GOVERNMENT POLYTECHNIC, NAGPUR

(AN AUTONOMOUS INSTITUTE OF GOVT.OF MAHARASHTRA)

PROJECT REPORT ON

"VERTICAL FARMING"

SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE

AWARD OF DIPLOMA IN

ELECTRONICS AND TELECOMMUNICATION ENGINEERING

GUIDED BY

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2016-2017

GOVERNMENT POLYTECHNIC, NAGPUR

(AN AUTONOMOUS INSTITUTE OF GOVT.OF MAHARASHTRA)

CERTIFICATE

This is to certify that,

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of final year ELECTRONICS AND TELECOMMUNICATION Engineering students have submitted their project report on

"VERTICAL FARMING"

during academic session 2016-2017 as a part of project work described by Government Polytechnic, Nagpur for partial fulfillment for the Diploma in ELECTRONICS AND TELECOMMUNICATION Engineering in the sixth semester.

The project work is the record of students own work under my guidance and to my satisfaction.

PROF.K.G.GIRI — Guide

PROF.A.A.ALI — Head of Electronics and Telecommunication department

PROF.C.S.THORAT

Principal

Government Polytechnic, Nagpur


V.F.
racket
C++
JAVA
PHP
scala
haskell

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Lastly we would like to thank all our friends and library staff members whose encouragement and suggestion helped us to complete our seminar. We are also thankful to all those persons, who have contributed directly or indirectly in the completion of this project.

Thank you!

Signature and name of the students:

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This is to certify that the above statement made by the candidate is correct to the best of my knowledge

CONTENTS:

“VERTCAL FARMING”

ABSTRACT:

The farming method of future is here. Optimize your growth systems with LED systems lighting for sustainable crop cultivation, all year round. Tailor -made light recopies mean faster growth, bigger harvest and higher quality plant. Philips has been developing ways to apply lighting technology to crop farming for over 75 years. With cutting edge LED innovations at our command, we can custom build a science based solution for you. Vertical farming is the practice of producing food in vertically stacked layers, such as in a skyscraper, used warehouse, or shipping container. The modern ideas of vertical farming use indoor farming techniques and controlled-environment agriculture (CEA) technology, where all environmental factors can be controlled. These facilities utilize artificial control of light, environmental control (humidity, temperature, gases...) and fertilization. Some vertical farms use techniques similar to greenhouses, where natural sunlight can be augmented with artificial lighting and metal reflectors. The project is built around the Arduino Mega 2560 which is a microcontroller board based on the ATmega2560. This microcontroller has 54 digital I/O pins (of which 14 can be used as PWM output.), 16 analog inputs, 4 UARTs (hardware serial ports), 16 MHz crystal oscillator, a USB connection, power jack, an ICSP header, and reset button. This project uses DHT_11 sensors which sense temperature and humidity, an exhaust fan which provides heat regulation, an ultrasonic sensor which sense the height of the harvest, horticulture LEDs used for photosynthesis.

CHAPTER 1: INTRODUCTION

CHAPTER: 1

INTRODUCTION:

Vertical farming is the practice of producing food in vertically stacked layers, such as in a skyscraper, used warehouse, or shipping container. The modern ideas of vertical farming use indoor farming techniques and controlled-environment agriculture (CEA) technology, where all environmental factors can be controlled. These facilities utilize artificial control of light, environmental control (humidity, temperature, gases...) and fertilization. Some vertical farms use techniques similar to greenhouses, where natural sunlight can be augmented with artificial lighting and metal reflectors.

The term "vertical farming" was coined by Gilbert Ellis Bailey in 1915 in his book Vertical Farming. His use of the term differs from the current meaning—he wrote about farming with a special interest in soil origin, its nutrient content and the view of plant life as "vertical" life forms, specifically relating to their underground root structures. Modern usage of the term "vertical farming" usually refers to growing plants in layers, whether in a multistory skyscraper, used warehouse, or shipping container.

Depending on the method of electricity generation used, regular greenhouse produce can create more greenhouse gases than field produce, largely due to higher energy use per kilogram of produce. With vertical farms requiring much greater energy per kilogram of produce, mainly through increased lighting, than regular greenhouses, the amount of pollution created will be much higher than that from field produce. The amount of pollution produced is dependent on how the energy used in the process is generated.

As plants acquire nearly all their carbon from the atmosphere, greenhouse growers commonly supplement CO_2 levels to 3–4 times the rate normally found in the atmosphere. This increase in CO_2, which has been shown to increase photosynthesis rates by 50%, contributes to the higher yields expected in vertical farming. It is not uncommon to find greenhouses burning fossil fuels purely for this purpose, as other CO_2 sources, like from furnaces, and contain pollutants such as sulphur dioxide and ethylene which significantly damage plants. This means a vertical farm will require a CO_2 source, most likely from combustion, even if the rest of the farm is powered by "green" energy. Also, through necessary ventilation, much CO_2 will be leaked into the city's atmosphere.

CHAPTER 2: SYSTEM DESCRIPTION

CONCEPT

The conceptual idea behind vertical farming is that we are creating an artificial environment of harvesting of crops. In vertical farming we produce food in vertically stacked layers. The modern ideas of vertical farming use indoor farming techniques and controlled-environment agriculture (CEA) technology, where environmental factors can be controlled.

There are mainly two types of farming:

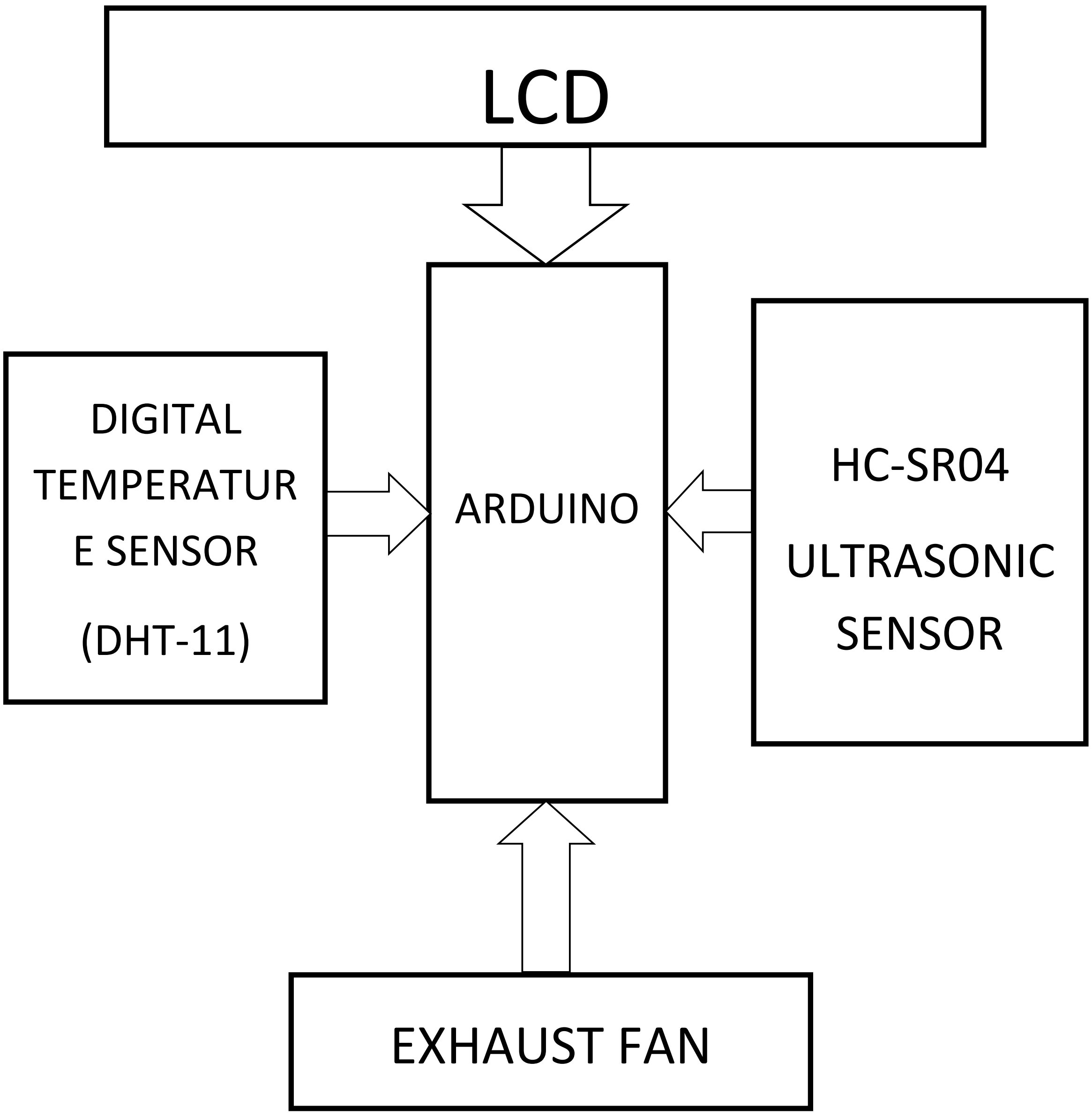
a. Soilless farming
b. Organic farming

The deal with organic farming is that it produces much lower yields than conventional farming, which in turn decrease the availability and increase the price. Organic fruits and vegetables often cost as much as 15 to 20 percent more than non-organic. It is also proved that organic farms are less efficient at getting their product to market, sometimes leading to lower quality of goods.

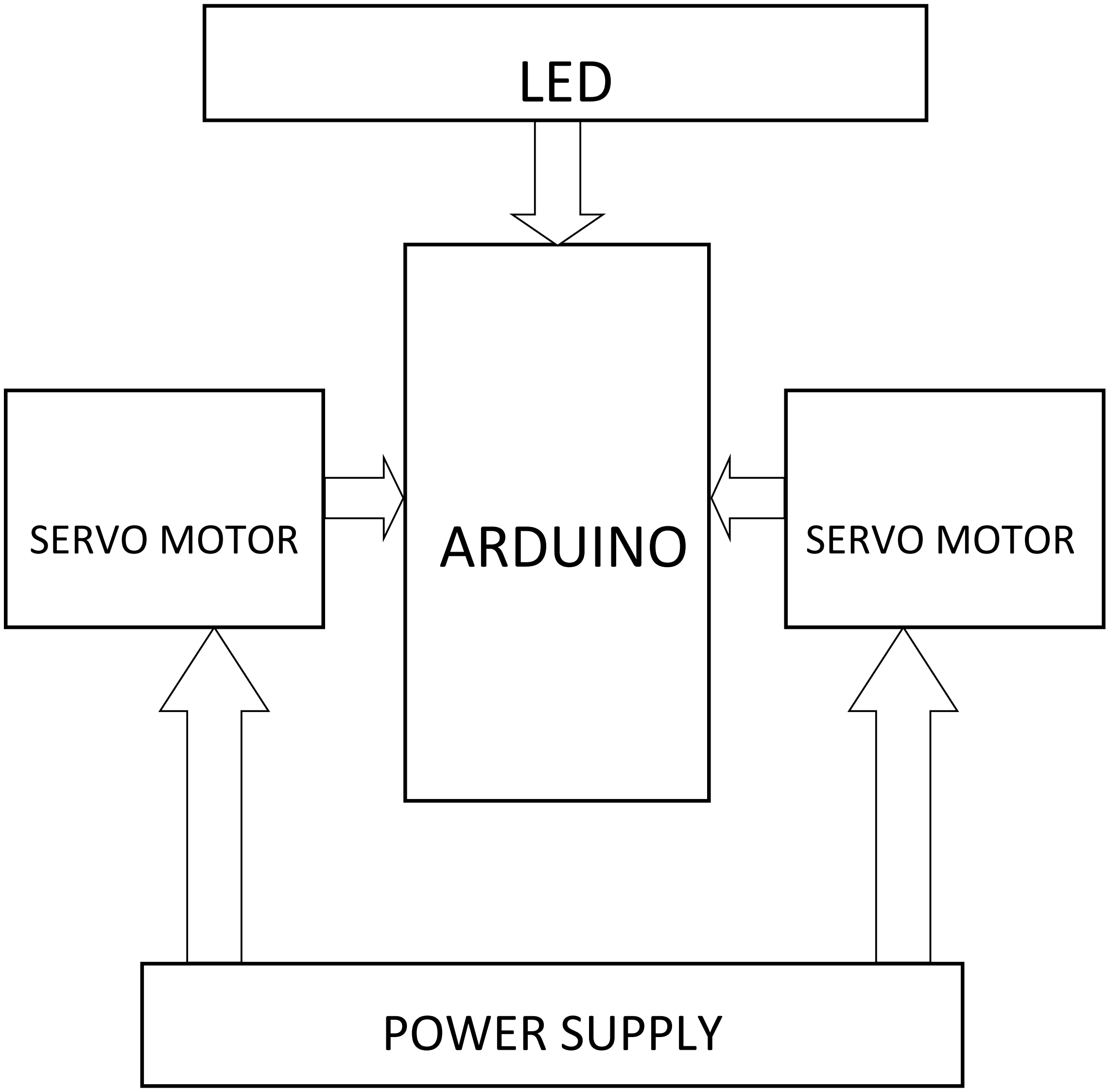
The major disadvantage of organic farming is that growth, nutrition of harvest is downgraded because of many soil related problems. That’s why the concept of vertical farming is taken as an alternative.

2.1:-BLOCK DIAGRAM

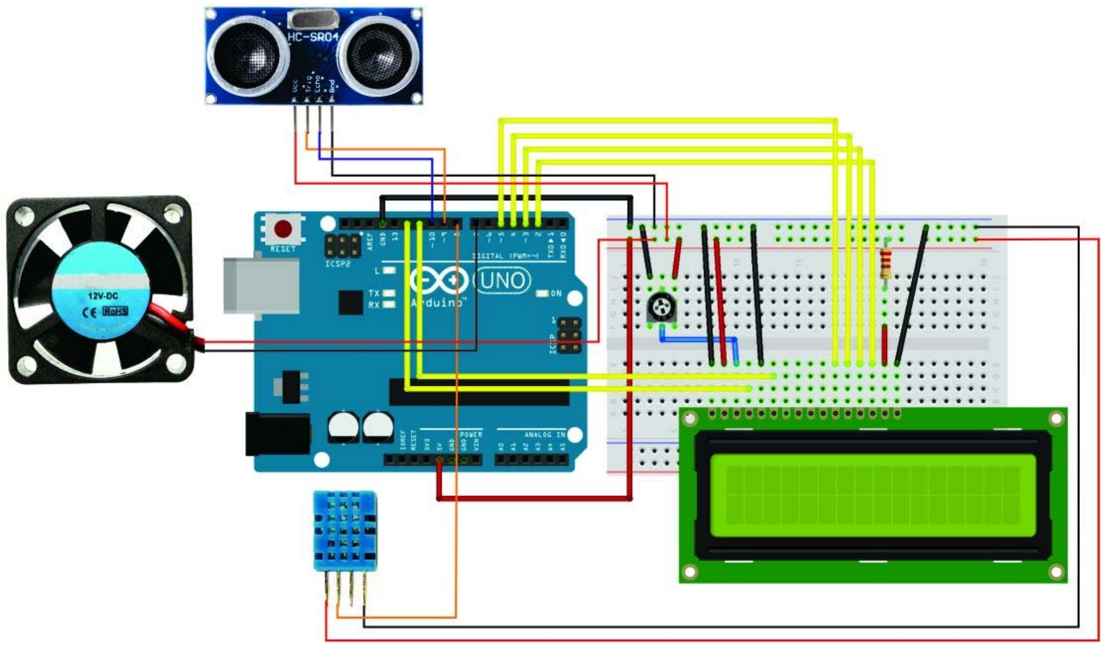
2.1.1:- ULTRA, LCD, SERVO TEMP AND HUMIDITY WITH EXHAUST FAN

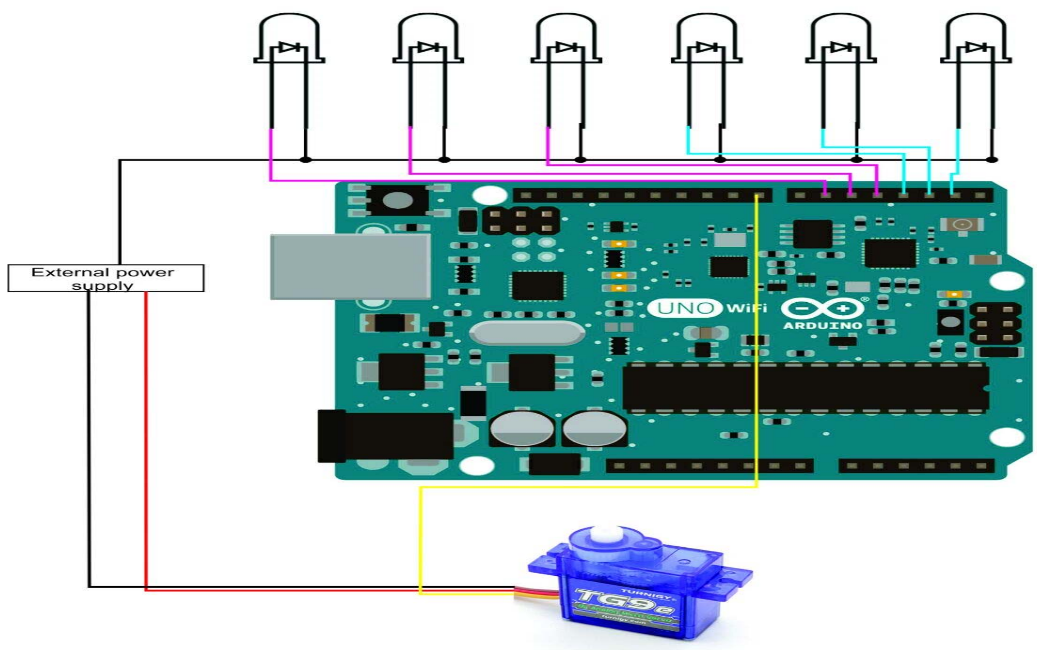


2.1.2:- - LED PWM WITH SERVO CONTROL



2.2 CIRCUIT DIAGRAM:





2.3 WORKING:-

Vertical farming is a concept of creating an artificial environment for the growth of plants by controlling the inner atmospheric conditions. In this project we are using arduino for controlling the electronic devices such as temperature sensor, ultrasonic sensor, exhaust fan, servo motor, horticulture LED,LCD. The use of horticulture LED is to give a pink color wavelength of 450nm which is the combination of red color wavelength 750nm and blue color wavelength 650nm, the horticulture LED is developed by Philips. These LED are designed to provide the essential spectrums of sunlight. We are giving PWM signal to the LED which varies from 0V-5V (0-255).The PWM signal is given so that the intensity of the LED's can be controlled. There are three floors; the second floor is the temperature controlled chamber where the temperature sensor (DHT 11) and exhaust is placed. The DHT 11 gives us value of temperature in degree Celsius and humidity in percentage on arduino pin 8.in arduino programming we have set a value and if the value goes below a particular level then the LED's increase their intensity and if the value goes above the particular level then the exhaust fan turns ON and in normal conditions it remains OFF. The exhaust has two terminals in which the VCC is connected to 5V of arduino and ground pin is connected to pin 7 of arduino. The ultrasonic sensor helps to measure the height of the crops. The ultrasonic sensor uses a piezoelectric principle. This sensor uses a piezoelectric material to generate ultrasonic waves. This sensor emits the sound pulses and receives the echo when the object is detected the distance to an object is determined by measuring the time of flight and not intensity of sound. The formula for measuring distance in centimeters is given below:

(Microseconds /2) /29

Servo motor is used for rotating ultrasonic sensor in a particular angle(clockwise and anticlockwise direction) .Here we are using 360 degree servo motor in which the steps of the servo motor controlled by the control signals of the arduino. It has a controlled winding by which it changes the steps.

We are using a 16*2 LCD for displaying the temperature, humidity as well as distance of the ultrasonic sensor. The LCD also displays the status of the exhaust fan.

2.4 LIST OF COMPONENTS

Component	**Quantity**	**Price(Rs)**
ARDUINO	2	1500
SERVO	2	500
LCD 16*2	1	200
EXHAUST FAN	1	500
ULTRASONIC	1	130
HORTICULTURE LED	20	300
DHT_11 SENSOR	1	200

POTENTIOMETER	1	20
WIRES	1	200
RESISTOR	1	2
ADAPTER	1	120
BREADBOARD	1	20
PLASTIC SHEET	1	90
ARTIFITIAL GRASS MAT	5	300
GREEN MAT	3	150
ICE CREAM STICKS	100	20
CASIN	1	25
CHASIS	1	1500
BOX	6	200
TOTAL:-		5977

CHAPTER 3:-HARDWARE DESCRIPTION

HARDWARE DESCRIPTION

3.1:- ARDUINO:

An Arduino board historically consists of an Atmel 8-, 16- or 32-bit AVR microcontroller (although since 2015 other makers' microcontrollers have been used) with complementary components that facilitate programming and incorporation into other circuits. An important aspect of the Arduino is its standard connectors, which let users connect the CPU board to a variety of interchangeable add-on modules termed shields. Some shields communicate with the Arduino board directly over various pins, but many shields are individually addressable via an I²C serial bus—so many shields can be stacked and used in parallel. Before 2015, Official Arduinos had used the Atmel megaAVR series of chips, specifically the ATmega8, ATmega168, ATmega328, ATmega1280, and ATmega2560. In 2015, units by other producers were added. A handful of other processors have also been used by Arduino compatible devices. Most boards include a 5 V linear regulator and a 16 MHz crystal oscillator (or ceramic resonator in some variants), although some designs such as the LilyPad run at 8 MHz and dispense with the onboard voltage regulator due to specific form-factor restrictions. An Arduino's microcontroller is also pre-programmed with a boot loader that simplifies uploading of programs to the on-chip flash memory, compared with other devices that typically need an external programmer. This makes using an Arduino more straightforward by allowing the use of an ordinary computer as the programmer. Currently, opt boot loader is the default boot loader installed on Arduino UNO.

At a conceptual level, when using the Arduino integrated development environment, all boards are programmed over a serial connection. Its implementation varies with the hardware version. Some serial Arduino boards contain a level shifter circuit to convert between RS-232logic levels and transistor– transistor logic (TTL) level signals. Current Arduino boards are programmed via Universal Serial Bus (USB), implemented using USB-to-serial adapter chips such as the FTDI FT232. Some boards, such as later-model Uno boards, substitute the FTDI chip with a separate AVR chip containing USB-to-serial firmware, which is reprogrammable via its own ICSP header. Other variants, such as the Arduino Mini and the unofficial arduino, use a detachable USB-to-serial adapter board or cable, Bluetooth or other methods, when used with traditional microcontroller tools instead of the Arduino IDE; standard AVR in-system programming (ISP) programming is used. The Arduino board exposes most of the microcontroller's I/O pins for use by other circuits. The Diecimila, Duemilanove, and current Uno provide 14 digital I/O pins, six of which can produce pulse-width modulated signals, and six analog inputs, which can also be used as six digital I/O pins. These pins are on the top of the board, via female 0.1-inch (2.54 mm) headers.

Several plug-in application shields are also commercially available. The Arduino Nano, and Arduino-compatible Bare Bones Board and arduino boards may provide male header pins on the underside of the board that can plug into solder less breadboards.

Many Arduino-compatible and Arduino-derived boards exist. Some are functionally equivalent to an Arduino and can be used interchangeably. Many enhance the basic Arduino by adding output drivers, often for use in school-level education, to simplify making buggies and small robots. Others are electrically equivalent but change the form factor, sometimes retaining compatibility with shields, sometimes not. Some variants use different processors, of varying compatibility.

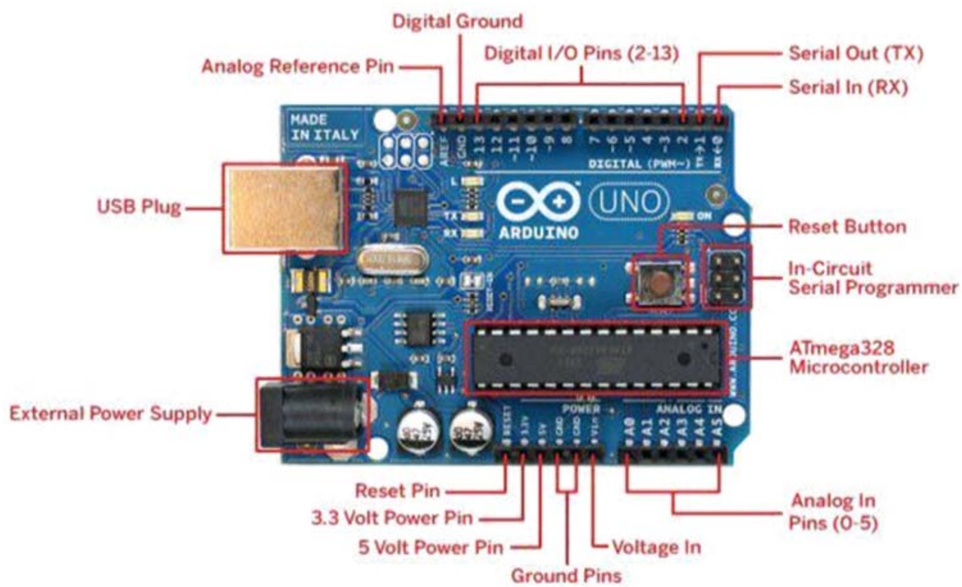


FIG. 3.1 SIMPLE ARDUINO UNO BORD

FEATURES:

1. High Performance, Low Power AVR® 8-bit microcontroller.

2. Advanced RISC Architecture-131 Power full Instruction-most single clock cycle execution-32*8 General Purpose Working Resistor-Fully Static Operation-up to 20 MIPS through put at 20MHz-On chip 2 cycle multiplier.

3. High Endurance Non-volatile Memory Segments – 4/8/16/32K Bytes of In-System Self-Programmable Flash program memory (ATmega48PA/88PA/168PA/328P) – 256/512/512/1K Bytes EEPROM (ATmega48PA/88PA/168PA/328P) – 512/1K/1K/2K Bytes Internal SRAM (ATmega48PA/88PA/168PA/328P) – Write/Erase Cycles: 10,000 Flash/100,000 EEPROM – Data retention: 20 years at 85°C/100 years at 25°C(1) – Optional Boot Code Section with Independent Lock Bits In-System Programming by On-chip Boot Program True Read-While-Write Operation – Programming Lock for Software Security

4. Peripheral Features – Two 8-bit Timer/Counters with Separate Prescaler and Compare Mode – One 16-bit Timer/Counter with Separate Prescaler, Compare Mode, and Capture Mode – Real Time Counter with Separate Oscillator – Six PWM Channels – 8-channel 10-bit ADC in TQFP and QFN/MLF package Temperature Measurement – 6-channel 10-bit ADC in PDIP Package Temperature Measurement – Programmable Serial USART – Master/Slave SPI Serial Interface – Byte-oriented 2-wire Serial Interface (Philips I2 C compatible) – Programmable Watchdog Timer with Separate On-chip Oscillator – On-chip Analog Comparator – Interrupt and Wake-up on Pin Change

5. Special Microcontroller Features – Power-on Reset and Programmable Brown-out Detection – Internal Calibrated Oscillator – External and Internal Interrupt Sources – Six Sleep Modes: Idle, ADC Noise Reduction, Power-save, Power-down, Standby, and Extended Standby

6. I/O and Packages – 23 Programmable I/O Lines – 28-pin PDIP, 32-lead TQFP, 28-pad QFN/MLF and 32-pad QFN/MLF

7. Operating Voltage: – 1.8 - 5.5V for ATmega48PA/88PA/168PA/328P

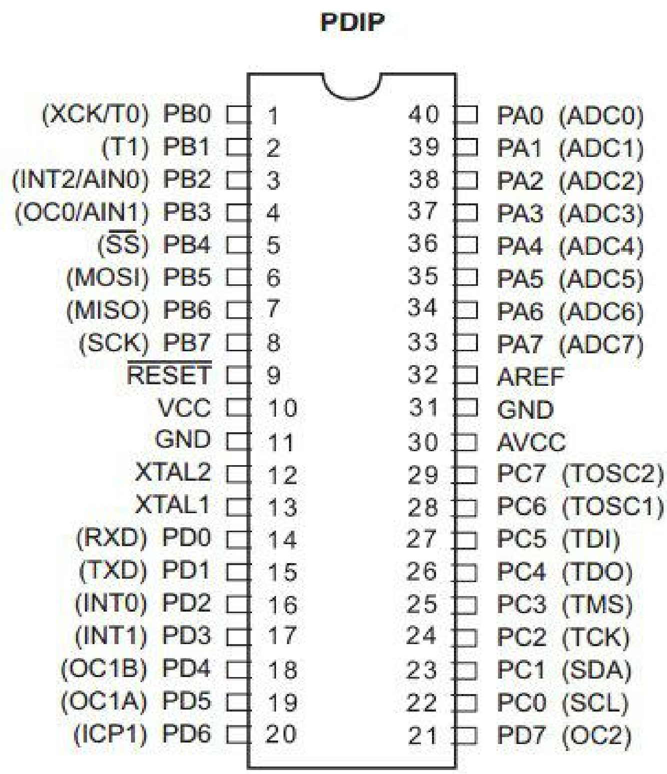
8. Temperature Range: – -40°C to 85°C

9. Speed Grade: – 0 - 20 MHz @ 1.8 - 5.5VLow Power Consumption at 1 MHz, 1.8V, 25°C for ATmega48PA/88PA/168PA/328P: – Active Mode: 0.2 mA – Power-down Mode: 0.1 µA – Power-save Mode: 0.75 µA (Including 32 kHz RTC)

Atmega 16:

The ATmega16 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega16 achieves throughputs approaching 1 MIPS per MHz allowing the system designed to optimize power consumption versus processing speed.

The AVR core combines a rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in one single instruction executed in one clock cycle. The resulting architecture is more code efficient while achieving throughputs up to ten times faster than conventional CISC microcontrollers. The ATmega16 provides the following features: 16 Kbytes of In-System Programmable Flash Program memory with Read-While-Write capabilities, 512 bytes EEPROM, 1 Kbyte SRAM, 32 general purpose I/O lines, 32 general purpose working registers, a JTAG interface for Boundary scan, On-chip Debugging support and programming, three flexible Timer/Counters with compare modes, Internal and External Interrupts, a serial programmable USART, a byte oriented Two-wire Serial Interface, an 8-channel, 10-bit ADC with optional differential input stage with programmable gain (TQFP package only), a programmable Watchdog Timer with Internal Oscillator, an SPI serial port, and six software selectable power saving modes. The Idle mode stops the CPU while allowing the USART, Two-wire interface, A/D Converter, SRAM; Timer/Counters, SPI port, and interrupt system to continue functioning. The Power-down mode saves the register contents but freezes the Oscillator, disabling all other chip functions until the next External Interrupt or Hardware Reset. In Power-save mode, the Asynchronous Timer continues to run, allowing the user to maintain a timer base while the rest of the device is sleeping. The ADC Noise Reduction mode stops the CPU and all I/O modules except Asynchronous Timer and ADC, to minimize switching noise during ADC conversions. In Standby mode, the crystal/resonator Oscillator is running while the rest of the device is sleeping. This allows very fast start-up combined with low-power consumption. In Extended Standby mode, both the main Oscillator and the Asynchronous Timer continue to run. The device is manufactured using Atmel’s high density nonvolatile memory technology. The Onchip ISP Flash allows the program memory to be reprogrammed in-system through an SPI serial interface, by a conventional nonvolatile memory programmer, or by an On-chip Boot program running on the AVR core. The boot program can use any interface to download the application program in the Application Flash memory. Software in the Boot Flash section will continue to run while the Application Flash section is updated, providing true Read-While-Write operation. By combining an 8-bit RISC CPU with In-System Self-Programmable Flash on a monolithic chip, the Atmel ATmega16 is a powerful microcontroller that provides a highly-flexible and cost-effective solution to many embedded control applications. The ATmega16 AVR is supported with a full suite of program and system development tools including: C compilers, macro assemblers, program debugger/simulators, in-circuit emulators, and evaluation kits.



SPECIFICATIONS:

SR NO.	SPECIFICATION		
1.	I\O and Packages		32 Programmable I/O Lines
			40-pin PDIP, 44-lead TQFP, and 44-pad QFN/MLF
2.	Operating Voltages	2.7V to 5.5V	ATMEGA 16L
		4.5 V to 5.5V	ATMEGA 16

3.	Speed Grades	0MHz to 8MHz	ATMEGA 16L.
		0MHz to 16MHz	ATMEGA 16
4.	Power Consumption	Active	1.1mA
		Ideal	0.35mA
		Power Down	<1mA
5.	Peripheral Features	Two 8bit Timer/Counters	Separate Prescalers and Compare Modes
		One 16bit Timer/Counter	Separate Prescaler, Compare Mode, and Capture
6.	Mode		Real time counter with separate oscillator
			Four PWM Channels
			8 single ended channel, 10-bit ADC
7.	7 Differential Channels in TQFP Package Only		
8.	2 Differential Channels with Programmable Gain at 1x, 10x, or 200x		Byte oriented two wire Serial Interface
			Programmable Serial USART
			Master/Slave SPI Serial Interface
			Programmable watchdog timer with on-chip oscillator
			On-chip Analog Comparator.
9.	Special microcontroller functions		Power on Reset and Programmable Brown Detection

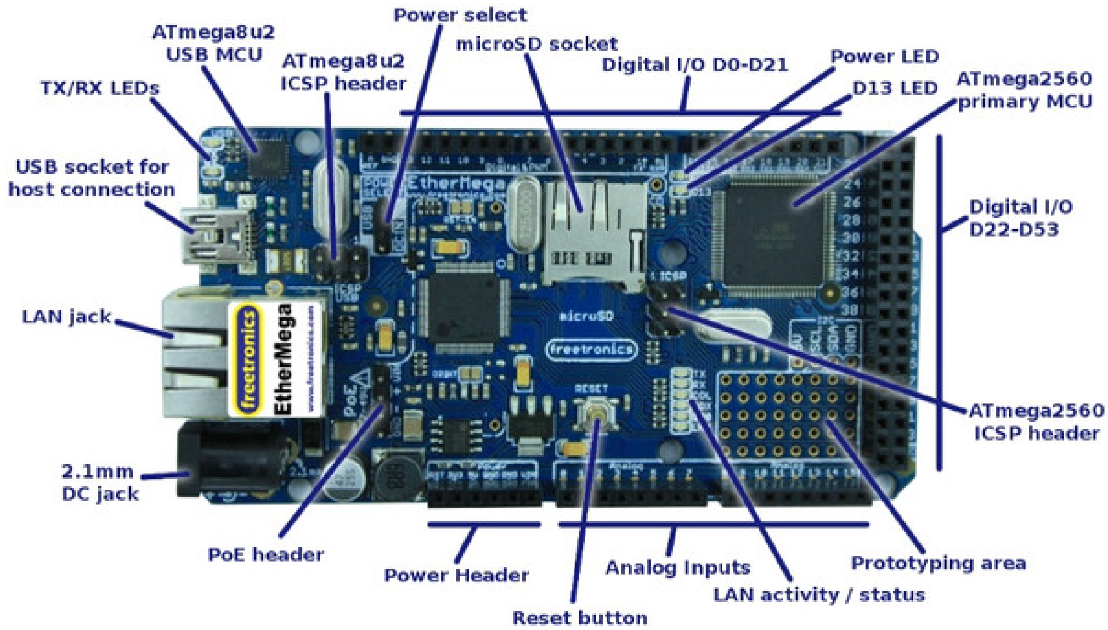


FIG. 3.1.B. SIMPLE ATMEGA 16 BOARD

The Mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 15 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 2560 board is compatible with most shields designed for the Uno and the former boards Duemilanove or Diecimila.

The Mega 2560 is an update to the Arduino Mega, which it replaces.

Technical specification

Microcontroller	ATmega2560
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limit)	6-20V
Digital I/O Pins	54 (of which 15 provide PWM output)
Analog Input Pins	16

DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	256 KB of which 8 KB used by boot loader
SRAM	8 KB
EEPROM	4 KB
Clock Speed	16 MHz
LED_BUILTIN	13
Length	101.52 mm
Width	53.3 mm
Weight	37 g

Programming:

The Mega 2560 board can be programmed with the Arduino Software (IDE). For details, see the reference and tutorials.

The ATmega2560 on the Mega 2560 comes preprogrammed with a boot loader that allows you to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol (reference, C header files).

You can also bypass the boot loader and program the microcontroller through the ICSP (In-Circuit Serial Programming) header using Arduino ISP or similar; see these instructions for details.

The ATmega16U2 (or 8U2 in the rev1 and rev2 boards) firmware source code is available in the Arduino repository. The ATmega16U2/8U2 is loaded with a DFU boot loader, which can be activated by:

- On Rev1 boards: connecting the solder jumper on the back of the board (near the map of Italy) and then resetting the 8U2.
- On Rev2 or later boards: there is a resistor that pulling the 8U2/16U2 HWB line to ground, making it easier to put into DFU mode. You can then use Atmel's FLIP software (Windows) or the DFU programmer (Mac OS X and Linux) to load a new

firmware. Or you can use the ISP header with an external programmer (overwriting the DFU boot loader). See this user-contributed tutorial for more information.

WARNINGS:

The Mega 2560 has a resettable poly fuse that protects your computer's USB ports from shorts and over current. Although most computers provide their own internal protection, the fuse provides an extra layer of protection. If more than 500 mA is applied to the USB port, the fuse will automatically break the connection until the short or overload is removed.

POWER:

The Mega 2560 can be powered via the USB connection or with an external power supply. The power source is selected automatically.

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

The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may become unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.

The power pins are as follows:

- VIN. The input voltage to the board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.
- 5V. this pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 12V), the USB connector (5V), or the VIN pin of the board (7-12V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage your board. We don't advise it.
- 3V3. A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.
- GND. Ground pins.
- IOREF. This pin on the board provides the voltage reference with which the microcontroller operates. A properly configured shield can read the IOREF pin voltage and select the appropriate power source or enable voltage translators on the outputs for working with the 5V or 3.3V.

MEMORY:

The ATmega2560 has 256 KB of flash memory for storing code (of which 8 KB is used for the boot loader), 8 KB of SRAM and 4 KB of EEPROM (which can be read and written with the EEPROM library).

3.2:- ULTRASONIC SENSOR

The Parallax PING)))™ ultrasonic distance sensor provides precise, non-contact distance measurements from about 2 cm (0.8 inches) to 3 meters (3.3 yards). It is very easy to connect to microcontrollers such as the BASIC Stamp®,

Propeller chip, or Arduino, requiring only one I/O pin The PING))) sensor works by transmitting an ultrasonic (well above human hearing range) burst and providing an output pulse that corresponds to the time required for the burst echo to return to the sensor. By measuring the echo pulse width, the distance to target can easily be calculated.

KEY SPECIFICATIONS:

SR. NO.	**SPECIFICATIONS**	
1	SUPPLY VOLTAGE	+5V DC
2	OPERATING TEMPRATURE	0 to 70°C
3	PACKAGE	3-pin SIP, 0.1 spacing
4	WEIGHT	9 G (0.32 oz)
5	SUPPLY CURRENT	30 mA typ , 35 mA max
6	COMMUNICATION	Positive TTL Pulse
7	SIZE	22mm H x 46 mm W x 16 mm D

FEATURES:

SR. NO	FEATURES
1	Range = 2cm to 3m (0.8 inches to 3.3 yards)
2	Burst indicator led shows sensor activity.
3	Bidirectional TTL pulse interface on a single I/O pin can communicate with 5V TTL or 3.3VCMOS microcontrollers
4	Input trigger: positive TTL pulse, 2 µs min, 5 µs typ.
5	Echo pulse: positive TTL pulse, 115 µs Minimum to 18.5 ms maximum.
6	ROHS Compliant

PIN DISCRIPTION:

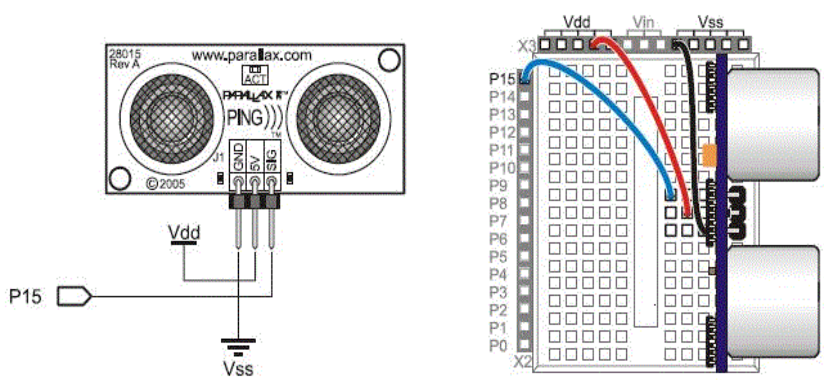
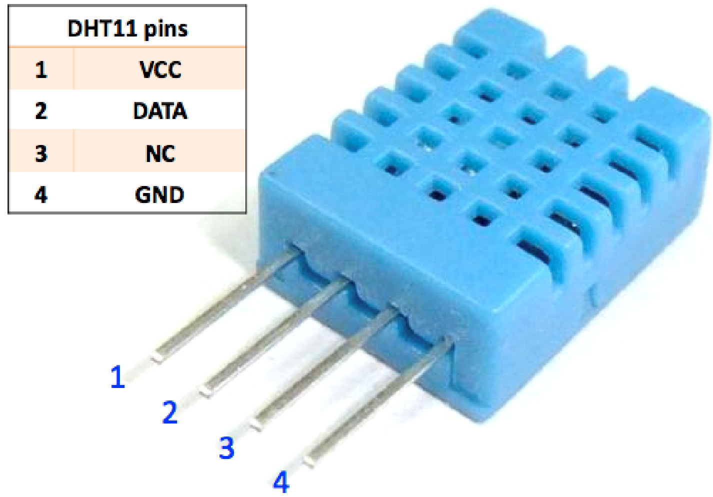


FIG. 3.2 PIN DISCRIPTION OF ULTRASONIC SENSOR

The PING))) sensor has a male 3-pin header used to supply ground, power (+5 VDC) and signal. The header may be plugged into a directly into solder less breadboard, or into a standard 3-wire extension cable (Parallax part #800-00120).

3.3:- DHT-11 SENSOR:

1. INTRODUCTION:



This DF Robot DHT11 Temperature & Humidity Sensor features a temperature & humidity sensor complex with a calibrated digital signal output. By using the exclusive digital-signal-acquisition technique and temperature & humidity sensing technology, it ensures high reliability and excellent long-term stability. This sensor includes a resistive-type humidity measurement component and an NTC temperature measurement component, and connects to a high-performance 8-bit microcontroller, offering excellent quality, fast response, anti-interference ability and cost-effectiveness. Page | 3

Each DHT11 element is strictly calibrated in the laboratory that is extremely accurate on humidity calibration. The calibration coefficients are stored as programs in the OTP memory, which are used by the sensor’s internal signal detecting process. The single-wire serial interface makes system integration quick and easy. Its small size, low power consumption and up-to-20 meter signal transmission making it the best choice for various applications, including those most demanding ones. The component is 4-pin single row pin package. It is convenient to connect and special packages can be provided according to users’ request.

2. TECHNICAL SPECIFICATIONS:

Overview:

Item	**Measurement Range**	**Humidity Accuracy**	**Temperature Accuracy**	**Resolution**	**Package**
DHT11	20-90%RH 0-50 ℃	±5%RH	±2℃	1	4 Pin Single Row

Detailed Specifications:

Parameters	**Conditions**	**Minimum**	**Typical**	**Maximum**
Humidity				
Resolution	1%RH	1%RH	1%RH	
8 Bit				
Repeatability	±1%RH			
Accuracy	25℃	±4%RH		
0-50℃	±5%RH			
Interchangeability	Fully Interchangeable			
Measurement Range	0℃	30%RH	90%RH	
25℃	20%RH	90%RH		
50℃	20%RH	80%RH		

Response Time (Seconds)	1/e(63%)25℃ , 1m/s Air	6 S	10 S	15 S
Hysteresis	±1%RH			
Long-Term Stability	Typical	±1%RH/year		
Temperature				
Resolution	1℃	1℃	1℃	
8 Bit	8 Bit	8 Bit		
Repeatability	±1℃			
Accuracy	±1℃	±2℃		
Measurement Range	0℃	50℃		
Response Time (Seconds)	1/e(63%)	6 S	30 S	

3.4:- SERVO:

Servo motors have been around for a long time and are utilized in many applications. They are small in size but pack a big punch and are very energy-efficient. These features allow them to be used to operate remote-controlled or radio-controlled toy cars, robots and airplanes. Servo motors are also used in industrial applications, robotics, in-line manufacturing, pharmaceutics and food services. But how do the little guys work?

The servo circuitry is built right inside the motor unit and has a positionable shaft, which usually is fitted with a gear (as shown below). The motor is controlled with an electric signal which determines the amount of movement of the shaft.

WHAT'S INSIDE THE SERVO?

Fig.3.4.A. Standard Heavy Duty Servo

To fully understand how the servo works, you need to take a look under the hood.

When the shaft of the motor is at the desired position, power supplied to the motor is stopped. If not, the motor is turned in the appropriate direction. The desired position is sent via electrical pulses through the signal wire. The motor's speed is proportional to the difference between its actual position and desired position. So if the motor is near the desired position, it will turn slowly, otherwise it will turn fast. This is called proportional control**.** This means the motor will only run as hard as necessary to accomplish the task at hand, a very efficient little guy.

HOW SERVO IS CONTROLLED?

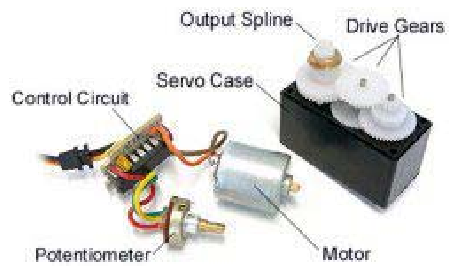


Fig.3.4.B. the guts of a servo motor and an assembled servo

Servos are controlled by sending an electrical pulse of variable width, or pulse width modulation (PWM), through the control wire. There is a minimum pulse, a maximum pulse, and a repetition rate. A servo motor cans usually only turn 90 degrees in either direction for a total of 180 degree movement. The motor's neutral position is defined as the position where the servo has the same amount of potential rotation in the both the clockwise or counter-clockwise direction. The PWM sent to the motor determines position of the shaft, and based on the duration of the pulse sent via the control wire; the rotor will turn to the desired position. The servo motor expects to see a pulse every 20 milliseconds (ms) and the length of the pulse will determine how far the motor turns. For example, a 1.5ms pulse will make the motor turn to the 90-degree position.

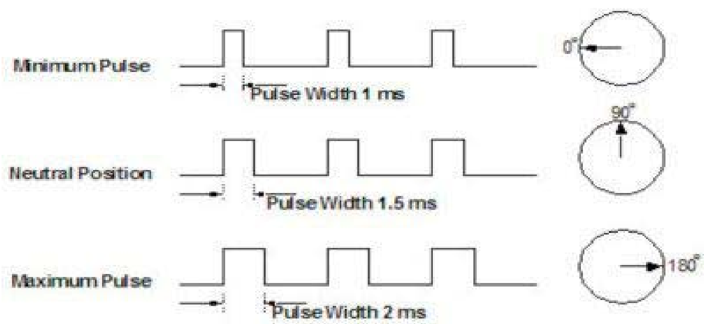


Fig. 3.4.C Variable Pulse width control servo position

When these servos are commanded to move, they will move to the position and hold that position. If an external force pushes against the servo while the servo is holding a position, the servo will resist from moving out of that position. The maximum amount of force the servo can exert is called the torque rating of the servo. Servos will not hold their position forever though; the position pulse must be repeated to instruct the servo to stay in position.

TYPES OF SERVO MOTORS:

There are two types of servo motors - AC and DC. AC servo can handle higher current surges and tend to be used in industrial machinery .DC servos are not designed for high current surges and are usually better suited for smaller applications. Generally speaking, DC motors are less expensive than their AC counterparts. These are also servo motors that have been built specifically for continuous rotation, making it an easy way to get your robot moving. They feature two ball bearings on the output shaft for reduced friction and easy access to the rest-point adjustment potentiometer.

SERVO MOTOR APPLICATIONS:

Servos are used in radio-controlled airplanes to position control surfaces like elevators, rudders, walking a robot, or operating grippers. Servo motors are small, have built-in control circuitry and have good power for their size.

In food services and pharmaceuticals, the tools are designed to be used in harsher environments, where the potential for corrosion is high due to being washed at high pressures and temperatures repeatedly to maintain strict hygiene standards. Servos are also used in in-line manufacturing, where high repetition yet precise work is necessary.

Of course, you don't have to know how a servo works to use one, but as with most electronics, the more you understand, the more doors open for expanded projects and projects' capabilities.

Whether you're a hobbyist building robots, an engineer designing industrial systems, or just constantly curious, where will servo motors take you?

SPECIFICATIONS:

Working Voltage:	+5V, 200mA regulated
Output Format :	Serial Data at 9600 baud rate (8 bits data, No parity,1 stop bits).
Torque-	9gm

SENSOR PIN OUTS:

1. Logic = 0/1
2. +5V = Regulated 3.3V-12v supply input.
3. GND = Board Common Ground

3.5:- LCD:

A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in color or monochrome. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden, such as preset words, digits, and 7-segment displays, as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements.

LCDs are used in a wide range of applications including computer monitors, televisions, instrument panels, aircraft cockpit displays, and indoor and outdoor signage. Small LCD screens are common in portable consumer devices such as digital cameras, watches, calculators, and mobile telephones, including smart phones. LCD screens are also used on consumer electronics products such as DVD players, video game devices and clocks. LCD screens have replaced heavy, bulky cathode ray tube (CRT) displays in nearly all applications. LCD screens are available in a wider range of screen sizes than CRT and plasma displays, with LCD screens available in sizes ranging from tiny digital watches to huge, big-screen television sets.

Since LCD screens do not use phosphors, they do not suffer image burn-in when a static image is displayed on a screen for a long time (e.g., the table frame for an aircraft schedule on an indoor sign). LCDs are, however, susceptible to image persistence. The LCD screen is more energy-efficient and can be disposed of more safely than a CRT can. Its low electrical power consumption enables it to be used in battery-powered electronic equipment more efficiently than CRTs can be. By 2008, annual sales of televisions with LCD screens exceeded sales of CRT units worldwide, and the CRT became obsolete for most purposes.

PIN DIAGRAM:

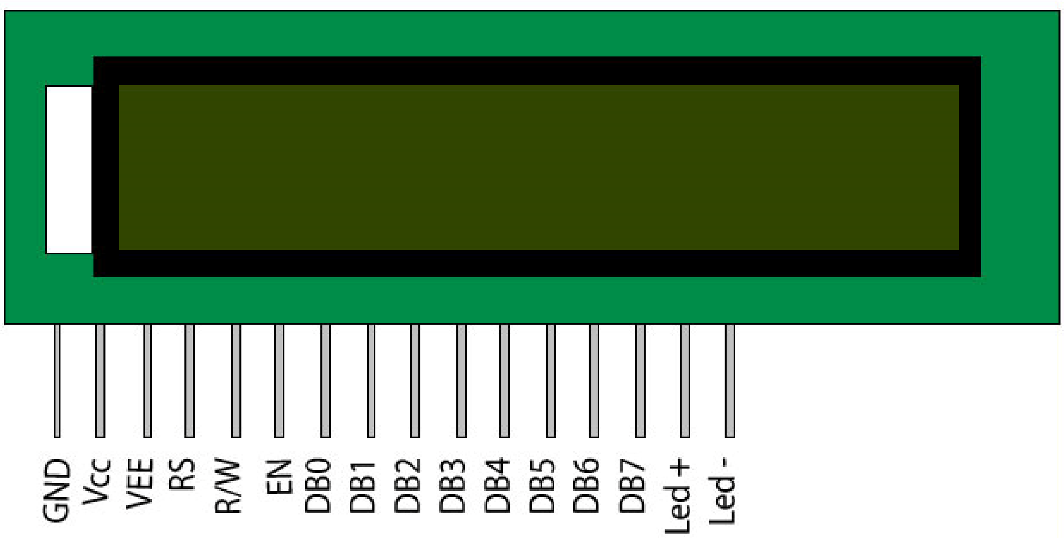


FIG. 3.5 PIN OUT DISCRIPTION OF LCD

Pin Description:

Pin No	Function	Name
1	Ground (0V)	Ground
2	Supply voltage; 5V (4.7V – 5.3V)	Vcc

3	Contrast adjustment; through a variable resistor	V_{EE}
4	Selects command register when low; and data register when high	Register Select
5	Low to write to the register; High to read from the register	Read/write
6	Sends data to data pins when a high to low pulse is given	Enable
7	8-bit data pins	DB0
8		DB1
9		DB2
10		DB3
11		DB4
12		DB5
13		DB6
14		DB7
15	Backlight V_{CC} (5V)	Led+
16	Backlight Ground (0V)	Led-

3.6:- HORTICULTURE LED:

Today LED lighting can stimulate plant growth by up to 40%. Durable and long lasting LEDs from OSRAM Opto Semiconductors are the green alternative to standard horticultural lighting. They can significantly stimulate plant growth while drastically reducing energy consumption through the use of targeted lighting at 730, 660 and 450 nanometers. LEDs provide the perfect lighting for all types of plants and flowers, allowing the grower to adapt the light exactly to the needs of various crops.

Peak Emission Wavelengths of Different Light Sources

Colour	UV	blue	green	yellow	orange	red	far-red
Wavelength (nm)	280-400	400-495	495-570	570-590	590-620	620-710	710-850
Sunlight (at earth's surface)	x	x	x	x	x	x	x
Incandescent					x	x	
Full-Spectrum Fluorescent	x	x	x	x	x	x	x
Cool-White Fluorescent	x	x	x	x	x		
Warm-White Fluorescent					x	x	
HID: High Pressure Sodium				x	x	x	x
HID: Metal Halide	x	x	x	x	x		
All Plant Pigments	x	x				x	x

BLUE LED:-

Blue light has one of the largest effects in the development of plant. Multiple studies have shown that exposing a plant to this color influences the formation of chlorophyll, which enables the plant to intake more energy from the sun. It also controls a plant’s cellular respiration and lessens water loss through evaporation during hot and dry days.

Blue light also has an effect on photosynthesis, and more exposure to this light can increase a plant’s growth and maturity rates. This process is called photo morphogenesis. Overall, blue light has an influence over multiple functions in a plant’s life , and is a crucial color to have in your own grow room in order to ensure the most optimal growth.

RED LED:-

Exposure to red light is another crucial factor which contributes to the optimal development of plant. Individually, red light won't have major effect on a plant, but when combined with blue light, it makes the plant yield better results when flowering. A study which compared red light, blue light, and a mixture of both indicated that even though plants which grew under red light yielded more leaves than the ones grown under blue lights, the combination of both produced an amount of leaves which surpassed the plants who grew strictly under red light. A similar case occurred during the growth of wheat where the crop yielded far better results when grown under a mixture of red and blue light, compared to strictly red light.

3.7:- EXHAUST FAN:

Exhaust fans are needed for better indoor air quality. Think about all the pollution that is created in your home every day. Because of cleaning, cooking, bathing and yes, even breathing can produce moisture and pollution that you want to remove from your house. Some of the biggest pollution generators are the kitchen, laundry and bathroom.

The fumes and smoke to even grease and dust all add to unsafe air quality in our homes. The perfect way to rid your home of these pollutants is by using exhaust fans. Here is a look at the different types of exhaust fans that are available and the health benefits that they provide.

Benefits of Exhaust Fans

When the exhaust fans are properly installed, they vent many pollutants to the outdoors, but what are the benefits of proper home ventilation?

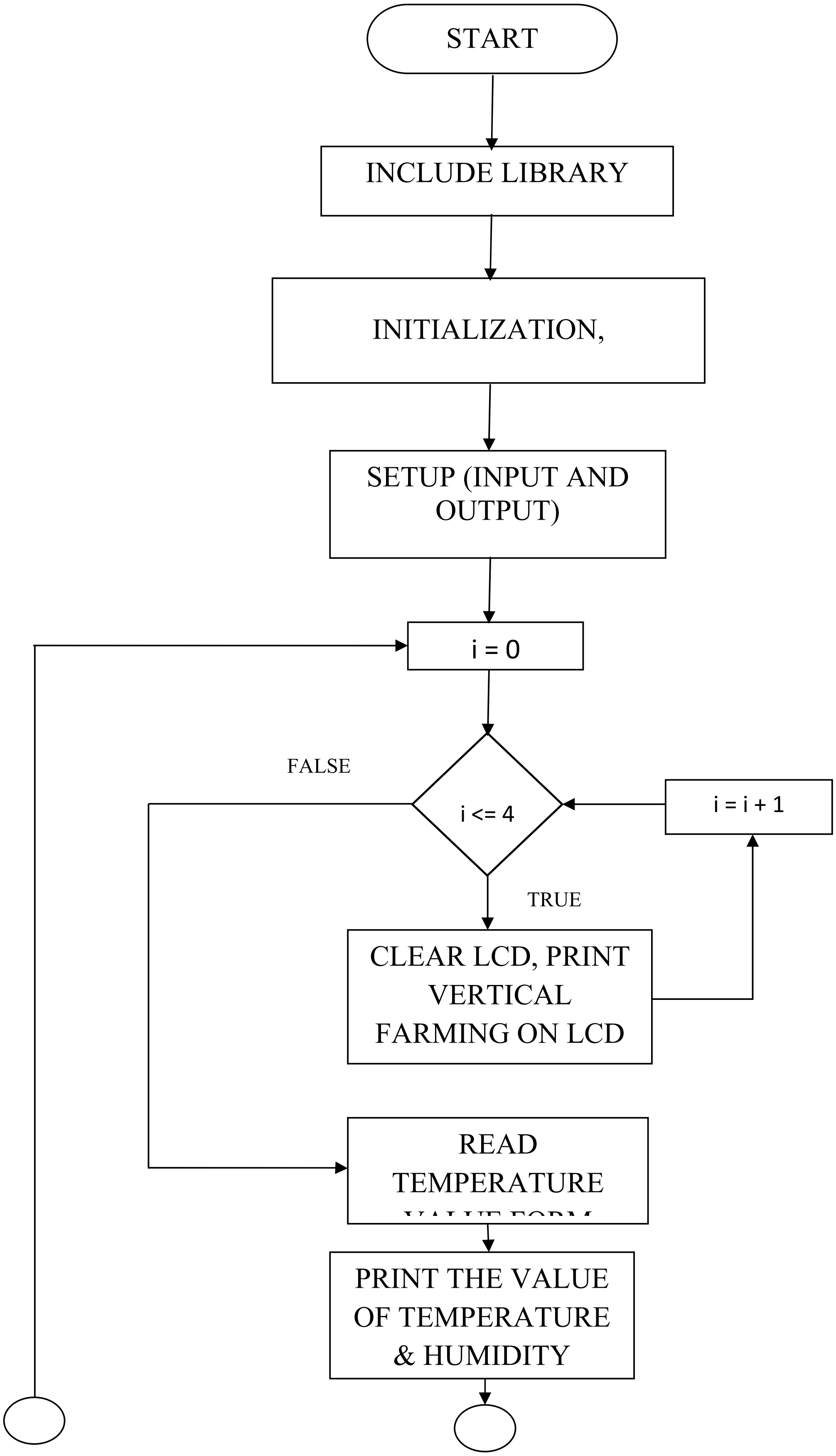
The decrease in many health problems is one main benefit of proper exhaust fan ventilation. Fewer asthma attacks, less allergy symptoms and other respiratory problems are less common when using an exhaust fan properly. Venting highly allergic pollen outdoors will help keep your family healthy and happy.

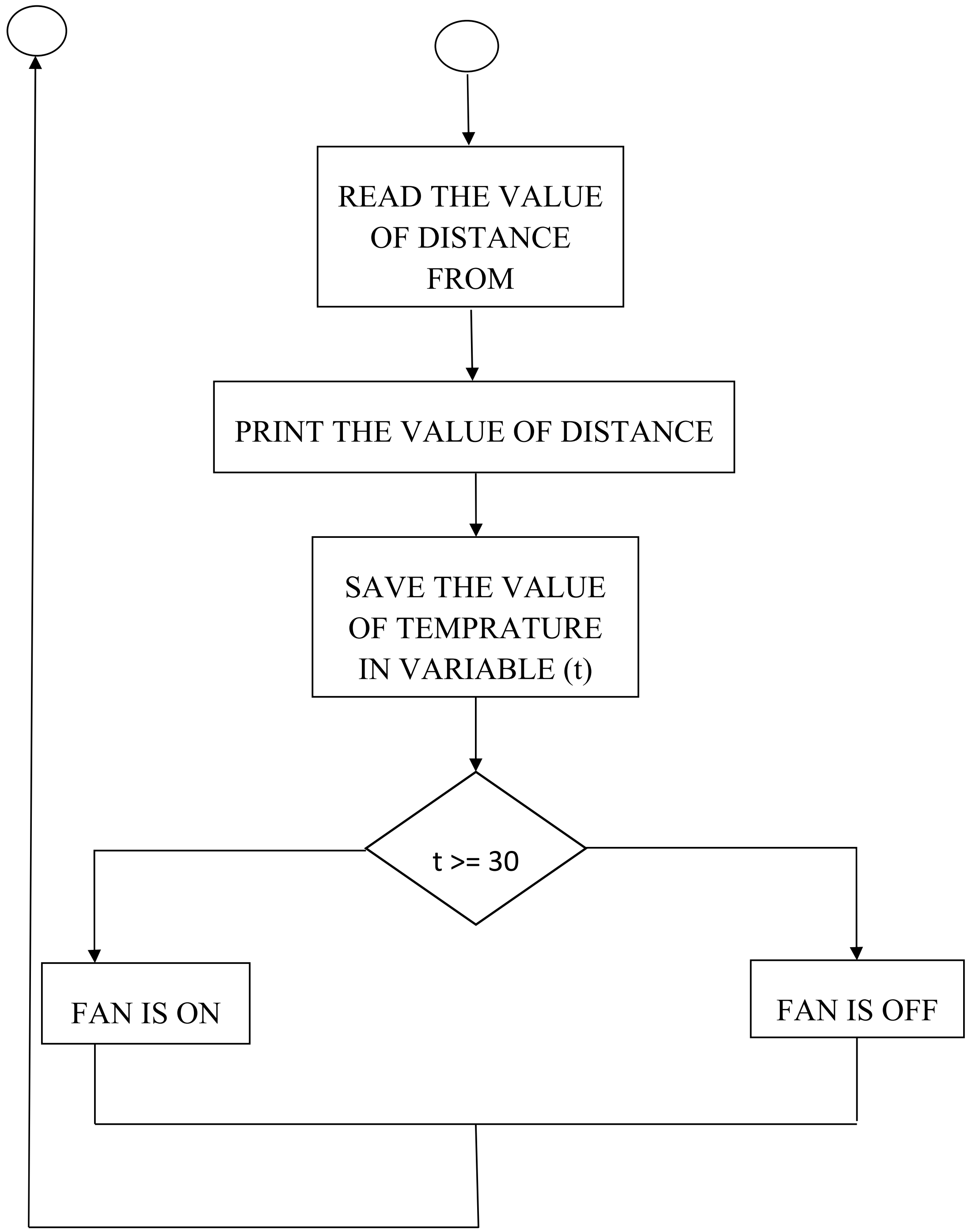
CHAPTER 4:-

FLOW CHART

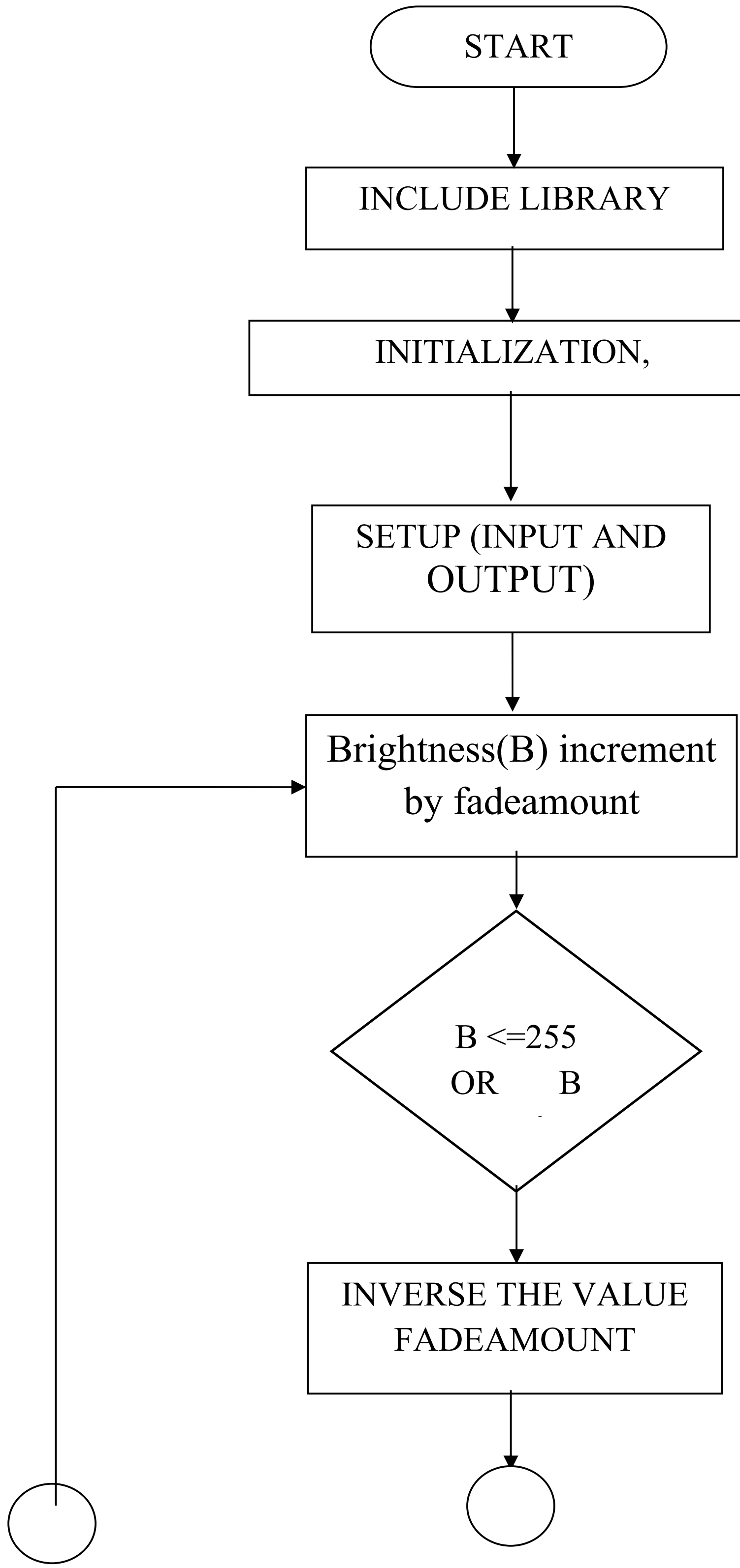
4.1. FLOWCHART

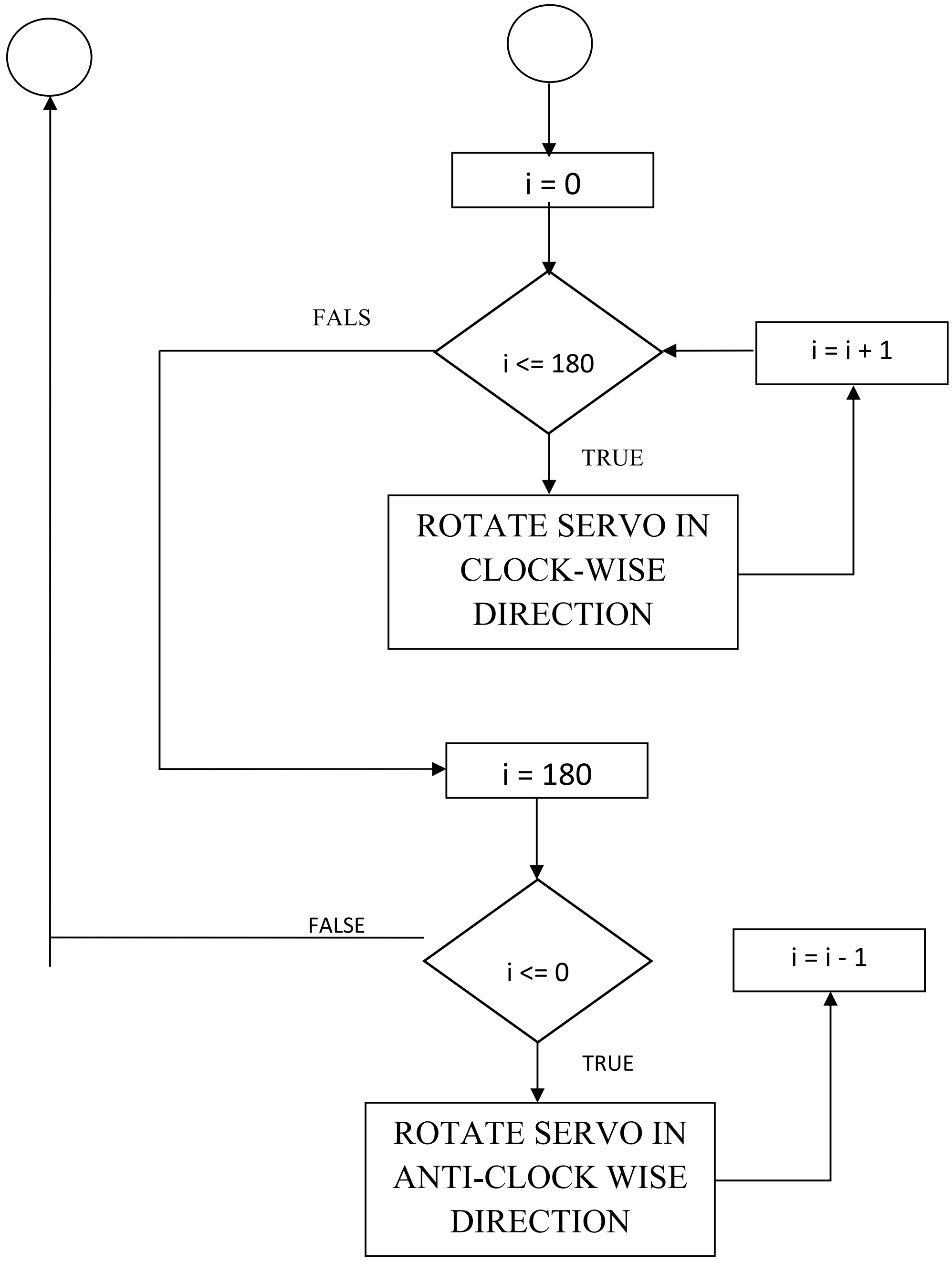
4.1. A. - ULTRA, LCD, SERVO TEMP AND HUMIDITY WITH EXHAUST FAN




READ THE VALUE OF DISTANCE FROM
PRINT THE VALUE OF DISTANCE
SAVE THE VALUE OF TEMPRATURE IN VARIABLE (t)
t >= 30
FAN IS ON
FAN IS OFF

4.2. B. - LED PWM WITH SERVO CONTROL




i = 0
FALS
i <= 180
i = i + 1
TRUE
ROTATE SERVO IN CLOCK-WISE DIRECTION
i = 180
FALSE
i <= 0
i = i - 1
TRUE
ROTATE SERVO IN ANTI-CLOCK WISE DIRECTION

CHAPTER 5:-

PROGRAMMING

5. PROGRAMMING

5.1:- PROGRAM A

```
// include the library code:
#include <LiquidCrystal.h>
// initialize the library with the numbers of the interface pins
LiquidCrystal lcd(12, 11, 5, 4, 3, 2);

// temp
#include <dht.h>
dht DHT;
int fan =7;
int  i;
#define DHT11_PIN 8

//ultra
const int trigpin=9;
const int echopin=10;

void setup() {
  // set up the LCD's number of columns and rows:
  lcd.begin(16, 2);
  Serial.begin(9600);
  pinMode(fan,OUTPUT);
  Serial.begin(9  n600);
  pinMode(trigpin,OUTPUT);
  pinMode(echopin,INPUT);
}

void loop() {
  delay(2000);
  for(i=0;i<=4;i++){
```

```
  lcd.clear();
  delay(500);
  lcd.print("VERTICAL");
  lcd.setCursor(7, 1);
  lcd.print("FARMING");
  delay(500);
  }
// temp
  int chk = DHT.read11(DHT11_PIN);
  lcd.clear();
  lcd.setCursor(0,0);
  lcd.print("Humidity = ");
  lcd.print(DHT.humidity);
  lcd.setCursor(0,1);
  lcd.print("Temp = ");
  lcd.print(DHT.temperature);
  delay(1000);
  Serial.print("Temperature = ");
  Serial.println(DHT.temperature);
  Serial.print("Humidity = ");
  Serial.println(DHT.humidity);
  int f = DHT.temperature;
  Serial.println(f)
delay(1000);

// ultra
    long duration,inches,cm;
    digitalWrite(trigpin,LOW);
    delayMicroseconds(2);
    digitalWrite(trigpin,HIGH);
    delayMicroseconds(10);
    digitalWrite(trigpin,LOW);
```

```
    duration = pulseIn(echopin,HIGH);

    cm=mtc(duration);
    lcd.clear();
    lcd.setCursor(0,0);
    lcd.print("CM = ");
    lcd.print(cm);
    lcd.print("cm");
    delay(1000);
    Serial.print(cm);
    Serial.print("cm");
    Serial.print("\n");
    delay(100);

   // Exhaust fan
    if(f >= 25){
      lcd.clear();
      lcd.setCursor(0,0);
       digitalWrite(fan,LOW);
       lcd.print("FAN = ON");
       delay(1000);
       }else{
        lcd.clear();
        lcd.setCursor(0,0);
        lcd.print("FAN = OFF");
       digitalWrite(fan,HIGH);
       delay(1000);
      }
  }

 long mtc(long microseconds){
```

```
return microseconds/29/2;
}
```

5.2:- PROGRAM B:

```
#include <Servo.h>
Servo myservo;  // create servo object to control a servo
int pos = 0;    // variable to store the servo position

int brightness = 0;     // how bright the LED is
int fadeAmount = 25;    // how many points to fade the LED by
int led1 = 2;           // the PWM pin the LED is attached to
int led2 = 3;           // the PWM pin the LED is attached to
int led3 = 4;           // the PWM pin the LED is attached to
int led4 = 5;           // the PWM pin the LED is attached to
int led5 = 6;           // the PWM pin the LED is attached to
int led6 = 7;           // the PWM pin the LED is attached to

void setup() {
  myservo.attach(8);      // attaches the servo on pin 8 to the servo
  pinMode(led1, OUTPUT);  // initialize led1 as output
  pinMode(led2, OUTPUT);  // initialize led2 as output
  pinMode(led3, OUTPUT);  // initialize led3 as output
  pinMode(led4, OUTPUT);  // initialize led4 as output
  pinMode(led5, OUTPUT);  // initialize led5 as output
  pinMode(led6, OUTPUT);  // initialize led6 as output
}
```

```
void loop() {
  // change the brightness for next time through the loop:
 brightness = brightness + fadeAmount;

 // reverse the direction of the fading at the ends of the fade:
 if (brightness <= 0 || brightness >= 255) {
   fadeAmount = -fadeAmount;
 }
 // wait for 30 milliseconds to see the dimming effect
 delay(5);
 // set the brightness of pin 2, 3, 4, 5, 6, 7:
 analogWrite(led1, brightness);
 analogWrite(led2, brightness);
 analogWrite(led3, brightness);
 analogWrite(led4, brightness);
 analogWrite(led5, brightness);
 analogWrite(led6, brightness);



  for (pos = 0; pos <= 180; pos += 1) {
       myservo.write(pos);     // goes from 0 degrees to 180 degrees
                                    // in steps of 1 degree
                           // tell servo to go to position in variable 'pos'
   delay(15);            // waits 15ms for the servo to reach the position
 }
 for (pos = 180; pos >= 0; pos -= 1) {
                                // goes from 180 degrees to 0 degrees
   myservo.write(pos);  // tell servo to go to position in variable 'pos'
```

```
    delay(15);           // waits 15ms for the servo to reach the position
  }


   }
```

CHAPTER 6:-

BIBLOGRAPHY

BIBLOGRAPHY

[A] R. Al-Ali, Member, IEEE, Imran Zualkernan, and FadiAloul, Senior Member, IEEE, “A mobile gprs-sensors array for Air pollution monitoring” vol. 6, pp. 410–422, Oct. 2010.

[B] Da-Jeng Yao, “A gas sensing system for indoor air quality control and polluted environmental monitoring,” pp. 11-14, 2009.

[C] Kai-Tai Song and Chih-Chieh Yang, of National Chiao Tung University, Taiwan, “Front Vehicle Tracking Using Scene Analysis”, Proceedings of the IEEE International Conference on Mechatronics & Automation 2005.

[D] Hibikino, Wakamatsu, Kitakyushu, “Accident Prevention System Based On Semantic Network Jian-Xiong Yang, JunzoWatada”, Proceedings of the Seventh International Conference on Machine Learning and Cybernetics, Kunming, 12-15 July 2008, pp.: 3738-3743.

[E] www.eXtremeElctronics.co.in

[F] Sai Prabha.M, Roy.K.S and Shaik Mahboob Ali of KL University , Guntur, A.P, India, IJETT “Obstacle Avoidance with Anti-theft Mechanism system And Cabin Safety System for Automobiles” vol. 4, April 2013.