

A
Major Project Report on
Satellite: SHUNYA



SESSION 2017-2018
A Major Project Report
submitted to
Rajiv Gandhi Proudhyogiki Vishwavidyalaya
Bhopal (M. P.)
In partial fulfillment of awarding the degree of
Bachelor of Engineering
In
Electronics & Communication

Guided by:
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**MAHAKAL INSTITUTE OF TECHNOLOGY
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SESSION 2017-18

Certificate

This is to certify that the Major Project work of **Team SHUNYA** entitled “**Satellite**” towards partial fulfillment of the requirement for the award of the degree of Bachelor of Engineering in Electronics & Communication Engineering is a satisfactory account of his work based on syllabus and is approved for the degree of Bachelor of Engineering in Electronics & Communication Engineering.

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The successful completion of this project is the results of dedicated efforts of many people and this report would be incomplete without giving due credit to them. This acknowledgement is small token of gratitude in recognition of their help in there endeavor.

I express my profound sense of gratitude to **Dr. Vivek Bansod**, Director, MIT, Ujjain, for providing their valuable guidance, spontaneous motivation and moral support in carrying out this work.

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I am extremely grateful to my parents for their love, prayers, caring and sacrifices for educating and preparing me for my future.

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1. INTRODUCTION

Satellite: “SHUNYA” project is developed for accomplishment of major government-based applications that will come under principles of “DIGITAL INDIA”.

1. E- election
2. Controlling of water plants through satellite.
3. Controlling of street light through satellite.

In this project we are going to transcend the concept of IOT (Internet of the things) by applying it on Satellite. This satellite setup will be beneficial over several social issues and for providing services to every citizen of our country. This includes,

1. **E-election**

The citizens of India are proactive for choosing the government and they are contributing in every aspect through election however, there are several cases when a citizen wants to be a contributing member but due to some circumstances he/she is not able to do so. Moreover, to set up an election several utilities likewise, stationaries, time and accommodation. Also, different training programs are required for the execution of the process. Notwithstanding, these satellite modules will provide solution over such problems by providing a mobile earth station by which voting can be done from our home, real time data sharing will be available between the voter and the election commission department that will provide immunity over spams and fake votes and will also help the disabled so that they won't have to go to the booth.

2. **Controlling of water plants through satellite.**

India is the second most populous country in the world, with more than 1 billion citizens for such myriad no. of citizen water management should be meticulous but it's quite challenging task to execute the same. exemplarily, From the total quantity of water supplied to the city, about 124 million liters per day (MLD) is lost in the process of distribution due to illegal connections and leakages. The water lost every day in Indore is double the amount of water parched Latur in Maharashtra has received from the water train between April 11 to May 1.

Thus, to execute this prodigious task we require a new setup that can save resources efficiently, for this we have designed a satellite module that will manage the controlling of water so that we can save enough amount of water for sustainable development of India.

3. Controlling of street light through satellite.

The street lighting is controlled and operated by the local municipal corporations. Sometimes due to lack of management huge amount of electricity gets wastage which could be used for several other purposes, to overcome this issue we have managed to have a solution: with the use of this setup controlling of street lights could be done. At several occasion it usually happens that the street lights don't turn off till day light thus, it causes so much wastage of electricity our setup is sod designed that it can control the street light to the up time of the city helps in proper management of electricity.

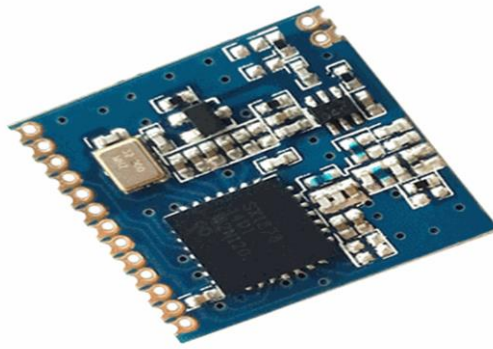
2.Relevant Theory

AI Thinker

The SX1276/77/78/79 transceivers feature the LoRa® long range modem that provides ultra-long range spread spectrum communication and high interference immunity whilst minimising current consumption.

Using Semtech's patented LoRaTM modulation technique SX1276/77/78/79 can achieve a sensitivity of over -148dBm using a low cost crystal and bill of materials. The high sensitivity combined with the integrated +20 dBm power amplifier yields industry leading link budget making it optimal for any application requiring range or robustness. LoRaTM also provides significant advantages in both blocking and selectivity over conventional modulation techniques, solving the traditional design compromise between range, interference immunity and energy consumption.

- LoRaTM Modem 168 dB maximum link budget
- +20 dBm - 100 mW constant RF output vs. V supply
- +14 dBm high efficiency PA
- Programmable bit rate up to 300 kbps
- High sensitivity: down to -148 dBm
- Bullet-proof front end: IIP3 = -11 dBm
- Excellent blocking immunity
- Low RX current of 9.9 mA, 200 nA register retention
- Fully integrated synthesizer with a resolution of 61 Hz
- FSK, GFSK, MSK, GMSK, LoRaTM and OOK modulation
- Built-in bit synchronizer for clock recovery
- Preamble detection
- 127 dB Dynamic Range RSSI
- Automatic RF Sense and CAD with ultra-fast AFC
- Packet engine up to 256 bytes with CRC
- Built-in temperature sensor and low battery indicator



Arduino 2560

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

The Arduino Mega2560 can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector.



Arduino 2560

2.0 About Satellite

A satellite is an object in space that orbits or circles around a bigger object. There are two kinds of satellites: natural (such as the moon orbiting the Earth) or artificial (such as the International Space Station orbiting the Earth).

There are dozens upon dozens of natural satellites in the solar system, with almost every planet having at least one moon. Saturn, for example, has at least 53 natural satellites, and between 2004 and 2017, it also had an artificial one — the Cassini spacecraft, which explored the ringed planet and its moons.

Artificial satellites, however, did not become a reality until the mid-20th century. The first artificial satellite was Sputnik, a Russian beach-ball-size space probe that lifted off on Oct. 4, 1957. That act shocked much of the western world, as it was believed the Soviets did not have the capability to send satellites into space.

an artificial earth satellite that facilitates communications, as radio, television, and telephone transmissions, by means of the reflection or the amplification and retransmission of signals between stations on earth or in space. Origin of communications satellite 1960-1965.

071405 Fingerprint Recognition Module

Secure your project with biometrics - this all-in-one optical fingerprint sensor will make adding fingerprint detection and verification super simple. These modules are typically used in safes - there's a high powered DSP chip that does the image rendering, calculation, feature-finding and searching. Connect to any microcontroller or system with TTL serial, and send packets of data to take photos, detect prints, hash and search. You can also enroll new fingers directly - up to 162 finger prints can be stored in the onboard FLASH memory. There's a red LED in the lens that lights up during a photo so you know its working. We like this particular sensor because not only is it easy to use, it also comes with fairly straight-forward Windows software that makes testing the module simple - you can even enroll using the software and see an image of the fingerprint on your computer screen. But, of course, we wouldn't leave you a datasheet and a "good luck!" - we wrote a full Arduino library so that you can get running in under 10 minutes. The library can enroll and search so its perfect for any project. We've also written a detailed tutorial on wiring and use. This is by far the best fingerprint sensor you can get.

Supply voltage: 3.6 - 6.0VDC

Operating current: 120mA

max Peak current: 150mA max

Window area: 14mm x 18mm

Signature file: 256 bytes

Template file: 512 bytes

Storage capacity: 162 templates



Satellite Communications Supporting Internet of Remote Things

Wireless data transmission systems are being increasingly deployed in industrial and home automation applications. These robust systems are used to transmit sensor data and control information across network infrastructures. In the age of the Internet of Things (IoT), people and things will be intelligently connected to one another, leading to innovations in business and Industry 4.0.

While the majority of IoT networks is terrestrial, IoT applications also provide various opportunities for established and newfound satellite operators, especially in connecting remote areas that lack terrestrial infrastructure. Opportunities range from selling additional capacity on GEO (geostationary) satellites in C-, Ku- and Ka-band for direct or backhaul connectivity to deploying new LEO (low earth orbit) or HEO (highly elliptical orbit) constellations, optimized for the IoT market.

Fraunhofer IIS solutions and IP (intellectual property) address many of the technical challenges in IoT communication, both terrestrially and via satellite. The following section provides further insight into

- use case examples,
- solutions and intellectual property available at Fraunhofer IIS.

2.1 Embedded System

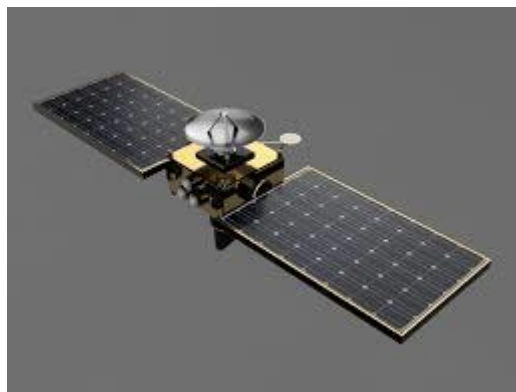
An embedded system is a [computer system](#) with a dedicated function within a larger mechanical or electrical system, often with [real-time computing](#) constraints. It is embedded as part of a complete device often including hardware and mechanical parts. Embedded systems control many devices in common use today. Ninety-eight percent of all [microprocessors](#) are manufactured as components of embedded systems.

Solar panel

A [photovoltaic](#) (PV) module is a packaged, connect assembly of typically 6x10 photovoltaic [solar cells](#). Photovoltaic modules constitute the photovoltaic array of a [photovoltaic system](#) that generates and supplies [solar electricity](#) in commercial and residential applications. Each module is rated by its [DC](#) output power under standard test conditions (STC), and typically ranges from 100 to 365 [Watts \(W\)](#). The [efficiency](#) of a module determines the area of a module given the same rated output – an 8% efficient 230 W module will have twice the area of a 16% efficient 230 W module. There are a few commercially available solar modules that exceed efficiency of 22%^[1] and reportedly also exceeding 24%. A single solar module can produce only a limited amount of power; most installations contain multiple modules. A photovoltaic system typically includes an array of photovoltaic modules, an [inverter](#), a [battery pack](#) for storage, interconnection wiring, and optionally a [solar tracking mechanism](#).

The most common application of solar panels is [solar water heating](#) systems.

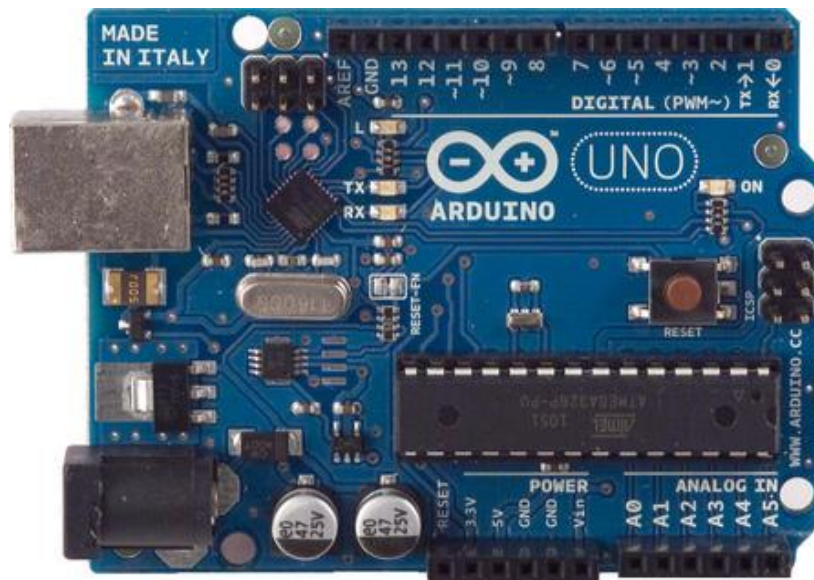
The price of solar power has continued to fall so that in many countries it is cheaper than ordinary [fossil fuel](#) electricity from the grid (there is "[grid parity](#)").



2.2 Arduino

Arduino is an open source computer hardware and software company, project, and user community that designs and manufactures [single-board microcontrollers](#) and [microcontroller](#) kits for building digital devices and interactive

objects that can sense and control objects in the physical world. The project's products are distributed as [open-source hardware](#) and [software](#), which are licensed under the [GNU Lesser General Public License](#) (LGPL) or the [GNU General Public License](#) (GPL),^[1] permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially in preassembled form, or as [do-it-yourself](#) kits.



2.3 ATmega 328 Microcontroller

The Atmel 8-bit AVR RISC-based microcontroller combines 32 kB ISP flash memory with read-while-write capabilities, 1 kB EEPROM, 2 kB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts. The device achieves throughput approaching 1 MIPS per MHz.

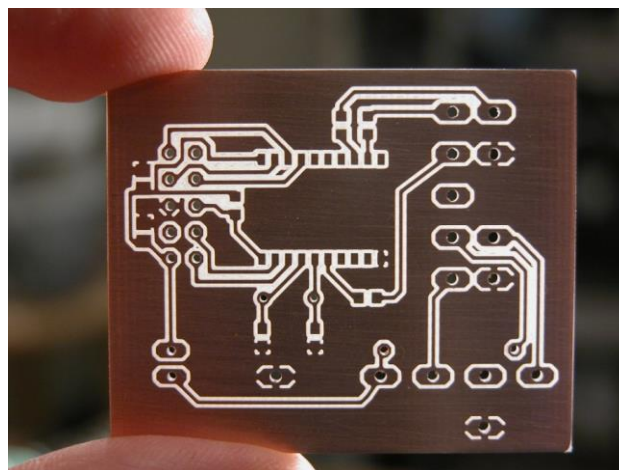
PCINT14/RESET) PC6	1*	28	PC5 (ADC5/SCL/PCINT13)
(PCINT16/RXD) PD0	2	27	PC4 (ADC4/SDA/PCINT12)
(PCINT17/TXD) PD1	3	26	PC3 (ADC3/PCINT11)
(PCINT18/INT0) PD2	4	25	PC2 (ADC2/PCINT10)
(PCINT19/OC2B/INT1) PD3	5	24	PC1 (ADC1/PCINT9)
(PCINT20/XCK/T0) PD4	6	23	PC0 (ADC0/PCINT8)
Vcc	7ATmega	22	GND
GND	8 28PD7	21	AREF
(PCINT6/XTAL1/TOSC1) PB6	9	20	AVCC
(PCINT7/XTAL2/TOSC2) PB7	10	19	PB5 (SCK/PCINT5)
(PCINT21/OC0B/T1) PD5	11	18	PB4 (MISO/PCINT4)
(PCINT22/OC0A/AIN0) PD6	12	17	PB3 (MOSI/OC2A/PCINT3)
(PCINT23/AIN1) PD7	13	16	PB2 (SS/OC1B/PCINT2)
(PCINT0/CLKO/ICP1) PB0	14	15	PB1 (OC1A/PCINT1)

Pin Configuration

2.5 Printed Circuit Board

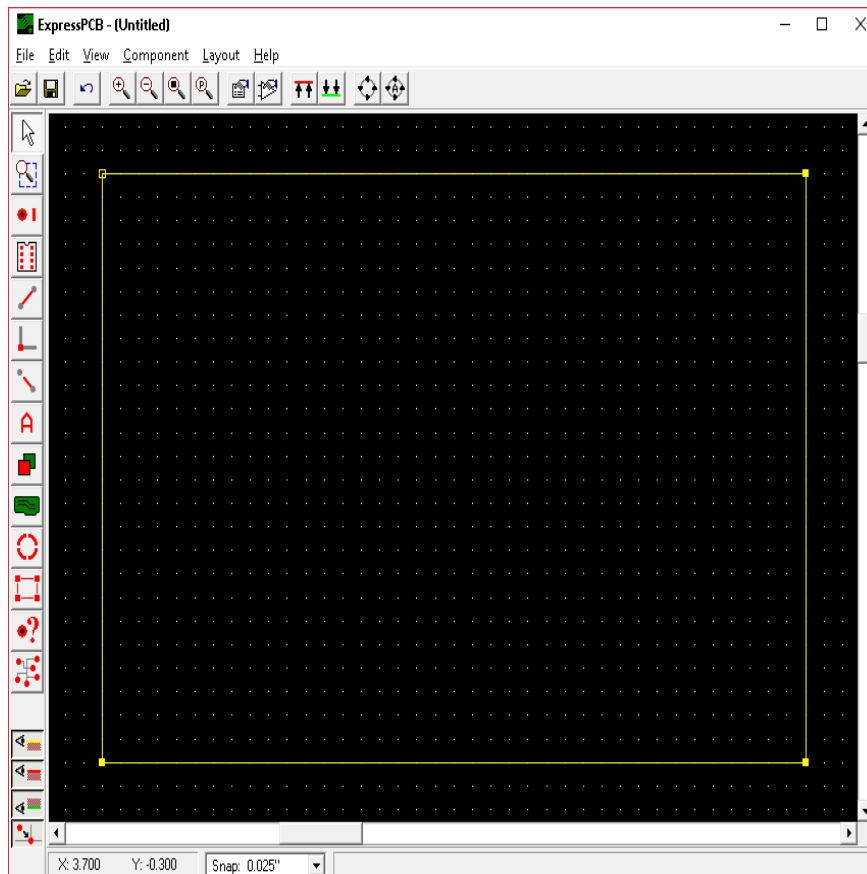
A printed circuit board (PCB) mechanically supports and electrically connects [electronic components](#) using [conductive](#) tracks, pads and other features [etched](#) from copper sheets [laminated](#) onto a [non-conductive substrate](#). Components (e.g. [capacitors](#), [resistors](#) or active devices) are generally [soldered](#) on the PCB. Advanced PCBs may contain components embedded in the substrate.

PCBs can be *single sided* (one copper layer), *double sided* (two copper layers) or *multi-layer* (outer and inner layers). Conductors on different layers are connected with via. Multi-layer PCBs allow for much higher component density.

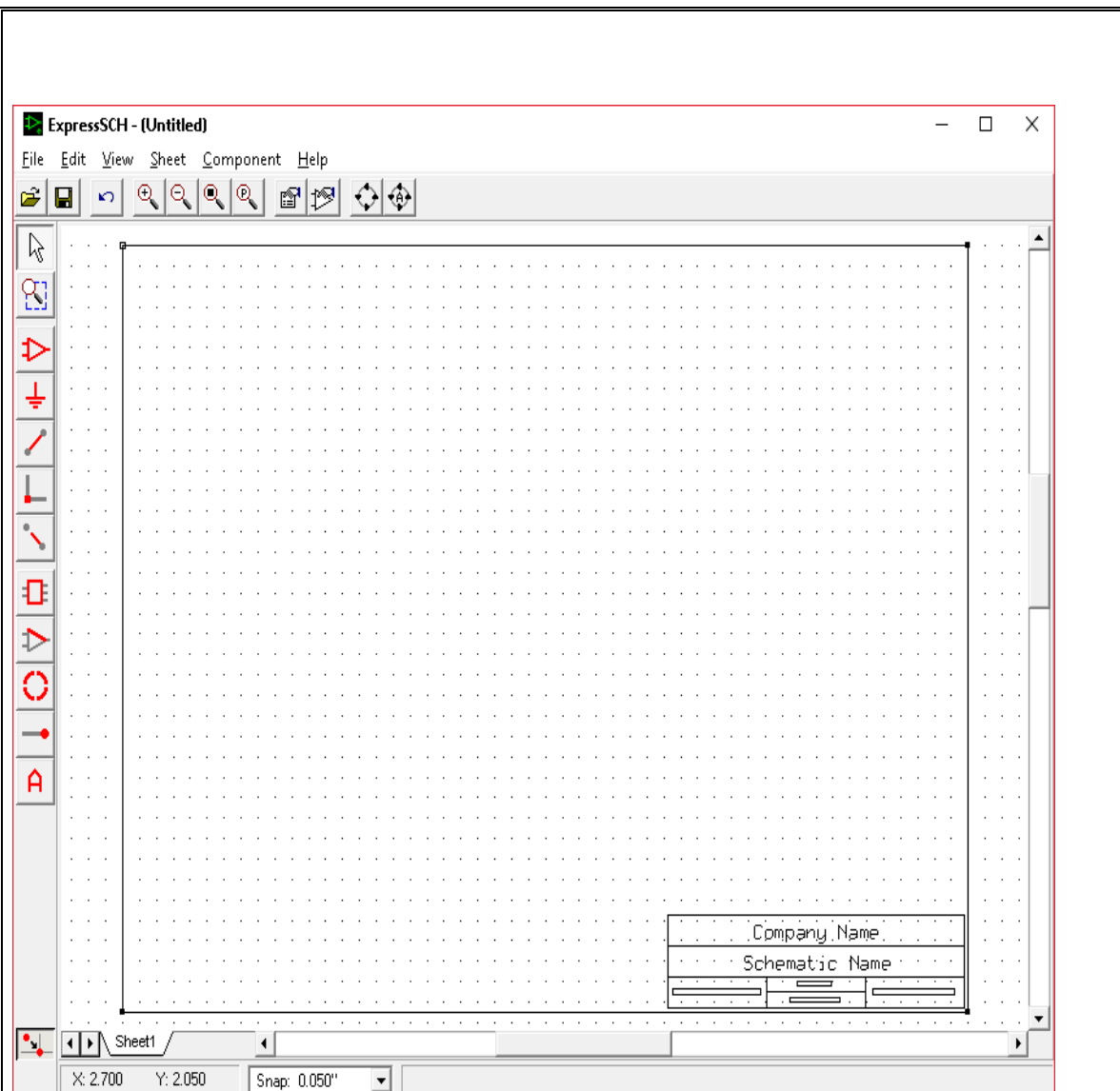


2.6 Express PCB Software

Software includes Express SCH Classic for drawing schematics and Express PCB Plus for circuit board layout. Both programs are completely free, fully functional and easily installed with a single Install Shield setup program.



1.software screenshot 1



2) software screenshot window 2

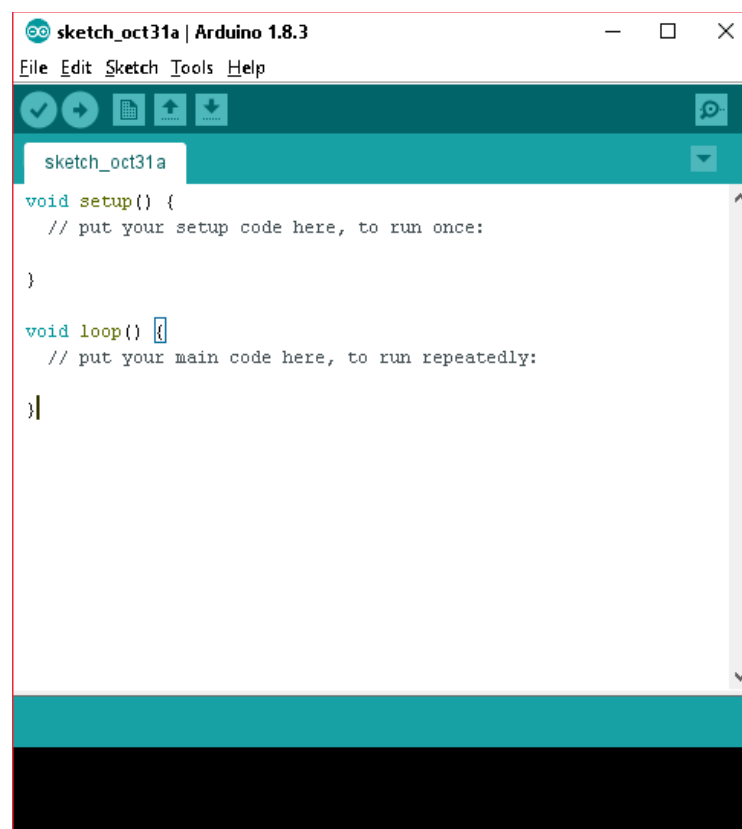
2.7 Arduino Software

A program for Arduino may be written in any programming language for a compiler that produces binary machine code for the target processor. Atmel provides a development environment for their microcontrollers, AVR Studio and the newer Atmel Studio.

The Arduino project provides the Arduino integrated development environment (IDE), which is a cross-platform application written in the programming language Java. It originated from the IDE for the languages Processing and Wiring. It includes a code editor with features such as text cutting and pasting, searching and replacing text, automatic indenting, brace matching, and syntax highlighting, and provides simple one-click mechanisms to compile and upload programs to an Arduino board. It also contains a message area, a text console, a toolbar with buttons for common functions and a hierarchy of operation menus.

A program written with the IDE for Arduino is called a sketch. Sketches are saved on the development computer as text files with the file extension .ino. Arduino Software (IDE) pre-1.0 saved sketches with the extension .pde.

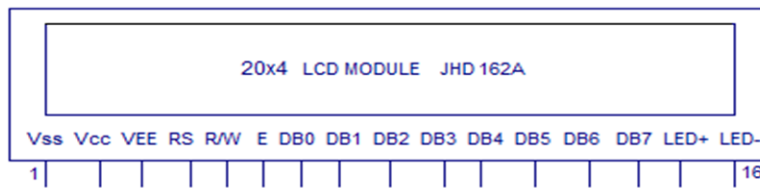
The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main() into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution. The Arduino IDE employs the program avrdude to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.



1) Software snap window 1

4.2 Interface of 2*16 LCD with ATmega 328

LCD Module - PIN Out Diagram

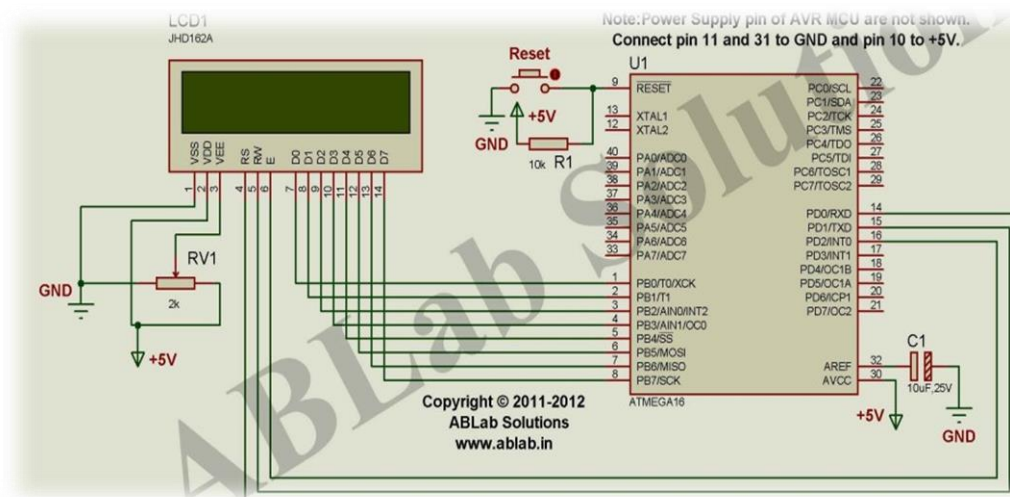


Pin 16 - Ground - Backlight LED
Pin 15 - +5V - Connect through a current limiting resistor
DB0 - DB7 - Data Pins - Use only 4 Data pins in 4 Bit Mode
E - Enable Pin
R/W - Read/Write Mode
RS - Register Select
VEE - Contrast Adjustment - Connect through a Potentiometer
Vcc - +5V - Power to LCD
Vss - Ground

Note: This pin out diagram is same and common for many line LCD modules like 16x1, 16x2, 16x4, 8x1, 8x2, 20x1, 20x2, 20x4, 40x2, and other types of Line LCD Modules making use of the Hitachi Driver.

www.CircuitsToday.com

- Pin configuration



Interface with microcontroller

4.1 Components Used

S.NO	Components Name	Quantity	Price (rs.)
1	LORA AI thinker rao2	3	2500
2	Arduino 2560	1	800
3	Arduino UNO board	2	1000
4	LCD Display	1	150
5	Ultrasonic sensor	1	100
6	Buzzer	1	40
7	Rechargeable Battery 12volts, 0.4-1.3 A	1	700
8	Arduino Relay	2	200
9	Cables	3 set	250
10	PCB cu plate	1	200
11	Silicon stick	6	90
12	Soldering wire	1 meter	45
13	7805 voltage regulator IC	3	90
14	IR Sensor	1	125
15	Temperature sensor	2	700
16	22 micro-farad capacitors	6	42
17	Resistors	20	60
18	Preset	1	5
19	Chassis	1	2000
20	Solar Plate	2	4000
21	071405 finger print sensor	1	2500
	Total		15556

