

TESTING THE SILKWORM SMART FARMING SURVEY TECHNIQUE IN SERICULTURE

Submitted in partial fulfilment of the requirements for the award of
Bachelor of Engineering Degree of Mechatronics Engineering

By

JohnBruttus R (Reg. No. 38090008)

Nesaraj D (Reg. No. 38090016)



**DEPARTMENT OF MECHATRONICS ENGINEERING
SCHOOL OF MECHANICAL ENGINEERING**

SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

Accredited with Grade “A” by NAAC

JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI - 600 119

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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of John Bruttus R (38090008), Nesaraj D (38090008) who carried out the project entitled "TESTING THE SILKWORM AND SMART FARMING SURVEY TECHNIQUE IN SERICULTURE" under our supervision from 01.11.2021 to 10.05.2022

Internal Guide

Dr.LILLY MERCY

Head of the Department

Dr. S. PRAKASH, M.E., Ph.D.,

Submitted for Viva voce Examination held on 10.05.2022

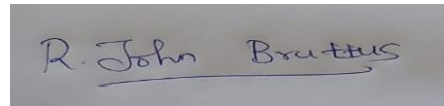
Internal Examiner

External Examiner

DECLARATION

I JOHN BRUTTUS R(Reg. No. 38090008) and NESARAJ D(Reg. No. 38090016) hereby declare that the Project Report entitled “TESTING THE SILKWORM AND SMART FARMING SURVEY TECHNIQUE IN SERICULTURE” done by us under the guidance of DR.LILLY MERCY, is submitted in partial fulfilment of the requirements for the award of Bachelor of Engineering degree in Mechatronics Engineering.

1)

A rectangular box containing a handwritten signature in blue ink that reads "R. John Bruttus".

2)

A handwritten signature in black ink, appearing to read "Nesaraj", written over a horizontal line.

SIGNATURE OF THE CANDIDATE

DATE: 10.05.2022

PLACE: CHENNAI

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ABSTRACT

Sericulture is the process of growing silkworms for the purpose of producing silk. India is the world's second-largest silk producer. Sericulture is at the heart of India's social, economic, cultural, and political development. Temperature and humidity play a critical role in the growth of healthy silkworms at all stages, particularly during larval development. We used a MEGA controller in our project to plot real-time data in order to maintain track of the silkworms. Image processing aids in the identification of infection, illness, and non-identical stages of silkworms. Using MEGA Controller, our specimen maintains the collecting of real-time statistics. The entire organization or structure is based on data and is managed by a MEGA controller. The MEGA checks or controls the atmospheric environment or surrounding inside the silkworm rearing room at the same phases as the silkworm. Using the MEGA board, reduce the farmer's manual intervention by automating the irrigation of mulberry plantations, as well as temperature testing and control of the silkworm rearing unit. The technique of image processing is mostly utilised to determine the colour change in the silkworm's body. It denotes non-identical phases, such as black worms and swallow worms, as well as diseases caused by worms.

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CHAPTER 1

INTRODUCTION

The Internet of Things is a modern technological trend (IoT), which resulted in the diversity of each object's detection, activation and transmission across the internet by perceiving itself through a unique addressing format. Furthermore, the components are linked remotely for a more elegant use. More than M2M correspondence. The performance of IoT is significantly higher because of Wireless Sensor Networks (WSN), Radio Frequency Identification (RFID), 2G/3G/4G, and Bluetooth. The Internet of Things (IoT) is a collection of network connections and network systems with unique characteristics that allow applications to be stored in various locations [1]. According to a report by the Central Silk Board, India ranks second in the world for silk production. India, on the other hand, contributes only 15% of global silk production, compared to China's 85 percent. Sericulture is the science of growing silkworms for the purpose of producing silk. Sericulture is primarily concerned with the cultivation of silkworms for the purpose of producing silk. Silk production is a time-consuming, labor-intensive, and challenging process. Silkworms are believed to be one of the most important house-trained organisms, harvesting dynamic silk-fiber in the form of cocoon by eating mulberry leaves during their larval stage [2]. Sericulture is the process of producing raw silk by rearing caterpillars [*Bombyx mori*]. Silk is referred to as the 'QUEEN OF TEXTILES' and is a naturally occurring animal fibre. Sericulture is a cottage enterprise based on agriculture. Silkworm care is primarily concerned with the preparation of silk through the care of silkworms. The lack of mechanisation in the sericulture industry is the primary source of the huge disparity. The seasonal variations disrupt changes in the environment in the silkworm raising house, affecting cocoon and shell weight ratios as well as cocoon fineness [3]. The change in the atmosphere inside the silk worm raising home is disrupted by seasonal variations. The cocoon and shell load ratio is also impacted by cocoon uniformity. As a result of the environmental change, the silk quality in the silkworm rearing house is altered.

This study recommends using automation in sericulture to improve the quality and production of silk thread. According to the findings, environmental factors play a significant effect in the silk harvest. Controlling numerous environmental parameters such as temperature, humidity, and light intensity during the silk-lifespan worm's promises improved silk quality and quantity [4]. There is a pressing need to build systems that are completely innovative and innovative for the long-term use of water, including specialised, agronomic, administrative, and institutional improvements. There are various frameworks for obtaining water investing funds in various plants, ranging from central to more mechanically propelled ones. For example, in a single gadget plant, water notoriety was evaluated and a water system was planned in light of the plant's shade temperature dispersion, which was detected using warm imaging. Furthermore, by utilising a harvest water strain file, distinctive structures have been improved to timetable water system yields and streamline water utilisation (CWSI). Sensors such as stickiness and soil wetness are used in this device. These sensors transmit information to a small-scale controller [5]. According to Indian farming culture, it is done in tropical areas such as , tamil nadu,west bengal,andra pradesh and karnataka as well as to a lesser extent in the cooler region of Jammu and Kashmir.The current tropical environment gives a measure of the employment of the multivoltine bivoltine hybrid in the commercial market since they are resilient and have a great capacity for survival and reproduction under changing weather conditions. The majority of silk is produced from multivoltine seeds (ninety five percent) [6].

1.1 GENERAL

Sericulture refers to the practise of raising silkworms for the purpose of producing silk. Temperature, humidity, and light intensity are essential elements in silkworm advancement, and appropriate encouragement must be done according to the requirements at each stage. Environmental variables play a vital role in the silkworm's growth and development. Sericulture is a major occupation in India, yet agriculturists' techniques are still antiquated. There would be a need to develop modernisation in sericulture cultivation in the future. This endeavour raises the possibility of automating sericulture cultivation. The approach aims to integrate emerging technology, such as IoT and smart sericulture, in conjunction with

automation. The most crucial component to enhance is monitoring the silkworm rearing house's environmental conditions.

1.2 EXISTING SYSTEM

Currently, all labour is done manually to control the sericulture unit and keep the silkworms healthy.

1.2.1 Existing system disadvantages

- ◆ Maintenance cost is very high,
- ◆ more staff is required.

1.3 PROPOSED SYSTEM

The complete maintenance job is intended to be done utilizing automation based on sensors and controls.

1.3.2 Proposed system disadvantages

It's a low-cost procedure that doesn't require a lot of people.

CHAPTER 2

LITERATURE SURVEY

2.1 LITERATURE SURVEY

Amandeep et.al. (2017), 'Smart farming using IOT'. Traditional methods and backward techniques are still used in agriculture in several underdeveloped nations today. There has been little or no technological innovation in this area that has resulted in a major increase in manufacturing efficiency. This research presents a revolutionary design technique for increasing productivity.

Chetan Dwarkani M et al. (2015), 'Smart Farming System Using Sensors for Agricultural Task Automation'. Agriculture is the most diverse economic sector and plays a critical part in a country's overall economic development. Technological improvements in agriculture will ensure that specific farming tasks become more competent. We suggest a revolutionary approach for smart farming in this study, which involves using wireless communication technologies to link a smart sensing system and a smart irrigator system.

Divya Dharshini B Adharse et al. (2016), 'Automated Smart Sericulture System based on 6LoWPAN and Image Processing Technique'. Sericulture is the process of growing silkworms for the purpose of producing silk. India is the world's second-largest silk producer. Sericulture is at the heart of India's social, economic, cultural, and political development. Temperature and humidity play a critical role in the growth of healthy silkworms at all stages, particularly during larval development. Disinfection is one of the most important factors to consider when raising healthy and successful silkworms.

Dixit M.A et al. (2015), 'Intelligent Control System for Sericulture'. Sericulture (the manufacture of silk) is an important rural occupation. India is the world's second largest silk producer, accounting for around 15% of global production after China, which accounts for a staggering 80%. An examination of Indian sericulture processes reveals a significant need for automation, particularly during the pre-

cocoon stages. During this phase, the silkworms go through critical bodily changes that impact the quality and amount of the silk produced.

Lokesh K et al. (2017), 'Internet of Things Application for Implementation of Smart Agriculture System'. There has been a lot of interest in building smart agricultural systems in recent years. Smart farming practises can increase crop yield while also producing more output with the same amount of input. However, the majority of farmers are still uninformed of the most up-to-date technologies and techniques. A revolutionary wireless mobile robot based on the Internet of Things (IoT) is built and implemented in this study for conducting diverse outdoor operations.

CHAPTER 3

AIM AND SCOPE OF THE PROJECT

3.1 AIM OF THE PROJECT

According to a report by the Central Silk Board, India ranks second in the world for silk production. India, on the other hand, contributes only 15% of global silk production, compared to China's 85 percent. Sericulture is the science of growing silkworms for the purpose of producing silk. Sericulture is primarily concerned with the cultivation of silkworms for the purpose of producing silk. Silk production is a time-consuming, labor-intensive, and challenging process. Silkworms are considered to be one of the most important housetrained organisms, harvesting dynamic silk-fibre in the form of cocoon by eating mulberry leaves during their larval stage. The most important factor that can be identified as causing a significant difference is Seasonal fluctuations disrupt the silk worm rearing house's environment, affecting the weight of cocoons and shell ratio, as well as cocoon quality. As a result of the environmental change in the silkworm rearing house, the quality of silk is changed. The use of automation in sericulture is suggested in this research to improve the output and quality of silk thread. According to research, environmental factors play a significant role in silk harvesting. Controlling a variety of environmental parameters such as temperature, humidity, and light intensity throughout the silkworm's life cycle promises improved silk quality and quantity. It has been discovered that each moult, or period of growth for silkworms, demands a unique set of criteria.

3.1.1 System design and block diagrams for the proposed system

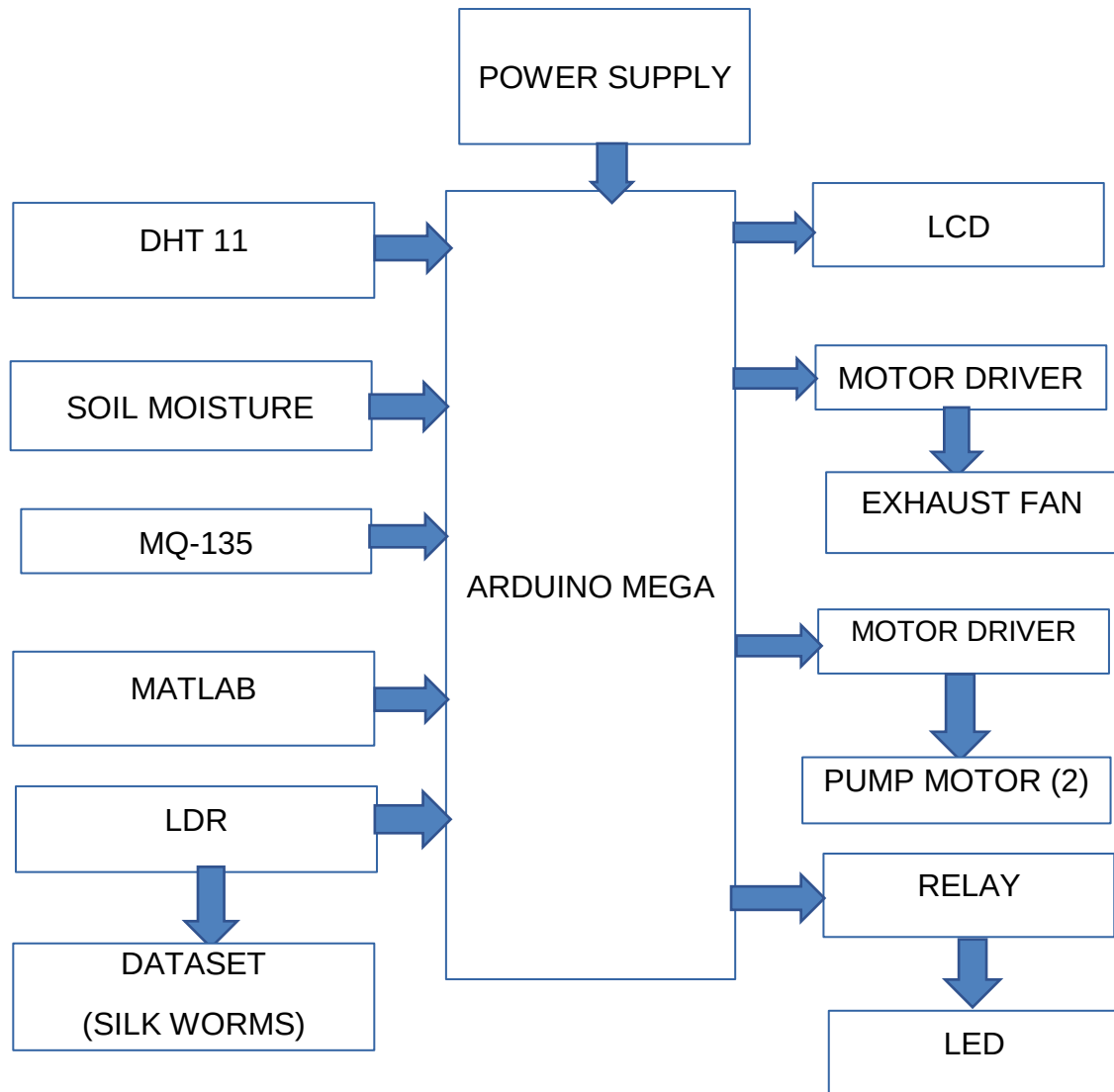


Fig: 3.1 : Block diagram of the project

The ARM microcontroller is used to interface with the sensors in this proposed method. The DHT11 sensor was utilised to keep track of the temperature in the silkworm area. The exhaust fan will run whenever the temperature is too high, lowering the temperature. The ideal temperature for regular silkworm growth is between 20°C and 28°C, while the ideal temperature for optimal productivity is between 23°C and 28°C. Temperatures above 30°C have a direct impact on the health of the worm. The soil moisture sensor detects the amount of moisture in the soil. The pump motor will run and pump water to the mulberry plants based on the

moisture level in the soil. The MQ-135 air quality sensor is used to keep track of the room's air quality. To determine whether it is day or night, the LDR (Light Dependent Resistor) is utilised. The light will turn on/off based on the LDR condition. The silkworm condition is detected via MATLAB processing. The medicine pump motor will switch on and spray the medicine if the silkworm is in poor health. All of the information is displayed on the LCD.

Module Description:

- ◆ Maintain the warehouse condition
- ◆ Maintain the food plant
- ◆ Maintain the silkworm health

The temperature in the silkworm warehouse must be strictly maintained. The temperature in the warehouse should be between 23 degree Celsius to 28 degree Celsius. Temperatures exceeding 30°C have a direct impact on the worm's health. To keep the silkworms healthy, the air quality must be good and the light must be available 24 hours a day, seven days a week.

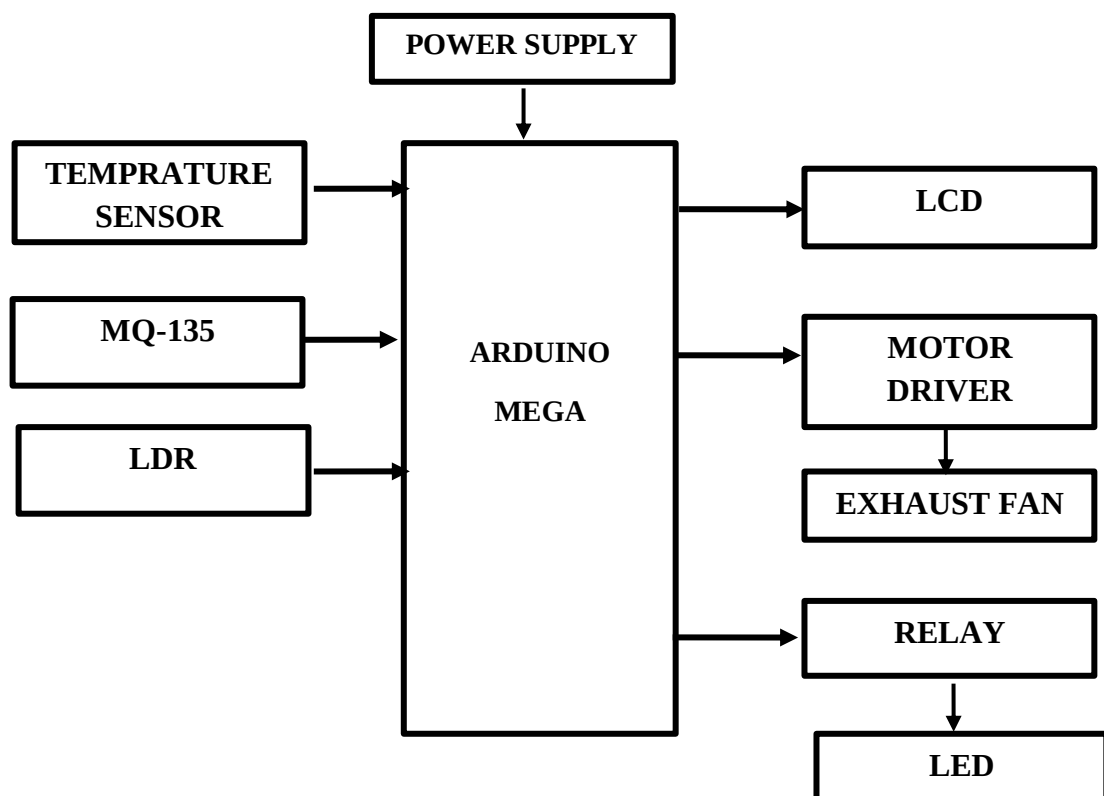


Fig: 3.2 : Block diagram for maintain the warehouse condition

Then there's the LDR warehouse (Light Dependent Warehouse). The sun provides light for the warehouse in the morning. The sensor detects low light intensity and activates the relay, which turns on the light. The warehouse air quality is monitored with the MQ-135 air quality sensor.

If the silkworm wants to create a large amount of silk, it will need a large amount of food. Mulberry plant is a particular feeding for silkworms. As a result, we want to keep the mulberry tree alive. To detect the moisture in the soil, we use a soil

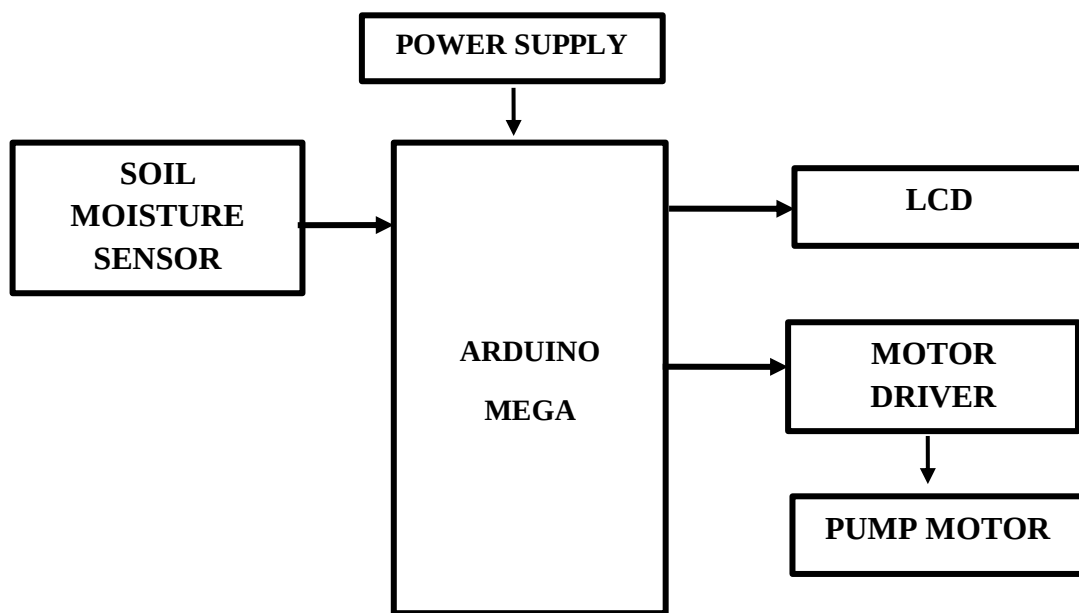


Fig: 3.3 : Block diagram for maintain the plant

moisture sensor. When the soil becomes dry, the water pump motor will automatically start and provide the plant with the water it requires.

The silkworm health condition is detected using a MATLAB image processing algorithm. The technique diagnosed ill silkworms based on the colour of the silkworms. When the system detects an illness, the medicine is immediately sprayed in the correct place. The silkworm death rate was reduced while silk production was increased as a result of this procedure.

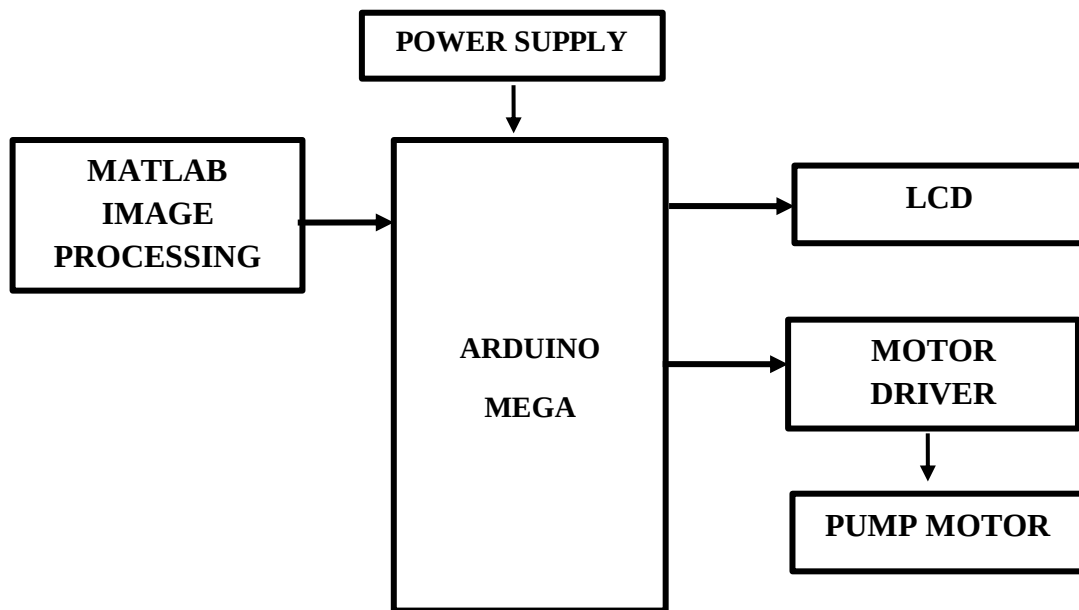


Fig: 3.4 : Block diagram for maintain the silkworm health

3.2 SCOPE OF THE PROJECT

This technique is used to create sericulture that is automated. MATLAB image processing makes it simple to process images. It suggests a cost-effective and power-efficient arrangement. A cost-effective wireless sensor network using IoT technology to monitor and control the temperature, humidity, and light intensity in a silkworm raising facility. There is no need for a large number of people, productive work, economic development, and an increase in the people's quality of life in rural areas. Various deep learning algorithms were used to identify the impacted silkworm and classify the type of disease that would be afflicted, as well as automatically recommend medicine for the affected persons.

CHAPTER 4

MATERIALS AND METHODS

4.1 HARDWARE DESCRIPTION:

4.1.1 Arduino

Arduino is an open-source electronics platform that uses simple hardware and software to make it easy to use. Arduino boards can take inputs - such as light from a sensor, a finger on a button, or a Twitter message - and convert them to outputs - such as turning on an LED, triggering a motor, or publishing anything online. By providing a set of instructions to the board's microcontroller, you may tell it what to do.

Thousands of projects have used Arduino throughout the years, ranging from simple household items to complicated scientific apparatus. This open-source platform has united a global community of makers - students, amateurs, artists, programmers, and professionals - whose contributions have added up to an enormous quantity of accessible knowledge that may be of tremendous benefit to novices and specialists alike.

4.1.1.1 WHAT IS THE PURPOSE OF ARDUINO?

Arduino has been used in many of projects and applications due to its simple and accessible user interface. Beginners will find the Arduino software simple to use, but advanced users will find it adaptable. It's compatible with Mac, Windows, and Linux. It is used by teachers and students to create low-cost scientific equipment, to demonstrate chemistry and physics principles, and to begin learning programming and robotics. Designers and architects create interactive prototypes, while musicians and artists utilise it to create installations and try out new instruments. Take, for example, the Maker Faire. Arduino is a valuable tool for learning new skills. Anyone - youngsters, amateurs, artists, programmers - may get started tinkering by following the step-by-step instructions in a kit or sharing ideas with other Arduino members online. For physical computing, there are a variety of additional microcontrollers and microcontroller platforms to choose from. Similar functionality

can be found in Parallax Basic Stamp, Netmedia's BX-24, Phidgets, MIT's Handyboard, and many other programmes. All of these programmes condense the complicated elements of microcontroller programming into an easy-to-use package. Although Arduino simplifies the process of working with microcontrollers, it has some advantage over other systems for teachers, students, and curious amateurs.

4.1.1.2 ARDUINO MEGA:

The MEGA 2560 is made for more difficult projects. It is the suggested board for 3D printers and robotics applications since it has 54 digital I/O pins, 16 analogue inputs, and more room for your sketch. This provides lots of room and options for your initiatives.



Fig: 4.1 : Arduino Mega

The ATmega2560 is the basis for the Arduino Mega 2560 microcontroller board. It contains 54 digital input/output pins, 16 analogue 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 comes with everything you'll need to get started with the microcontroller; simply plug it into a computer with a USB cable or power it with an AC-to-DC adapter or battery. Most shields created for the Uno and previous boards Duemilanove or Diecimila are compatible with the Mega 2560 Board.

4.1.4 TECHNICAL SPECIFICATIONS

Table 4.1 : Arduino Mega 2560 Specifications

Microcontroller	<u>ATmega2560</u>
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

4.1.2 Power Supply

This section explains how to produce a +5V DC power source.

4.1.2.1 CIRCUIT DIAGRAM

It must provide a constant output regulated power supply. For this, a 0-12V/1 mA. The most crucial section is the power supply. For the project to perform properly, transformer is utilized of this purpose. This transformer's primary is connected to the

main supply through an on/off switch and a fuse for overload and short circuit protection. To convert 12V AC to 12V DC voltage, the secondary is linked to the diodes. The capacitors filter the signal, which is then regulated to +5v by the IC 7805.

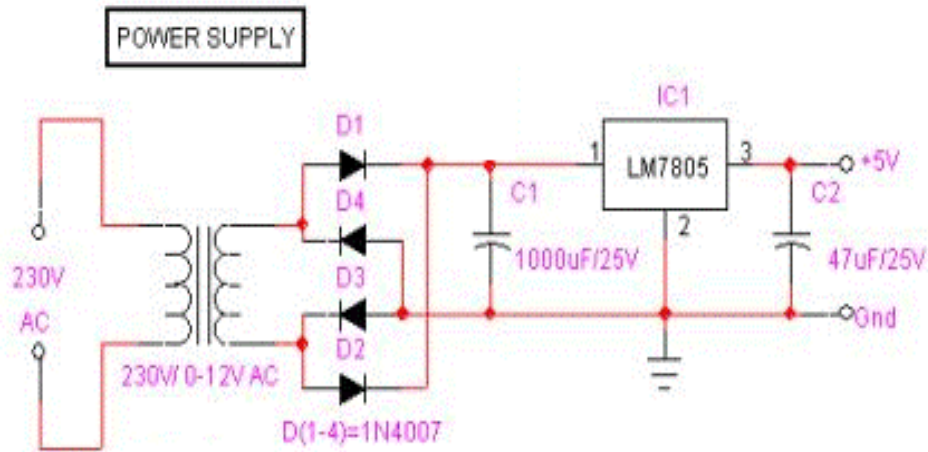


Fig: 4.2 : Power supply

4.1.3 LCD

An LCD screen is an electronic display module that can be used in a variety of ways. A 16x2 Lcd screen is a relatively basic module that can be found in a variety of devices and circuits. Seven-segment and other multi-segment LEDs are favoured over these modules. The reasons for this are as follows: LCDs are inexpensive; they are simple to programme; they have no restrictions on showing unique and even custom characters (unlike seven segments), animations, and so on.

A 16x2 LCD can display 16 characters per line on each of its two lines. Each character is presented in a 5x7 pixel matrix on this LCD. Command and Data are the two registers on this LCD. The LCD command instructions are stored in the command register. A command tells the LCD to perform a certain activity, such as initialising it, cleaning its screen, setting the cursor location, managing the display, and so on. The data to be displayed on the LCD is stored in the data register. The ASCII value of the character to be displayed on the LCD is the data. To discover more about the internal structure of an LCD, click and visit.

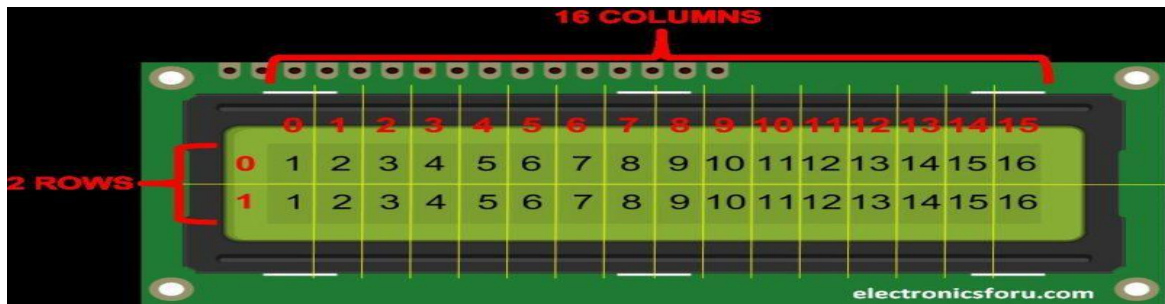


Fig: 4.3 : LCD

A LCD displays can be found all over the place. The time is displayed on computers, calculators, television sets, mobile phones, and digital watches using some type of display. A liquid crystal display (LCD) is an electrical display module that produces a visible image using liquid crystal. The 162 LCD display is a fairly simple module that is frequently used in projects. The 162 refers to a two-line display with 16 characters per line. Each character is presented in a 5x7 pixel matrix on this LCD.

4.1.4 WATER PUMP MOTOR

Water pumps do exactly what their name implies: they pump water. Customers may probably locate a water pump to fit their vehicle or to help them draw water from the ground in a self-dug well to be utilised in pressure tanks within the area, whether it's in a vehicle, at a business, at home, or in a well. Vehicle water pumps control the flow of water through the cooling system of a vehicle; when the seal on one fails, the entire pump must be replaced. Pressure water pumps, which are usually found inside a home or business, manage water flow and regulate water pressure throughout the year.

A pump motor is a DC motor that is used to transfer liquids. A DC motor transforms electrical power from direct current to mechanical power. When a current carrying conductor is put in a magnetic field, it experiences torque and has a tendency to move. This is how a DC or direct current motor operates. This is referred to as "motoring activity." Pumps use energy to produce mechanical work by moving fluid and are powered by a mechanism (usually reciprocating or rotary). Pumps can be powered by a variety of sources, including human work, electricity, engines, or wind power. They can come in a variety of sizes, ranging from microscopic pumps for medical applications to massive industrial pumps.



Fig: 4.4 : Water pump motor

4.1.5 Soil moisture sensor

This sensor may be used to evaluate the moisture of soil; when there is a water scarcity in the soil, the module output is high, and when there isn't, the output is low. This sensor can be used to automatically water a flower plant or any other plant that requires automatic watering. The volumetric water content in soil is measured by soil moisture sensors. Because direct gravimetric measurement of free soil moisture necessitates the removal, drying, and weighing of a sample, soil moisture sensors indirectly measure the volumetric water content by using another property of the soil as a proxy for the moisture content, such as electrical resistance, dielectric constant, or neutron interaction. Module has three output modes: digital, analogue, and serial. Digital output is simple, analogue output is more accurate, and serial output gives exact readings.

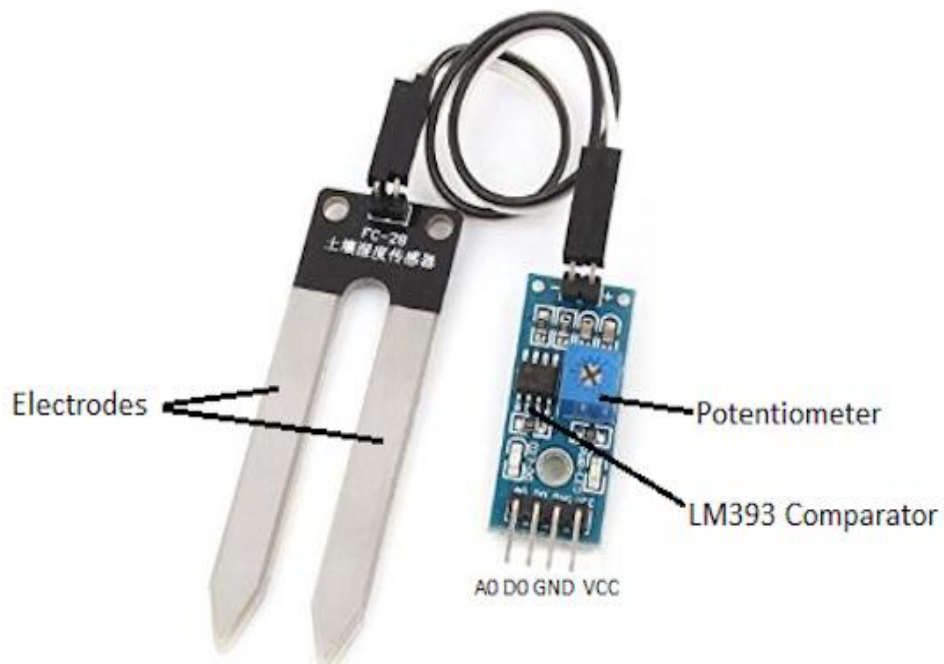


Fig: 4.5 : Soil moisture sensor

This sensor is made up of two components: a fork-shaped probe that must be nailed to the ground and an electronic module that will connect the probe to Arduino. It requires a 3.3V or 5V power, which is controlled by the VCC and GND pins. When we are feeding, the red LED will turn on. The pin AO will give us an analogue signal between the supply value to 0V (for Arduino UNO 5v to 0V) to higher humidity value

will be higher, this is related to the functioning of the probe since the higher the humidity, the greater the conductivity of the soil and thus raise the value that we measure.

When the humidity value is lower than the value manually set on the potentiometer, the DO pin will send us a digital signal of "1" and "0" when

it is higher. As the probe signal, the potentiometer is coupled to an LM393 comparator. We must calibrate it with different soil samples and humidities in order to utilise it effectively. The green LED will assist us in this endeavour because it will light on when we have a 1 in DO.

4.1.6 Motor Driver IC

Current greater than 250mA is required by most DC gear head motors. Many integrated circuits, such as the ATmega16 microcontroller and 555 timers, are available. However, the IC 74 series is incapable of supplying this level of current. They may be damaged if the motor is directly connected to the o/p of the aforesaid ICs. A motor control circuit, which can operate as a bridge between the aforesaid motors and ICs, is required to solve this problem (integrated circuits). H-bridge motor control circuits can be made in a variety of ways, including with transistors, relays, and L293D/L298.

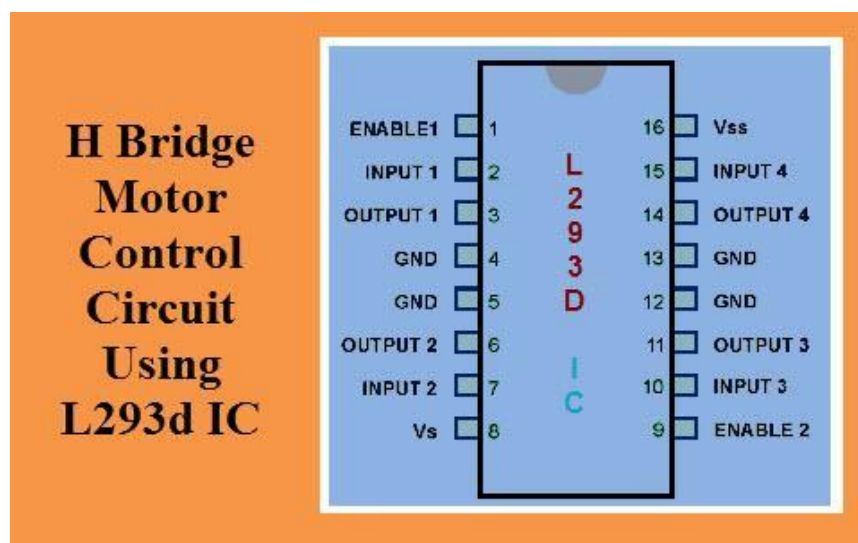


Fig: 4.6 : H Bridge Motor Control Circuit Using L293d IC

4.1.7 H-bridge circuit

An H bridge is a type of electronic circuit that allows a voltage to be applied in any direction across a load. H-bridge circuits are commonly used to allow DC motors to run forward and backward in robotics and other applications. These motor control circuits are commonly found in DC-DC, DC-AC, and AC-AC converters, as well as a variety of other power electronic converters. A motor controller with two H-bridges is always used to drive a bipolar stepper motor.

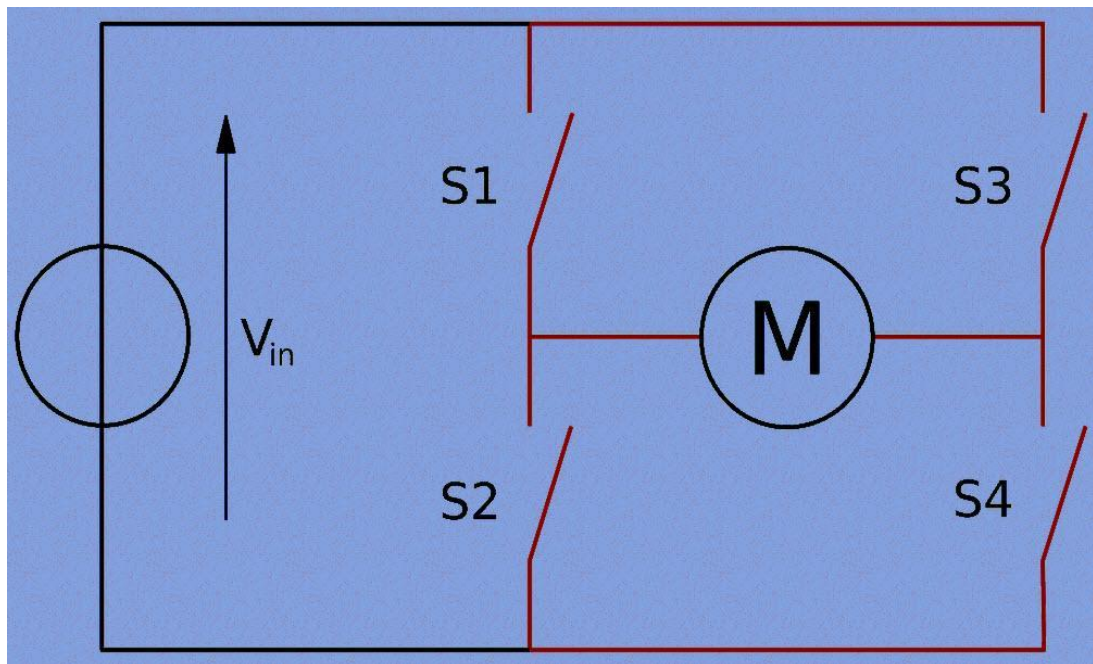


Fig: 4.7 : H-bridge circuit

4.1.8 Light Emitting diode

A light emitting diode (LED) is a semiconductor light source with two leads. Nick Holonyak, who was working for General Electric at the time, came up with the idea for the light emitting diode in 1962. The LED is a specific form of diode with electrical characteristics comparable to those of a PN junction diode. As a result, the LED permits current to flow in one direction while blocking current flow in the other. The LED takes up a very small space, less than 1 mm². LEDs have been employed in a variety of electrical and electronic devices. The functioning concept of the LED and its uses will be discussed in this article.

4.5.8.1 How does it work?

A p-n junction diode is used as the lights emitting diode. It's a semiconductor-based diode that's been doped in a unique way. A light emitting diode is a device that emits light when it is forward biased.

Simply put, a diode is a light-emitting diode. When the diode is forward biased, the electrons and holes move quickly across the junction, continually merging and ejecting one another.

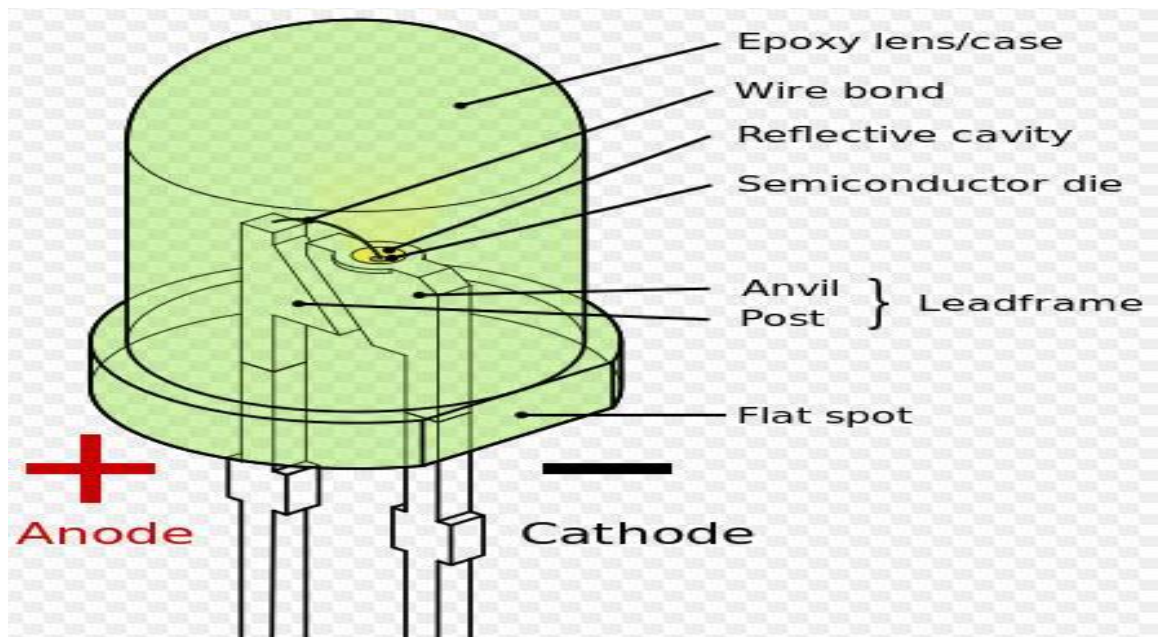


Fig: 4.8 : Light-emitting diode

It mixes with the holes shortly after the electrons go from n-type to p-type silicon and then vanishes. As a result, it stabilises the entire atom and provides a small burst of energy in the form of a tiny packet or photon of light.

4.1.7 Relay

In most control processes or equipment, relays serve as key protection and switching mechanisms. All relays open or close contacts or circuits in response to one or more electrical values such as voltage or current. A relay functions as a switching device, isolating or changing the status of an electric circuit from one state to another.



Fig: 4.9 : Relay

The classification and types of relays are determined by the purpose for which they are employed. Protective, reclosing, regulating, auxiliary, and monitoring relays are among the categories.

Protective relays continuously check the following characteristics: voltage, current, and power; if these parameters deviate from predetermined limits, an alert is generated or the circuit is isolated. These relays protect equipment such as motors, generators, and transformers, among other things

4.1.7.1 Different types of relay



Fig: 4.10 : Different types of relays

Reclosing relays are used to link various components and devices within the system network, such as the synchronising process, and to restore the various devices as soon as an electrical problem has passed, and then to connect transformers and

feeders to the line network. Regulating relays are contact switches that allow voltage to rise, such as in tap changing transformers.

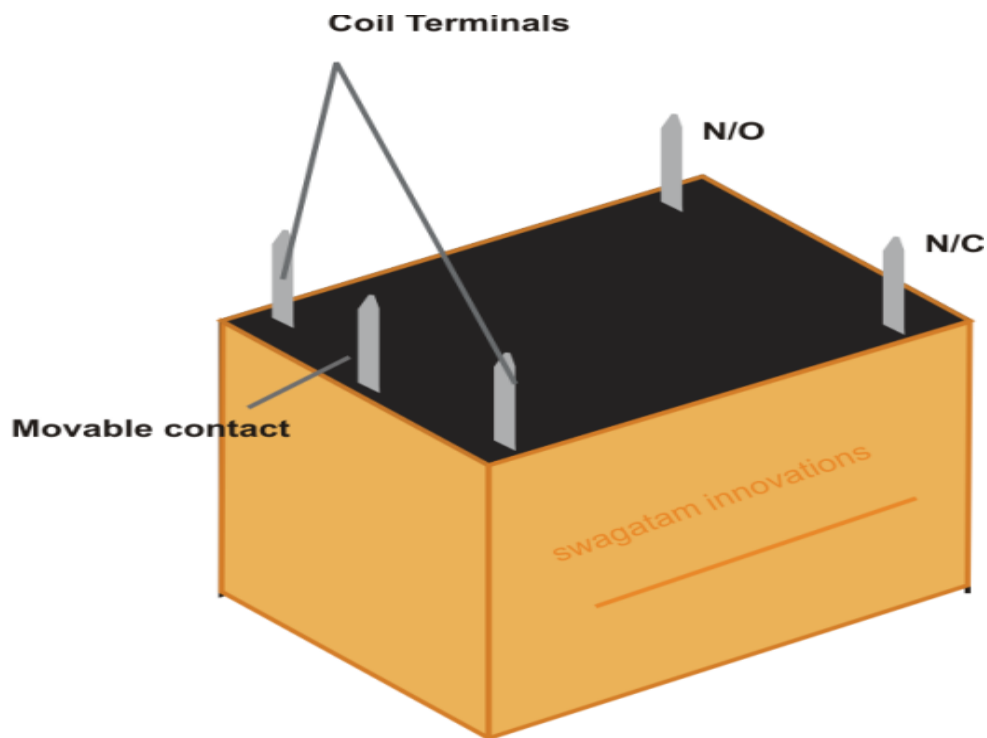


Fig: 4.11 Relay pins

4.1.8 Light Dependent Resistor

A Light Dependent Resistor (also known as an LDR, photoconductor, or photocell) is a device whose resistance varies depending on the quantity of light falling on it.

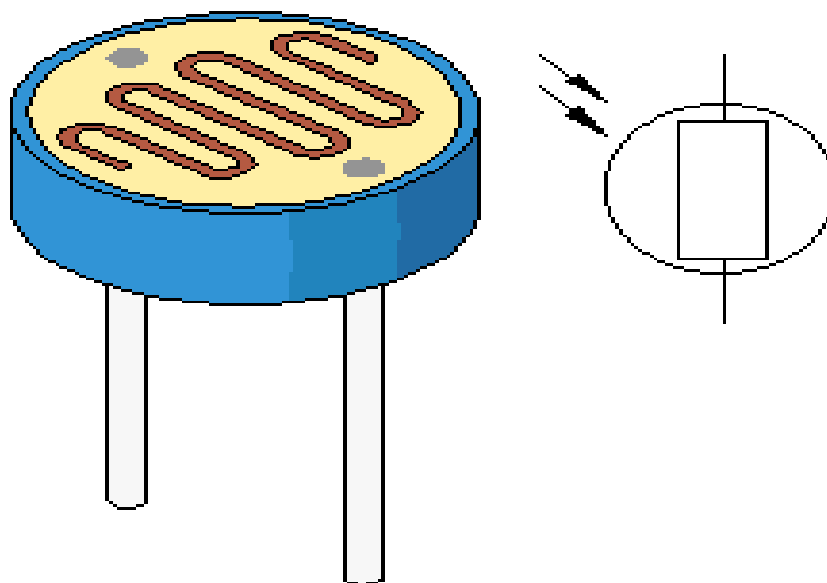


Fig: 4.12 Light-dependent resistor

A typical light-dependent resistor is shown above, along with its circuit schematic symbol (on the right). Varying LDRs have different specifications, however the ones we sell in the REUK Shop are quite common, with a resistance of 1 MOhm in complete darkness and a resistance of a few kOhm in bright light (10-20kOhm @ 10 lux, 2-4kOhm @ 100 lux). Light-dependent resistors have a variety of applications. Light-dependent resistors are an important part of any electric circuit that needs to turn on and off automatically based on the amount of ambient light, such as solar-powered garden lights and security lighting at night.

An LDR may also be used in a simple remote-control circuit to switch on a device using the backlight of a mobile phone - call the phone from anywhere in the globe, and the LDR lights up, allowing illumination (or a lawn sprinkler) to be turned on remotely!

4.1.9 DHT11 sensor

A temperature and humidity sensor complex with a calibrated digital signal output is included in the DHT11 Temperature & Humidity Sensor. It offers high dependability and outstanding long-term stability by employing an innovative digital-signal-acquisition technique as well as temperature and humidity sensing technologies. This sensor links to a high-performance 8-bit microcontroller and combines a resistive-type humidity measurement component and an NTC temperature measuring component, providing great quality, fast response, anti-interference ability, and cost-effectiveness. Each DHT11 element is meticulously calibrated in a laboratory to ensure the highest level of humidity accuracy. The single-wire serial interface simplifies system integration.

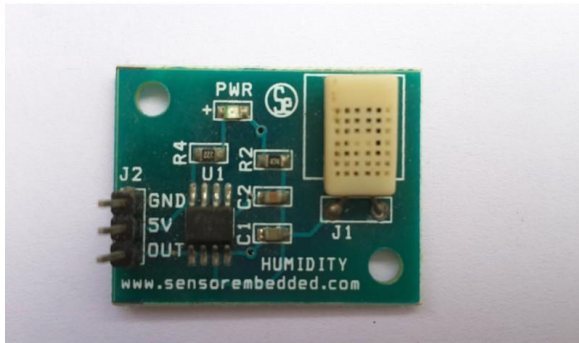


Fig: 4.13 : DHT11 sensor

4.1.10 Gas sensor

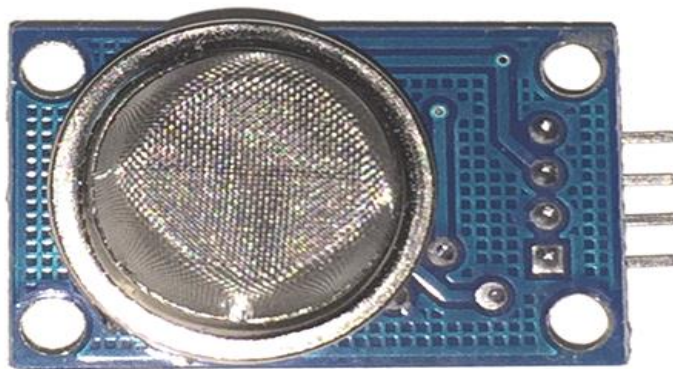


Fig: 4.14 MQ135-Gas sensor for air quality

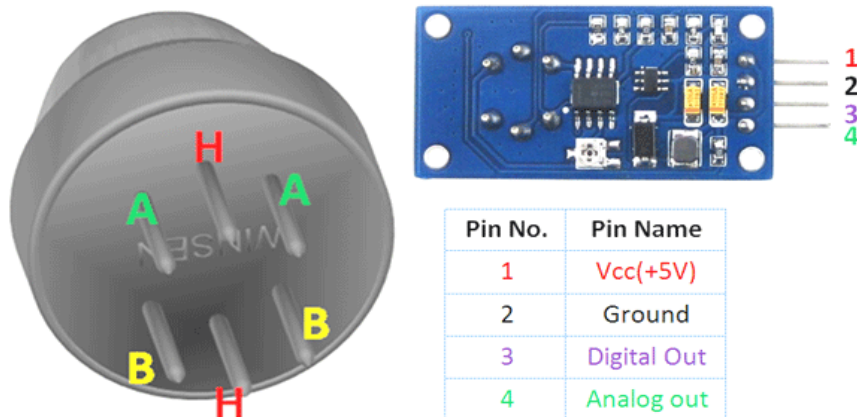


Fig: 4.15 : Gas sensor description

The air quality sensor is also a MQ-135 sensor, which can detect poisonous gases in the air in homes and offices. Tin dioxide (SnO_2) is used in the sensor unit's gas sensor layer; it has a lower conductivity than clean air, and its conductivity increases as a result of air pollution. Ammonia, nitrogen oxide, smoking, CO_2 , and other hazardous gases are detected by the air quality sensor. A tiny potentiometer on the air quality sensor allows the load resistance of the sensor circuit to be adjusted. The air quality sensor is powered by a 5V power supply.

4.1.10.1 PIN Configuration

Table 4.2 : Gas sensor PIN configuration

Pin No:	Pin Name:	Description
For Module		
1	Vcc	The operational voltage is usually +5V and is used to power the sensor.
2	Ground	This is the wire that connects the module to the system ground.
3	Digital Out	You can also use this sensor to acquire digital output from this pin by using the potentiometer to establish a threshold value.
4	Analog Out	This pin generates a 0-5V analogue voltage based on the gas intensity.
For Sensor		
1	H -Pins	One of the two H pins is connected to supply, while the other is connected to ground.
2	A-Pins	The A and B pins can be swapped out. The supply voltage will be linked to these pins.

3	B-Pins	A and B pins can be used interchangeably. One pin will be used as an output, while the other will be grounded.
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4.1.10.2 Features of MQ-135 sensor

- Wide detection range
- High sensitivity and quick response
- Long-lasting and stable
- The operating voltage is +5 volts
- NH₃, NO_x, alcohol, Benzene, smoke, CO₂, and other gases are detected and measured.
- Analog output voltage: 0V to 5V
- Digital output voltage: 0V or 5V (TTL Logic)
- Preheat time: 20 seconds
- It can function as a digital or analogue sensor.
- The potentiometer can be used to adjust the digital pin's sensitivity.

4.1.10.2 Selecting between sensor and module

The MQ series Gas sensors are the most affordable and widely utilised when it comes to measuring or detecting a specific Gas. MQ135 can be purchased as a module or as a single sensor. Because it comes with an op-amp comparator and a digital output pin, you can buy it as a module if you only want to detect (not measure PPM) the presence of a gas. However, if you want to measure the PPM of a gas, you should buy the sensor without the module.

4.1.12 Exhaust fan

Industrial systems are designed to move a specified amount of air out (exhaust) and in (intake) at a specific speed (velocity), resulting in the removal of unwanted impurities. While all ventilation systems are based on the same basic principles, each system is tailored to the type of work performed and the rate of pollutant emission at that location. Exhaust fans remove unpleasant odours, dampness, smoke, and other impurities from the air, as indicated. Mold can grow when there is

a lot of steam and moisture in the air. The steam is expelled outdoors when you use an exhaust fan, which helps you control mould in your home.



Fig: 4.16 : Exhaust fan

Exhaust fans work by pulling hot or humid air out of a small, confined region and replacing it with fresh air from somewhere else (maybe a doorway or vent). Warm air is taken out of the room by an exhaust fan, then pushed via a ducting system and released outside. These fans are most typically found in bathrooms, kitchens, and laundries because of the steam and humidity that builds up in those locations. Exhaust fans in kitchens include range hoods over cooktops. Some exhaust fans have sensors that allow them to turn on automatically when they detect steam in the room.

4.2 SOFTWARE REQUIREMENTS

4.2.1 Embedded C

Embedded C is the most widely used programming language in the software industry for creating electronic devices. Embedded software is coupled with each processor utilised in an electronic system.

Embedded C programming is essential for the CPU to accomplish specified tasks. We utilise a variety of technological equipment in our daily lives, such as a cell phone, a washing machine, a digital camera, and so on. All of these devices are controlled by a microcontroller that is programmed in embedded C.

Let's look at how embedded system programming is represented in a block diagram.

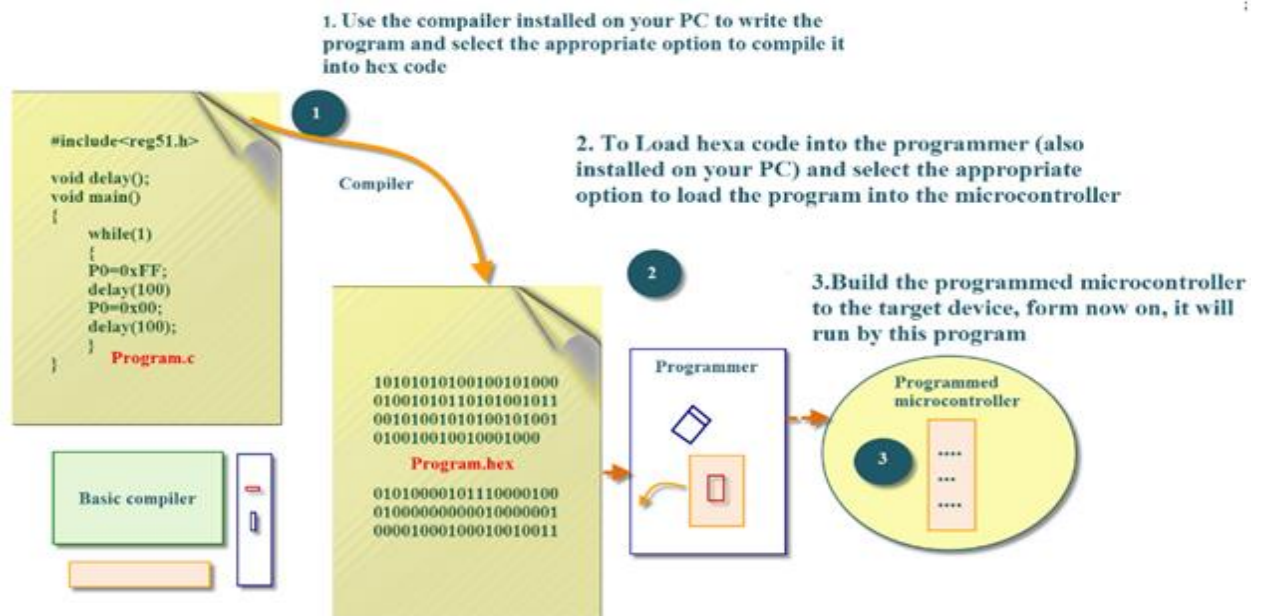


Fig: 4.17 : Block diagram for Embedded C code

The embedded C code in the block diagram above is used to flash the LED linked to the microcontroller's Port0. C code is preferred over other languages when developing embedded systems. For the reasons listed below:

- ◆ Simple to comprehend
- ◆ High Reliability
- ◆ Portability
- ◆ Scalability

4.2.1.2 Steps for basic embedded C programming

Let's look at the development of Embedded C Programming as a block diagram:

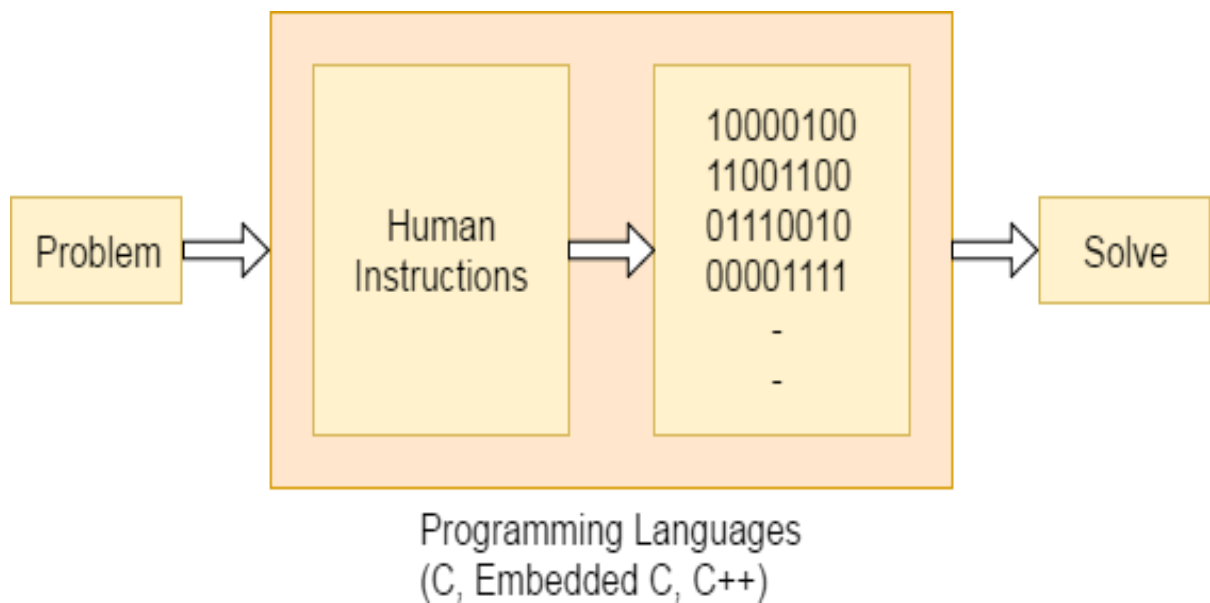


Fig: 4.18 : Development of Embedded C programming

A programming language is a collection of one or more functions that are used to do a specific task. A function is a collection of statements that are used to execute a specific activity. Basic elements and grammatical rules exist in every language. Variables, character set, data types, keywords, expressions, and other features of the C programming language are utilised to write C programmes.

The embedded C programming language is a C language extension. In addition to the elements listed above, embedded programming in C includes data types, keywords, and a header file, which is represented by `#includemicrocontroller name.h`.

Let's look at the Embedded C Programming Steps in a block diagram:

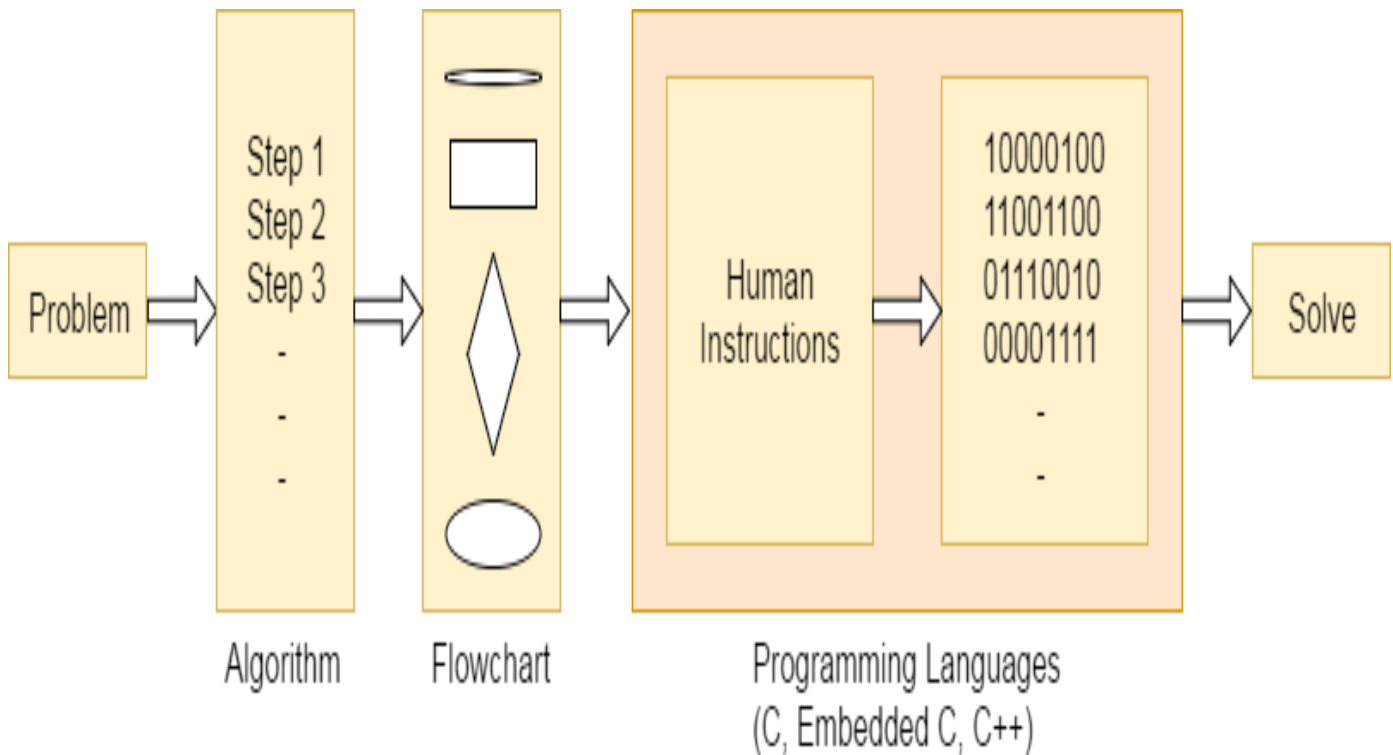


Fig: 4.19 : Block diagram for steps of Embedded C programming

Microcontroller programming differs depending on the operating system. Despite the fact that various operating systems exist, such as Windows, Linux, and RTOS, RTOS has a number of advantages for embedded system development.

4.2.2 Arduino Software IDE

The Arduino Software (IDE) includes a text editor for writing code, a message area, a text console, a toolbar with buttons for basic functions, and a series of menus. It communicates with the Arduino and Genuino devices by connecting to them and uploading code.

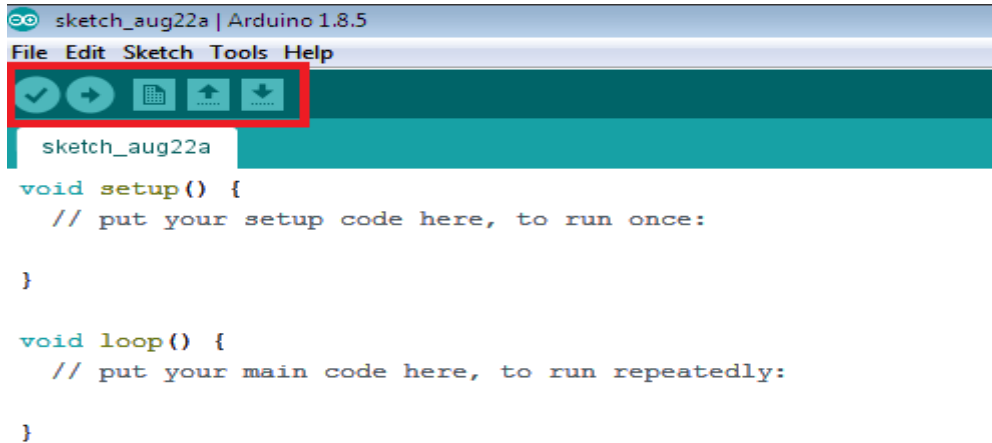


Fig: 4.20 : Arduino Software IDE

4.2.2.1 Writing Sketches

Sketches are created in a text editor and saved as files with the extension.ino. Cutting/pasting, as well as searching/replacing text, are all available in the editor. The message section indicates faults and provides feedback while storing and exporting. The Arduino Software (IDE) outputs text to the console, which includes detailed error messages and other information. The configured board and serial port are displayed in the window's bottom right corner. The toolbar buttons let you check if the programmes you wrote using the Arduino Software (IDE) are called sketches. These and other programmes, as well as the serial monitor, can be used to make, open, and save sketches.

NB: Previous versions of the Arduino Software (IDE) used the.pde extension to save sketches. These files can be opened with version 1.0, but you'll be required to save the sketch with the.ino extension when you save it.



Verify

Checks for mistakes while building your code.



Upload

Compiles and uploads your code to the specified board. For more information, see the section on uploading below..

Note: If you're using an external programmer with your board, you can use this icon while holding down the "shift" key on your computer. "Upload using Programmer" will be the new text.



New

Creates a new sketch.



Open

Displays a menu with all of your sketchbook's sketches. When you click one, it will open in the current window, overwriting the content.

Note: This menu does not scroll owing to a Java problem; if you need to open a sketch that is further down the list, use the File | Sketchbook menu instead.



Save

Saves your sketch.



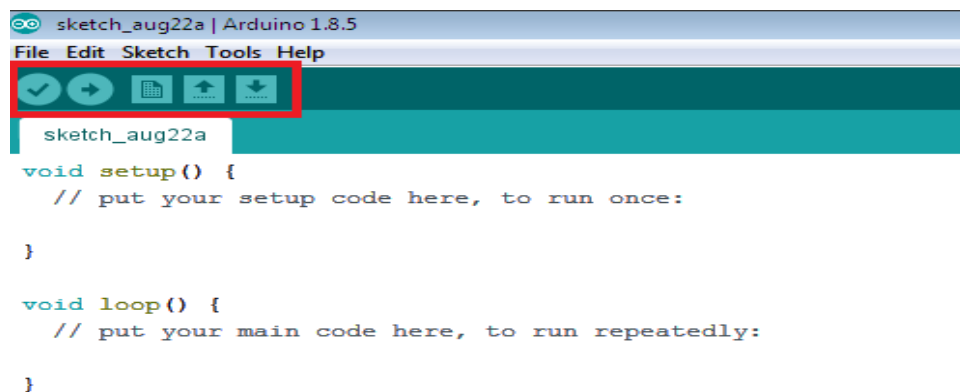
Serial

Opens the serial monitor.

Monitor

Fig:

:



4.21

Writing sketches of program code

CHAPTER 7

CONCLUSION

By utilising technology-based invention, the "Automated Sericulture System" provides automation and directed control in sericulture developments. Inside the silkworm growing home, the suggested system facilities and conduct the environmental conditions must be reserved. Depending on the ambient conditions, required edge values for parameters like temperature, relative humidity, and light intensity can be stable. The fan, light, and heater are turned on and off according to the requirements of the environment. The intended system is a cost-effective and energy-efficient organisation. The prototype system's implementation test confirms that the proposed system can gradually monitor the environmental conditions within the silkworm raising home. The proposed system saves time and money by reducing the number of people involved. The model is simple to set up and utilise.

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