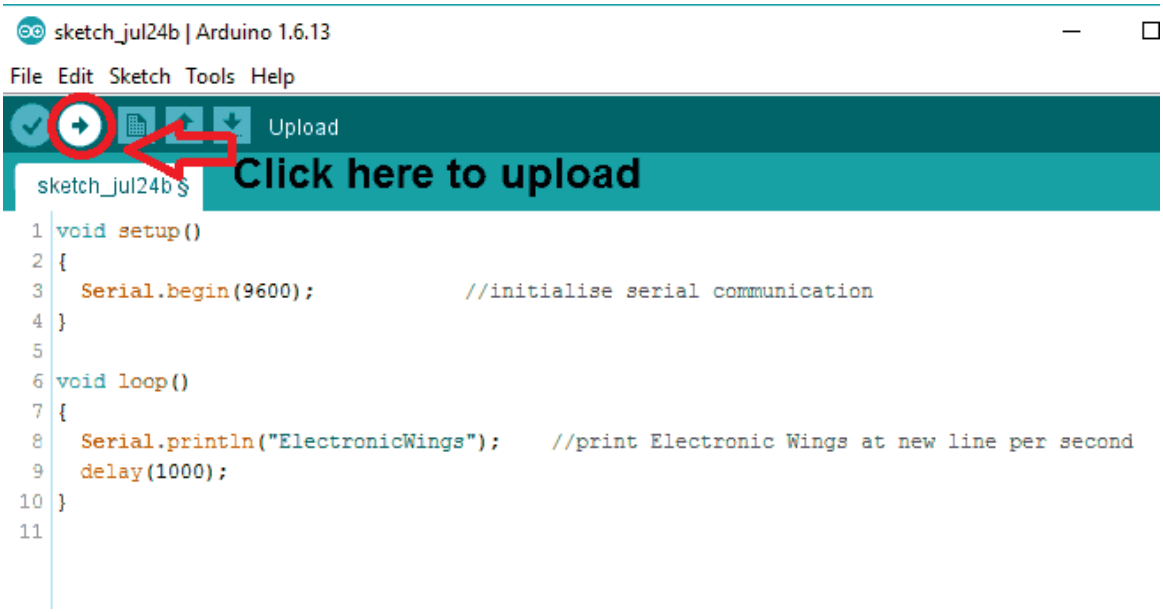
Arduino Sketch:

```
void setup() {
Serial.begin(9600);                /* initialise serial communication */
}
void loop() {
Serial.println("Smart Shopping Cart System");
/* print Electronic Wings at new line per second */
delay(1000);
}
```

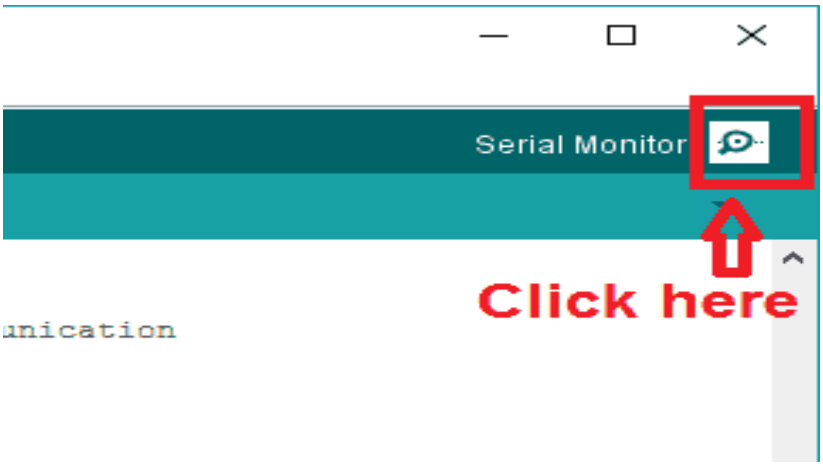
- **Ensure that you have selected the correct board** as shown in below figure. Also **make sure that you have selected the appropriate COM port**.



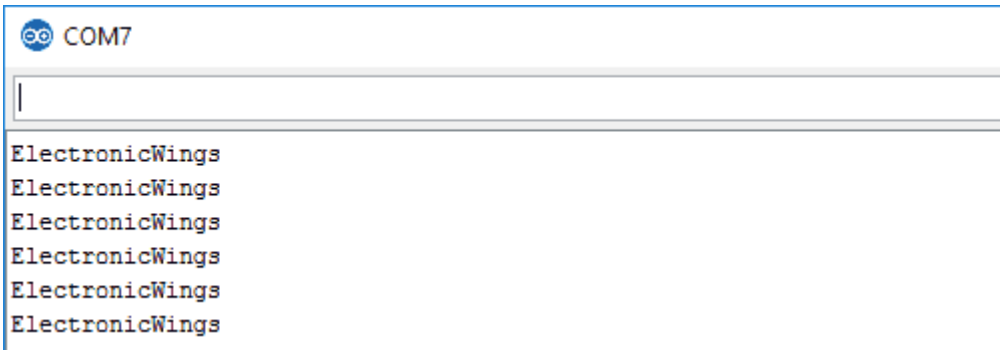
- Now **compile & upload the written sketch** directly to the NodeMCU Dev Kit by clicking on upload button.



- Now **Click on Serial Monitor (upper right corner) option** to check output on serial monitor window of Arduino IDE.

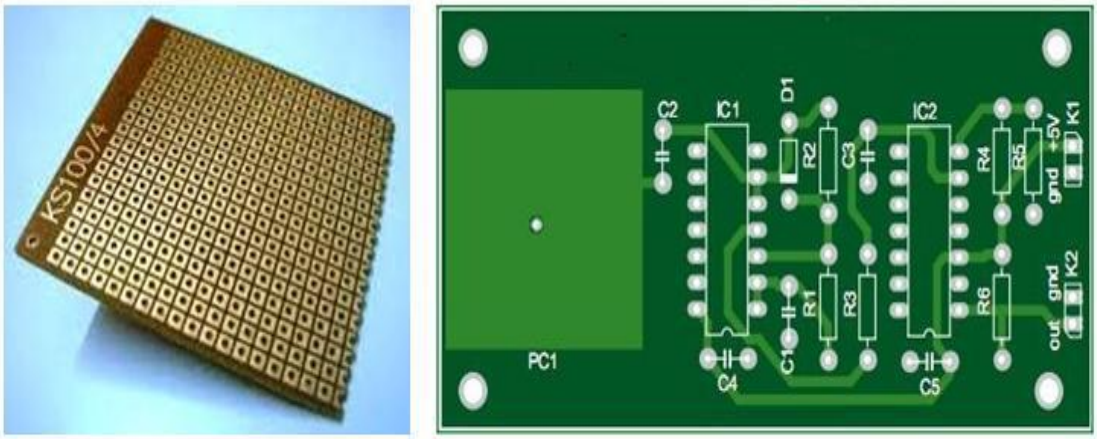


- Serial monitor output window will pop up with output as shown in below figure.



7.3 PCB Layout Design with Proteus

Generally, we are listening the words **PCB's**, **PCB layout**, **PCB designing**, etc. But what is PCB? Why we are using this PCB? We want to know about all these things as an electronic engineer. PCB means Printed Circuit Board. This is a circuit board with printed copper layout connections. These PCB's are two types. One is dotted PCB and another one is layout PCB. The two examples are shown in below.



Dotted PCB Layout PCB

Fig.7.1 PCB Designs

What is the main difference between the dotted PCB and layout PCB?

In dotted PCB board only dots are available. According to our requirement we can place or insert the components in those holes and attach the components with wires and soldering lid. In this dotted PCB we can make the circuit as out wish but it is very hard to design. There are so many difficulties are there. Those are connecting the proper pins, avoiding shot connections and etc. Coming to the layout PCB this is simple to design. First we select the our circuit and by using different PCB designing software's, design the layout of the circuit and by itching process preparing the copper layout of our circuit and solder the components in the correct places. It is simple to design, take less time to design, no shortages, looking nice and perfect.

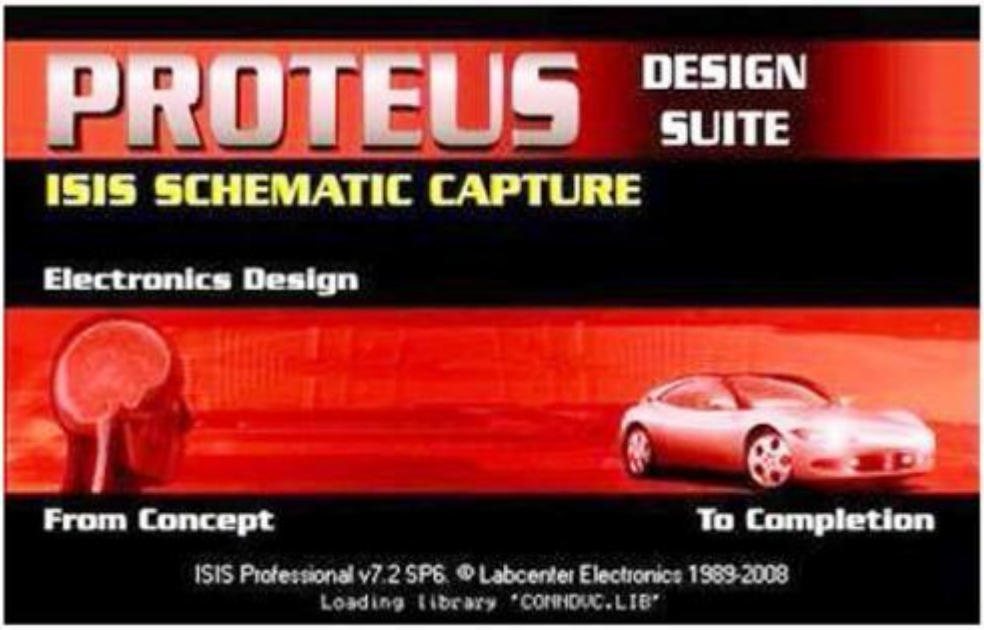
Up to now we have discussed about types of PCB's and difference between the types. Now we can discuss about **PCB designing software**. There are so many PCB designing software's available. Some are **Express PCB**, **eagle PCB**, **PCB Elegance**, **and**

free PCB, o**pen circuit design**, **zenith PCB** and **Proteus** etc. Apart from remaining Proteus is different. Proteus is design suit and PCB layout designing software. In Proteus we can design any circuit and simulate the circuit and make PCB layout for that circuit.

Introduction to Proteus:

Proteus professional is a software combination of ISIS schematic capture program and ARES PCB layout program. This is a powerful and integrated development environment. Tools in this suit are very easy to use and these tools are very useful in education and professional PCB designing. As professional PCB designing software with integrated space based auto router, it provides features such as fully featured schematic capture, highly configurable design rules, interactive SPICE circuit simulator, extensive support for power planes, industry standard CADCAM & ODB++ output and integrated 3D viewer.

Up to know we have discussed about the basics and software description. Now we are entering into the designing section. Run the ISIS professional program by clicking the icon on the desktop, then this splash screen will appear.



Next, a work space with interface buttons for designing circuit will appear as shown in figure below. Note that there is a blue rectangular line in the workspace; make sure that whole circuit is designed inside the rectangular space.

CHAPTER-8

RESULTS AND DISCUSSION

The complete system which contains the bins installed with sensor unit. The Arduino will get the level of the garbage from the ultrasonic sensor and send the information to the server via Wi-Fi module i.e., ESP 8266.In the service section, residents will throw the waste in a bin and that information with the sensors is collected and transferred to the administration section. The server will check for the threshold level and if the level is high, it will send the notification. The web Server displays the details and status of bin, at real time. The same information is transferred to concerned authority so that accordingly the filled bins are timely evacuated.

After the IOT field finding its grip in our lives. This is, however an original plan for designing smart garbage bin with ultrasonic sensor, Arduino and Wi-Fi module for transmission of data. Instead of using plenty of bins in an unordered fashion around the city, minimal number of smart bins can be used. Using only one sensor at the surface level instead of three to four not only makes it affordable but also achieves the same result.

Photo

CHAPTER-9

ADVANTAGES AND DISADVANTAGES

9.1 Advantages:

- Monitors the garbage bins and informs about the level of garbage collected in the garbage bins.
- To keep our Environment clean & Green.
- The cost & effort are less in this system.
- To collect dustbins at public places in city.
- Many times, garbage dust bin is over flown and many animals like dogs or goat enters inside or near the dust bin. This creates a bad scene. Also some birds are also trying to take out garbage from dustbin. This project can avoid such situations

9.2 Disadvantages:

- Have limited life after installation.
- Process is not always cost -effective
- Sensor nodes used in the dustbins have limited memory size.
- The training has to be provided to the people involved in the smart waste management system

9.3 Application:

- This project can be used in the “SMART CITY”.
- This project is helpful for the nation’s “CLEAN INDIA MISION”.
- This project is also helpful in the Government project of “SWACH BHARAT ABHIYAN”.
- This project can also be used in college/university campus.
- This project when implemented reduces the human interference and also increases the efficiency of waste collection.

CHAPTER-10
CONCLUSION

In this entire world, waste management Is a major challenging issue that plays a very important role in the development of the nation. If it is not properly disposed or cleaned which will causes lot of diseases and spoil the green environment? Using IoT there are different and efficient solutions for waste management with minimum human attention. In this paper we have addressed and came across the various techniques of waste management. We have considered solutions for checking status of trashcans, sending information to respective person by giving shortest way to collect it.

10.1 Future Scope:

Now this system can be used in certain areas but as soon as it proves its credibility it can be used in all the big areas. In future, a team can be made which will be in charge for handling and maintaining this system and also to take care of its maintenances. Inclusion of the control room will effectively help monitor the garbage level from the Central Office. Integrating the system with an application-based website to have an exact location on the map.

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