CHAPTER 1

COMPANY PROFILE

1.1 HISTORY:

TECHNOLOGICS GLOBAL PVT. LTD. headquartered in Bangalore, India. is established by technology pioneers having decades of experience across India & Middle East in controls and automation industry. They offer a wide range of services, related to PLC, SCADA, IBMS & Embedded systems for commercial, residential and Industrial sectors.

They provide training and turnkey solutions in the field of Industrial, automation, BMS, HAS, Facility Management software's, Embedded, Robotic, IT verticals with edge of competitive in quality & price to our valued customers in the ground of sustainability. They are also master dealer & system integrator of multi brand residential, commercial and Industrial automation products.

Technologics commenced business trading as a designer and installer of multi brand controls, automation distribution systems, providing a complete range of Custom Installation services and has an extensive experience in the field of complex turn-key solutions development and integration. We propose, design, develop, train, install, integrate, operate and maintain the state of the art IBMS/SCADA and the PLC automation systems and solutions. The services they offer span the full development / integration lifecycle from definition of requirements to field testing of implemented solutions.

Fig 1.1: Company Logo

Technologics State of the Art Laboratory with complete new generation hardware & Industrial Experienced trainers is ultimate combination to provide specially designed certification courses in Industrial automation, Embedded Systems & BMS technology. Their Trainings are custom designed for working professionals, fresh B-Tech, diploma graduates and undergraduate students all over India with accommodation options. Technologics decades of presence in Middle East market & Powerful placement team in India is committed to understand the real time industrial demand, so They dynamically introduce the needed topic to our training index with consent of students to place them in readily available openings in India & Abroad.

1.2 MAJOR MILESTONES:

The organization where they have a right mix of professionals as a stakeholders help to serve the clients with best of capability and with industry standards. They have young, enthusiastic, passionate and creative Professionals to develop technological innovations in the field of Mobile technologies, Web applications as well as Business and Enterprise solution. Motto of the organization is to "Collaborate with the clients to provide them with best Technological solution hence creating Good Present and Better Future for the client which will bring a cascading a positive effect in their business shape as well" Good Present Better Future is not just the tag line, it is the Vision for the Clients and strive hard to achieve it.

1.3 COMPANY MISSION AND VISION:

MISSION is to be an ultimate solution provider with a reputation for expertise, quality, and cost effective in the world of automation and to advocate sustainable environmental protection by maximizing our consolidated effort through unmatchable teamwork.

- Focus on profitability and return on investments over growth.
- Maintain a lean and flexible organization.
- Employ quality assurance in pursuit of service excellence.
- Practice sound financial management.
- Employ effective project management processes.
- Develop strong project management teams and support system

VISION is to provide training and implement services with edge of competitive in quality & price to our valued customers in the ground of sustainability.

Promote reputed multi brand residential, commercial and Industrial automation products. Our focus and growth will be on the technological outsourcing in the field of PLC controls, BMS, HVAC controls and other related sub systems in the Middle East and Indian subcontinent.

1.4 COMPANY DETAILS:

CIN	:	U74999KA2016PTC097654
Company Status	:	Active
RoC	:	RoC Bangalore
Registration Number	:	97654
Company Category	:	Company limited by Shares
Company Sub Category	:	Non-govt company
Class of Company	:	Private
Date of Incorporation	:	08 Nov 2016

1.5 APPROACHES:

- They develop the best talent at every level of our business.
- Provide best services to attract new client, retaining and expanding the relationship with the existing clients.
- Deliver leading quality and innovative services with maximum efficiency.
- Constantly update and adapt latest technology emerging in the control market.
- Managing risk while protecting our business values and brand.
- Thinking long term and act responsibly and strategically.

1.6 COMPANY VALUES:

1.6.1 PEOPLE ORIENTED:

- They offer our people the opportunity to accelerate more rapidly than is possible elsewhere. We will continue to drive the greater dimension length to identify and recruit the very best person for every position.
- They perceive the importance of individual creativity, but we know that a team effort produces the best results.
- The dedication of our people to the company and the intense efforts they give to their work is vital to our continued success.
- Advancement depends solely on ability, performance and contribution to the firm's success with no discrimination of race, color, age, creed, gender or national origin.

1.6.2 CLIENT-ORIENTED:

- They are big enough to solve our client's problems, yet substantial enough to sustain the loyalty, intimacy and culture that we all treasure and which contributes greatly to our success.
- Our client's interest always comes first. Our experience shows that if they treat our clients well, our own success will pursue.
- They always seek aggressively to widen up, our client relationships but they will never put down our competitors in this pursuit.
- Extensive Integrity in everything we do Integrity and honesty are at the heart of our business. They expect our people to maintain high ethical standards in everything they do, both in their work for the company and in their personal lives.
- They regularly receive confidential information as part of our normal client relationships.

1.6.3 EXTENCIVE INTEGRITY IN EVERYTHING TEHY DO:

- Integrity and honesty are at the heart of our business. They expect our people to maintain high ethical standards in everything they do, both in their work for the company and in their personal lives.
- They regularly receive confidential information as part of our normal client relationships. To breach a confidence or to use confidential information improperly or carelessly is unthinkable.
- They protect the company's intellectual property as though it were our own personal property.

1.6.4 INNOVATIVE:

- Their assets are our people, technology, intellectual capital, culture of innovation and reputation. If any of this is ever lost, the last is the most difficult to regain.
- They covet our culture of innovation and as such we stress creativity and imagination in all of our work. They are and will continue to be thought leaders in our chosen industries.
- They take great honor in the professional quality of our work. They have an uncompromising determination to achieve excellence in everything they do. they would rather not pursue opportunities than deliver solutions that do not represent the highest level of quality.

1.6.5 QUALITY POLICY STATEMENTS:

Technologics committed to providing the highest quality of service to its customers, delivering advanced systems, solutions and services that benefit the businesses, the industry and the society.

- To adhere to our quality policy we use the following as our guidelines in daily operation:
- Total commitment towards customer satisfaction through service excellence.
- Strive for quality excellence in offered solutions and products.
- Offer timely and cost-effective solutions.
- Constant up-gradation of skills and technologies.
- Sensitivity to the needs of our customers, associates and society

1.7 ENGGINEERING SERVICES:

1.7.1 MULTIBRAND INTEGRATION:

They have more than 100 plus well trained Industrial Ready to deploy Engineers across India & Middle East to carry out Multi Brand integration of PLC, SCADA, DDC & DCS controllers seamlessly integrated to an open platform for a smooth flow of Alarms, History Trend data's to different processing systems such as ERP.

1.7.2 VIRTUAL OFFICE & REMOTE ENGINEERING:

Technologics decades of international experienced engineering team along with broad cloud portfolio based infrastructure from our Bangalore India & Middle East offices is ready to provide you complete remote engineering solutions with robust data privacy.

1.7.3 DECADES OF INTERNATIONAL PRESENSE:

They operate in 4 countries with extensive experience of project execution in Doha Qatar, Dubai, Saudi Arabia & India in the field of Industrial Automation, Building & Home Automation sector. With this international experience & exposure now Technologics is ready to empower India's youth to global engineering requirement.

1.7.4 REMOTE SERVICES:

Technologics back end engineering team powered by cloud infrastructure will be an office next door to all its worldwide reputed clients to help them keeping their all Assets & MEP equipment's fully serviced & maintained 24/7.

1.7.5 RESEARCH & DEVELOPMENT UNIT:

The central R&D department is an independent division at Technologics. We have access to vastly different technologies, the combination of which can lead to novel products and also business fields. We can take over an entire R&D project for our customers with our team. Inquire with us about it!

1.7.6 ISO 9001:2008 QS SWISS ACCREDITATION:

They choose the best ISO Accreditation program in the world & dedicated in house audit team to reinforce quality system to bring in the optimal level Of service providing capability of PLC SCADA, Embedded System, LabVIEW, Integrated Building management systems(IBMS) & IT Software operations.

1.8 COMPANY CLIENTS:

Technologics - specialized Brands they deal and have expertise.

Technologics decades of international experienced engineering team along with broad cloud portfolio based infrastructure from our Bangalore India & Middle East offices is ready to provide you complete remote engineering solutions with robust data privacy.

Technologics provides the Automation, PLC SCADA, Robotic Process Automation (RPA), Building Management Systems (BMS), Direct Digital Control (DDC) and many such Automation Services to their Clients. Technologics also provides the Human Resources to some of their Clients.

Fig 1.2: COMPANY CLIENTS

CHAPTER 2

EMBEDDED SYSTEM & IOT

2.1 INTERDUCTION TO EMBEDDED SYSTEMS & IOT:

2.1.1 EMBEDDED SYSTEMS:

An embedded system combines mechanical, electrical, and chemical components along with a computer, hidden inside, to perform a single dedicated purpose.

There are more computers on this planet than there are people, and most of these computers are single-chip microcontrollers that are the brains of an embedded system.

Embedded systems are a ubiquitous component of our everyday lives.

We interact with hundreds of tiny computers every day that are embedded into our houses, our cars, our bridges, our toys, and our work.

As our world has become more complex, so have the capabilities of the microcontrollers embedded into our devices.

Therefore, the world needs a trained workforce to develop and manage products based on embedded microcontrollers.

2.1.2 INTERNET OF THINGS

The Internet of Things (IoT), is the network of physical objects or things embedded with electronics, software, sensors, and connectivity to enable objects to exchange data with the production, operator and/or other connected devices.

IoT helps in developing smart real-time industry and domestic applications involving safety, ease of usage, time criticality, entertainment and comfort with the help of Embedded, electronics, software, sensor and communication technologies so it opened up lot of career/entrepreneurial avenues for those who are studying electronics, instrumentation, computer science and IT engineering.

This internship program will introduce me to the world of IoT technologies and equip me to

identify the potential problems and provides a better platform to bring technological solutions. The Internship provides hands-on training to effectively use and customize sensor networks, user interaction modules, data management and device interactions. I understand the essentiality of inter-connected devices through wireless sensor networks and minimize human efforts and I got an overview of application deployment the process involved.

2.2 NodeMCU:

NodeMCU is an open-source firmware and development kit that helps to prototype or build IoT product. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Express if Systems, and hardware which is based on the ESP-12 module. The firmware uses the Lau scripting language

Fig 2.1: NodeMCU

There are two common variations of NodeMCU: v0.9 and v1.0. The highly recommended version is 1.0 as it has more convenient dimensions to work.

The ESP8266 12-E NodeMCU kit pinout diagram is shown below.

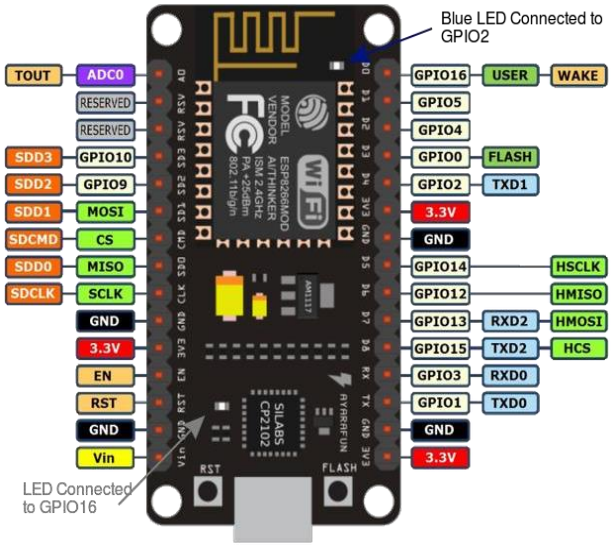


Fig: NodeMCU Pinout

2.2.1 INSTALLING THE ARDUINO IDE FOR Node MCU:

Now, I have completely set up the hardware for the ESP8266, I am ready to configure it using the Arduino IDE

The most basic way to use the ESP8266 module is to use serial commands, as the chip is basically a Wi-Fi/Serial transceiver. However, this is not convenient and this is not what I recommend doing. What I recommend is simply using the Arduino IDE, which i need to install on my computer. This makes it very convenient to use the ESP8266 chip, as I am using the well-known Arduino IDE.

Now am going to configure my ESP8266 chip using the Arduino IDE. This is a great way to use the chip, as I will be able to program it using the well-known Arduino IDE and also re- use several existing Arduino libraries.

If this is not done yet, then I need to install the latest version of the Arduino IDE. I can get it from http://www.arduino.cc/en/main/software. Now, I need to take a follow steps to be able to configure the ESP8266 with the Arduino IDE:

2.2.1.1 Start the Arduino IDE and open the Preferences window.

2.2.1.2 Enter the following URL into the Additional Board Manager URLs field: http://arduino.esp8266.com/stable/package_esp8266com_index.json

2.2.1.3 Open Boards Manager from the Tools | Board menu and install the esp8266 platform as shown here:

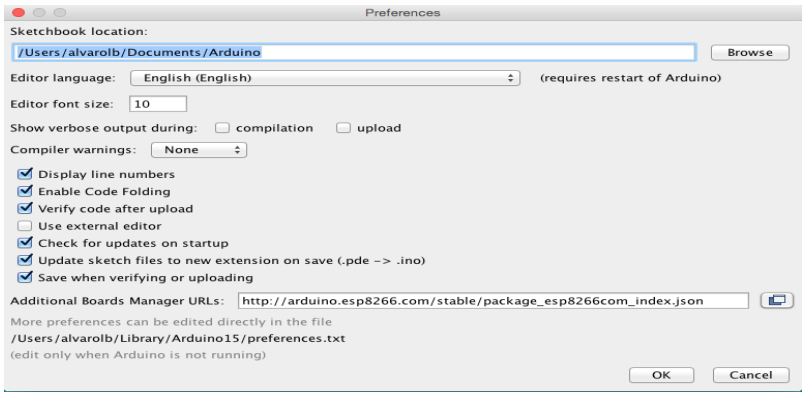


Fig 2.3: INSTALLATION OF ARDUINO IDE

2.2.2 DETAILS ON IDE:

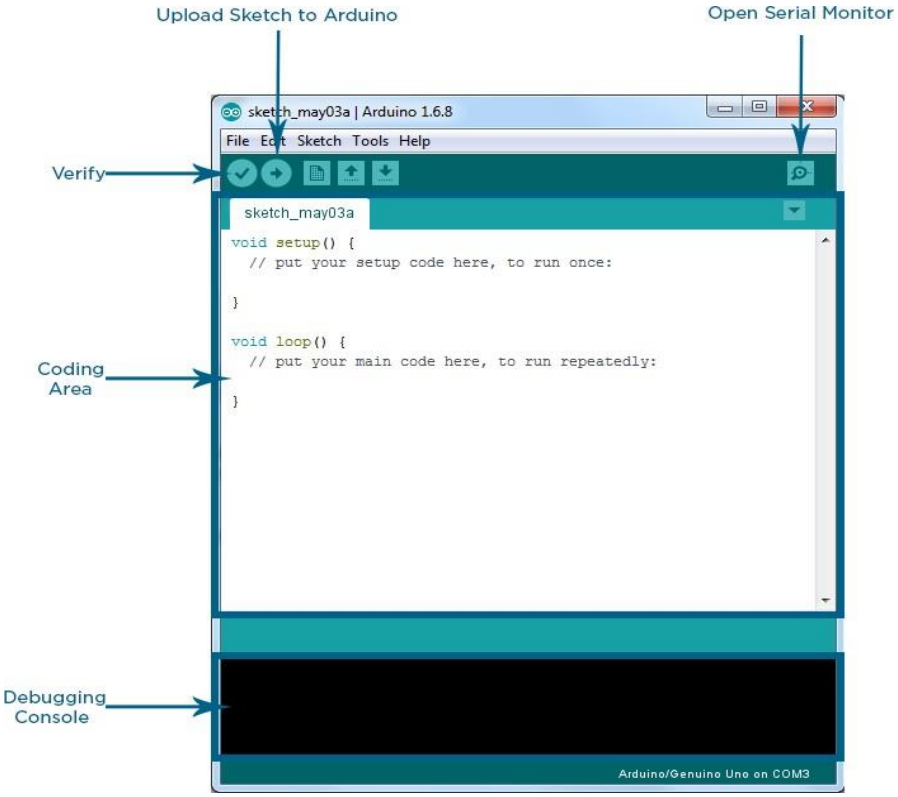


Fig 2.4: ARDUINO IDE

The bar appearing on the top is called **Menu Bar** that comes with five different options as follow:

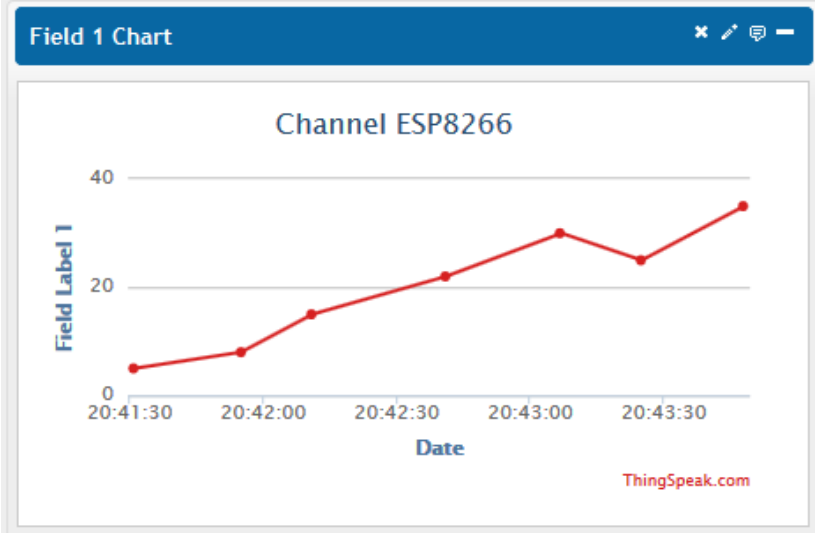
- **File** – I can open a new window for writing the code or open an existing one.
- **Edit** – Used for copying and pasting the code with further modification for font.
- **Sketch** – For compiling and programming.
- **Tools** – Mainly used for testing projects. The Programmer section in this panel is used for burning a bootloader to the new microcontroller.
- **Help** – In case you are feeling skeptical about software, complete help is available from getting started to troubleshooting.

And at the end of compilation, it will show me the hex file it has generated for the recent sketch that will send to the NodeMCU Board for the specific task that I aimed to achieve.

- The check mark appearing in the circular button is used to verify the code.
- The arrow key will upload and transfer the required code to the NodeMCU board.
- The dotted paper is used for creating a new file.
- The upward arrow is reserved for opening an existing project.
- The downward arrow is used to save the current running code.

The button appearing on the top right corner is a Serial Monitor – A separate pop-up window that acts as an independent terminal and plays a vital role for sending and receiving the Serial Data. I can also go to the Tools panel and select Serial Monitor pressing Ctrl+Shift+M all at once will open the Serial Monitor. The Serial Monitor will actually help to debug the written Sketches where I can get a hold of how my program is operating. My NodeMCU Module should be connected to my computer by USB cable in order to activate the Serial Monitor.

I need to select the baud rate of the NodeMCU board that I am using right now. For my board the Baud Rate is 115200.



2.2.3 BLYNK:

Blynk was designed for the Internet of Things. It can control hardware remotely, it can display sensor data, it can store data, visualize it and do many other cool things.

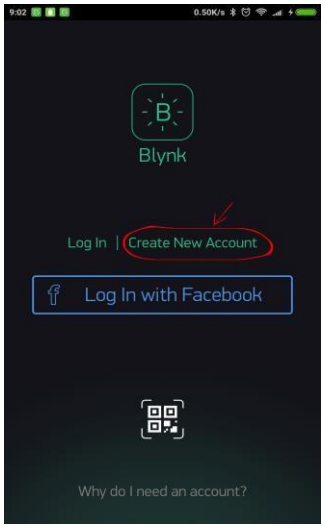
There are three major components in the platform:

- **Blynk App** - allows me to create amazing interfaces for my projects using various widgets that provides.
- **Blynk Server** - responsible for all the communications between the smartphone and hardware. I can use my Blynk Cloud or run my private Blynk server locally. It's open-source, could easily handle thousands of devices and can even be launched on a Raspberry Pi.
- **Blynk Libraries** - for all the popular hardware platforms - enable communication with the server and process all the incoming and outcoming commands.

2.2.4 FEATURES:

- Similar API & UI for all supported hardware & devices
- Connection to the cloud using: WiFi, Bluetooth, USB (Serial), GSM, Ethernet.
- Set of easy-to-use Widgets
- Direct pin manipulation with no code writing
- Easy to integrate and add new functionality using virtual pins
- History data monitoring via Super Chart widget
- Device-to-Device communication using Bridge Widget
- Sending emails, tweets, push notifications, etc.

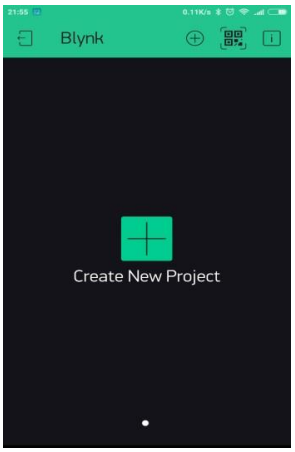
2.2.5 GETTING STARTED WITH BLYNK APP:



CREATE A BLYNK ACCOUNT:

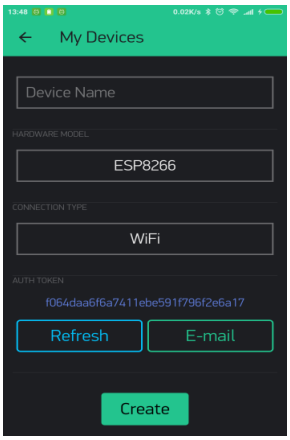
After downloading the Blynk App I need to create a New Blynk account. This account is separate from the accounts used for the Blynk Forums. It is recommend using a real email address because it will simplify things later. An account is needed to save my projects and have access to them from multiple devices from anywhere. It's also a security measure.

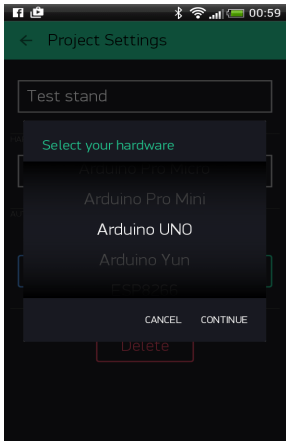
CREATIN A NEW PROJECT:



After I've successfully logged into my account,
I start by creating a new project.

CHOOSING MY HARDWARE:



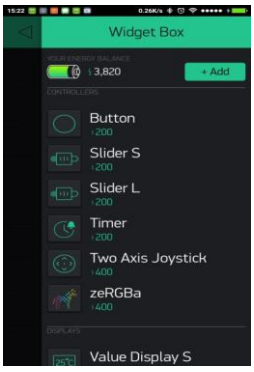


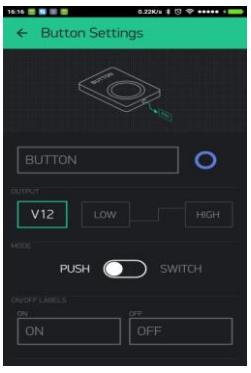
electing the hardware model that I am using.
Then I created my project by selecting my hardware that what am going to use in my project.

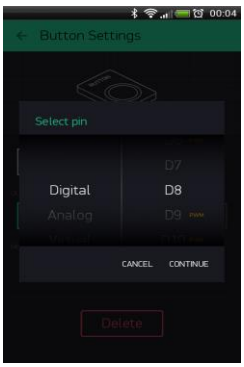
AUTHORIZATION TOKEN:

Authorization Token is a unique identifier which is needed to connect my hardware to my Smartphone. Every new project I have to create which will have its own Authorization Token. I'll get Authorization Token automatically on my email after project creation. I can also copy it manually. Click on devices section and selected required device.

ADDING WIDGETS:





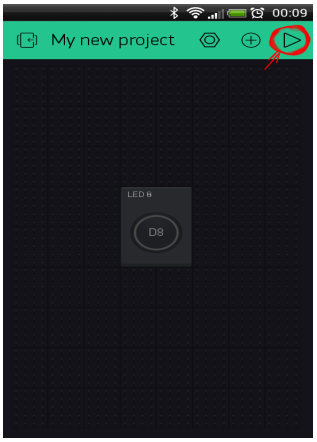


- **Drag-n-Drop** - Tap and hold the Widget to drag it to the new position.
- **Widget Settings** - Each Widget has its own settings. Tap on the widget to get to them.

The most important parameter to set is PIN. The list of pins reflects physical pins defined by my hardware. If my LED is connected to Digital Pin 8 - then I have to select D8 (D - stands for Digital).

RUNNING THE PROJECT:

When I have done with the Settings - press the **PLAY** button. This will switch me from EDIT mode to PLAY mode where I can interact with the hardware. While in PLAY mode, I won't be able to drag or set up new widgets, press **STOP** and get back to EDIT mode.



2.3 RASPBERRY PI:

The Raspberry Pi is a series of small single-board computers developed in the United Kingdom by the Raspberry Pi Foundation to promote teaching of basic computer science in schools and in developing countries. The original model became far more popular than anticipated selling outside its target market for uses such as robotics. It does not include peripherals (such as keyboards and mice) and cases. However, some accessories have been included in several official and unofficial bundles.

The organization behind the Raspberry Pi consists of two arms. The first two models were developed by the Raspberry Pi Foundation. After the Pi Model B was released, the Foundation set up Raspberry Pi Trading, with Eben Upton as CEO, to develop the third model, the B+. Raspberry Pi Trading is responsible for developing the technology while the Foundation is an educational charity to promote the teaching of basic computer science in schools and in developing countries.

According to the Raspberry Pi Foundation, more than 5 million Raspberry Pis were sold by February 2015, making it the best-selling British computer. By November 2016 they had sold 11 million units, and 12.5m by March 2017, making it the third best-selling general-purpose computer. In July 2017, sales reached nearly 15 million. In March 2018, sales reached 19 million.

Fig 2.3: Raspberry Pi

2.3.1 PYTHON:

Python is an interpreted high-level programming language for general-purpose programming. Created by Guido van Rossum and first released in 1991, Python has a design philosophy that emphasizes code readability, notably using significant whitespace. It provides constructs that enable clear programming on both small and large scales. In July 2018, Van Rossum stepped down as the leader in the language community after 30 years.

Python features a dynamic type system and automatic memory management. It supports multiple programming paradigms, including object-oriented, imperative, functional and procedural, and has a large and comprehensive standard library.

Python interpreters are available for many operating systems. CPython, the reference implementation of Python, is open source software and has a community-based development model, as do nearly all of Pythons other implementations. Python and CPython are managed by the non-profit Python Software Foundation.

Python uses dynamic typing, and a combination of reference counting and a cycle detecting garbage collector for memory management. It also features dynamic name resolution (late binding), which binds method and variable names during program execution.

2.3.2 RASPBIAN OS:

The Raspberry Pi operates in the open source ecosystem: it runs Linux (a variety of distributions), and its main supported operating system, Raspbian, is open source and runs a suite of open source software. The Raspberry Pi Foundation contributes to the Linux kernel and various other open source projects as well as releasing much of its own software as open source. Some people buy a Raspberry Pi to learn to code, and people who can already code use the Pi to learn to code electronics for physical projects. The Raspberry Pi can open opportunities for you to create your own home automation projects, which is popular among people in the open source community because it puts you in control, rather than using a proprietary closed system.

2.4 SENSORS & ACTUATORS:

2.4.1 IR SENSOR:

IR stands for Infrared. Infrared radiation was discovered by William Herschel. These waves are not visible to human eye. In the electromagnetic spectrum, infrared radiation can be found between the visible and microwave section. Infrared radiations typically have wavelength between 0.75 and 1000 µm. They are further classified on the basis of the range

I.e. 0.75 to 3 µm is known as near infrared radiation and region between 3 and 6 µm is mid-infrared radiation. Moreover, this wave proves to be useful to detect a nearby object. Some benefits of using IR sensors are low power requirements, simple circuitry and their portable features.

Fig 2.4: IR Sensor

2.4.2 ULTRASONIC SENSORS:

Ultrasonic sensors emit short, high-frequency sound pulses at regular intervals. These propagate in the air at the velocity of sound. If they strike an object, then they are reflected back as echo signals to the sensor, which itself computes the distance to the target based on the time-span between emitting the signal and receiving the echo. Fig 2.6 shows Ultrasonic sensor.

fig 2.5: Ultrasonic Sensor

2.4.3 LDR SENSOR:

A Light Dependent Resistor (LDR) is also called a photo resistor or a cadmium sulfide (CdS) cell. It is also called a photoconductor. It is basically a photocell that works on the principle of photoconductivity. The passive component is basically a resistor whose resistance value decreases when the intensity of light decreases. This optoelectronic device is mostly used in light varying sensor circuit, and light and dark activated switching circuits. Some of its applications include camera light meters, street lights, clock radios, light beam alarms, reflective smoke alarms, and outdoor clocks.

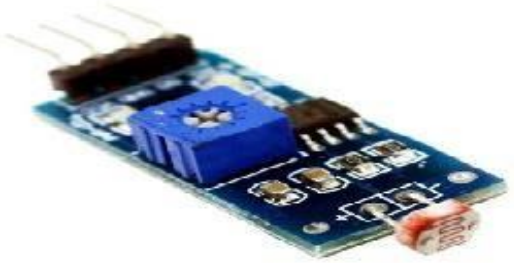


Fig 2.6: LDR Sensor

2.4.4 PIR SENSOR:

A passive infrared sensor is an electronic sensor that measures infrared light radiating from objects in its field of view. PIR Sensor is short for passive infrared sensor, which applies for projects that need to detect human or particle movement in a certain range, and it can also be referred as PIR (motion) sensor, or IR sensor. Since its powerful function and low-cost

advantages, it has been adopted in tons of projects and widely accepted by the open- source hardware community for projects related to Arduino and raspberry pi. All this can help the beginners learn about PIR sensor more easily.

Fig 2.7: PIR sensor

2.4.5 DC MOTOR:

A DC motor is an electric motor that runs on direct current power. In any electric motor, operation is dependent upon simple electromagnetism. A current carrying conductor generates a magnetic field, when this is then placed in an external magnetic field, it will encounter a force proportional to the current in the conductor and to the strength of the external magnetic field. It is a device which converts electrical energy to mechanical energy. It works on the fact that a current carrying conductor placed in a magnetic field experiences a force which causes it to rotate with respect to its original position.

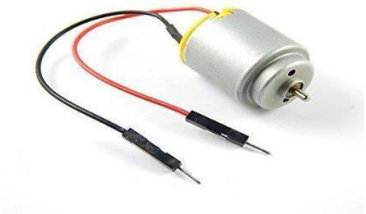


Fig 2.8: DC Motor

2.4.6 SERVO MOTOR:

A servo motor is an electrical device which can push or rotate an object with great precision. If you want to rotate and object at some specific angles or distance, then you use servo motor. It is just made up of simple motor which run through servo mechanism. If motor is used is DC powered then it is called DC servo motor, and if it is AC powered motor then it is called AC servo motor. We can get a very high torque servo motor in a small and light weight packages. Due to these features they are being used in many applications like toy car, RC helicopters and planes, Robotics, Machine etc.

Fig 2.9: Servo motor

2.4.7 LCD DISPLAY:

A liquid crystal display or LCD draws its definition from its name itself. It is combination of two states of matter, the solid and the liquid. The MCU can either read or write to this interface IC. Most of the times we will be just writing to the IC, since reading will make it more complex and such scenarios are very rare. Information like position of cursor, status completion interrupts etc. can be read if required.

Fig 2.10: LCD Display

2.4.8 BUZZER:

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.

Fig 2.11: Buzzer

2.4.9 DTH11 SENSOR:

The DHT11 is a basic, ultra-low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin (no analog input pins needed). It's fairly simple to use, but requires careful timing to grab data. This sensor can be easily interfaced with any micro-controller such as Arduino, Raspberry Pi etc., to measure humidity and temperature instantaneously.

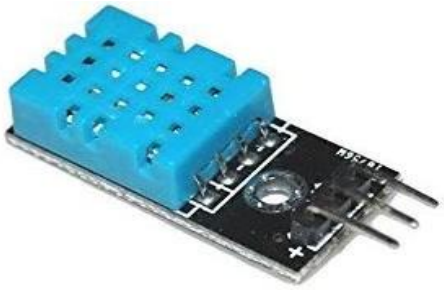


Fig 2.12: DTH11 Sensor

CHAPTER 3

TASK PERFORMED

IOT BASED SMART IRRIGATION SYSTEM:

Most of the farmers use large portions of farming land and it becomes very difficult to reach and track each corner of large lands. Sometime there is a possibility of uneven water sprinkles. This result in the bad quality crops which further leads to financial losses. In this scenario the Smart Irrigation System using Latest IoT technology is helpful and leads to ease of farming. The Smart Irrigation System has wide scope to automate the complete irrigation system. Here we are building a IoT based Irrigation System using ESP8266 NodeMCU Module and DHT11 Sensor. It will not only automatically irrigate the water based on the moisture level in the soil but also send the Data to Thing Speak Server to keep track of the land condition. The System will consist a water pump which will be used to sprinkle water on the land depending upon the land environmental condition such as Moisture, Temperature and Humidity.

3.1 SOFTWARE USED:

ARDUINO IDE:

The Arduino Integrated Development Environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in the programming language Java. It is used to write and upload programs to Arduino compatible boards. The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to NodeMCU hardware to upload programs and communicate with them.

3.2 CIRCUIT DIAGRAM:

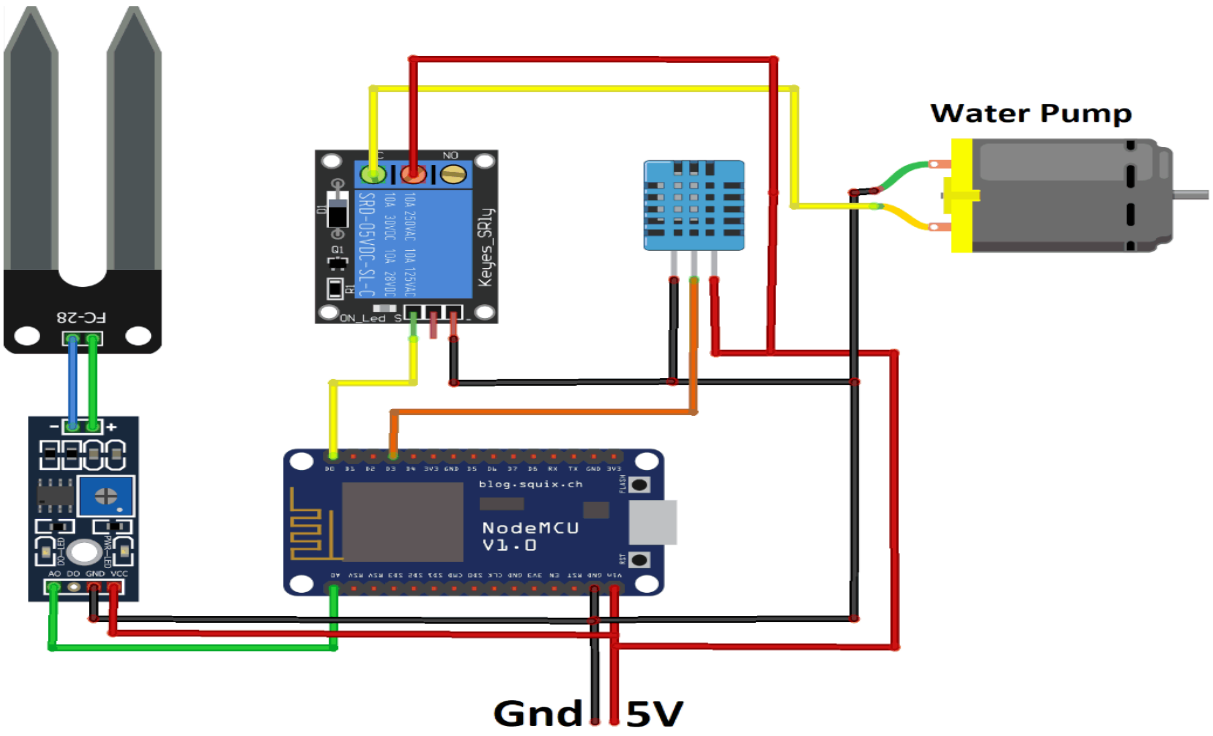


Fig 3.1 Circuit Diagram

3.3 HARDWARE COMPONENTS IN CIRCUIT;

3.3.1 NodeMCU ESP8266:

NodeMCU is an open source firmware for which open source prototyping board designs are available. The name "NodeMCU" combines "node" and "MCU" (micro-controller unit). The term "NodeMCU" strictly speaking refers to the firmware rather than the associated development kits. Both the firmware and prototyping board designs are open source.

The firmware uses the Lua scripting language. The firmware is based on the e Lua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open source projects, such as lua-cjson and SPIFFS. Due to resource constraints, users need to select the modules relevant for their project and build a firmware tailored to their needs. Support for the 32-bit ESP32 has also been implemented.

3.3.2 Soil Moisture Sensor Module:

Soil moisture sensors measure the volumetric water content in soil. Since the direct gravimetric measurement of free soil moisture requires removing, drying, and weighing of a sample, soil moisture sensors measure the volumetric water content indirectly by using some other property of the soil, such as electrical resistance, dielectric constant, or interaction with neutrons, as a proxy for the moisture content.

The relation between the measured property and soil moisture must be calibrated and may vary depending on environmental factors such as soil type, temperature, or electric conductivity. Reflected microwave radiation is affected by the soil moisture and is used for remote sensing in hydrology and agriculture. Portable probe instruments can be used by farmers or gardeners

3.3.3 Water Pump Module:

The pumping of water is a basic and practical technique, far more practical than scooping it up with one's hands or lifting it in a hand-held bucket. This is true whether the water is drawn from a fresh source, moved to a needed location, purified, or used for irrigation, washing, or sewage treatment, or for evacuating water from an undesirable location. Regardless of the outcome, the energy required to pump water is an extremely demanding component of water consumption. All other processes depend or benefit either from water descending from a higher elevation or some pressurized plumbing system.

3.3.4 Relay Module:

A relay is an electrically operated switch. It consists of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals. The switch may have any number of contacts in multiple contact forms, such as make contacts, break contacts, or combinations thereof.

3.3.5 DTH11:

The DHT11 is a basic, ultra-low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin (no analog input pins needed). It's fairly simple to use, but requires careful timing to grab data. This sensor can be easily interfaced with any micro-controller such as Arduino, Raspberry Pi etc., to measure humidity and temperature instantaneously.

3.4 CODE:

```
#include <DHT.h>
#include <ESP8266WiFi.h>
String apiKey = "X5AQ3EGIKMBYW31H";
const char* server = "api.thingspeak.com";
const char *ssid =  "CircuitLoop";
const char *pass =  "circuitdigest101";
#define DHTPIN D3
DHT dht(DHTPIN, DHT11);
WiFiClient client;

const int moisturePin = A0;
const int motorPin = D0;
unsigned long interval = 10000;
unsigned long previousMillis = 0;
unsigned long interval1 = 1000;
unsigned long previousMillis1 = 0;
float moisturePercentage;
float h;
float t;

void setup()
{
```

```
  Serial.begin(115200);
  delay(10);
  pinMode(motorPin, OUTPUT);
  digitalWrite(motorPin, LOW);
  dht.begin();
  Serial.println("Connecting to ");
  Serial.println(ssid);
  WiFi.begin(ssid, pass);
  while (WiFi.status() != WL_CONNECTED)
  {
    delay(500);
    Serial.print(".");
  }
  Serial.println("");
  Serial.println("WiFi connected");
}

void loop()
{
  unsigned long currentMillis = millis();

  h = dht.readHumidity();
  t = dht.readTemperature();

  if (isnan(h) || isnan(t))
  {
    Serial.println("Failed to read from DHT sensor!");
    return;
  }

  moisturePercentage = ( 100.00 - ( (analogRead(moisturePin) / 1023.00) * 100.00 ) );

  if ((unsigned long)(currentMillis - previousMillis1) >= interval1) {
    Serial.print("Soil Moisture is  = ");
```

```
    Serial.print(moisturePercentage);
    Serial.println("%");
    previousMillis1 = millis();
  }

if (moisturePercentage < 50) {
  digitalWrite(motorPin, HIGH);
}
if (moisturePercentage > 50 && moisturePercentage < 55) {
  digitalWrite(motorPin, HIGH);
}
if (moisturePercentage > 56) {
  digitalWrite(motorPin, LOW);
}

if ((unsigned long)(currentMillis - previousMillis) >= interval) {

  sendThingspeak();
  previousMillis = millis();
  client.stop();
}

}

void sendThingspeak() {
  if (client.connect(server, 80))
  {
    String postStr = apiKey;
    postStr += "&field1=";
    postStr += String(moisturePercentage);
    postStr += "&field2=";
    postStr += String(t);
    postStr += "&field3=";
```

```
    postStr += String(h);
    postStr += "\r\n\r\n";

    client.print("POST /update HTTP/1.1\n");
    client.print("Host: api.thingspeak.com\n");
    client.print("Connection: close\n");
    client.print("X-THINGSPEAKAPIKEY: " + apiKey + "\n");
    client.print("Content-Type: application/x-www-form-urlencoded\n");
    client.print("Content-Length: ");
    client.print(postStr.length());
    client.print("\n\n");
    client.print(postStr);
    Serial.print("Moisture Percentage: ");
    Serial.print(moisturePercentage);
    Serial.print("%. Temperature: ");
    Serial.print(t);
    Serial.print(" C, Humidity: ");
    Serial.print(h);
    Serial.println("%. Sent to Thingspeak.");
  }
}
```

3.5 RESULTS & DISCUSSIONS

The Objective of the project was to implement the modern technologies in required fields like agriculture. Usage of IoT concept makes the whole process of cropping easy. Here some level of automation is achieved in terms irrigating automatically. The advantages as mentioned like water-saving and laborsaving are required the most in current agricultural scenario. hence it is proved using the sensor networks again making smart irrigation. The data from IoT is sent to the client using Cloud. Thus, any variations in the crop can be identified easily and early diagnosis is done as such. The data is in graphical form so we can easily monitor

Fig 3.2: Temperature Measure

Fig 3.3: Humidity Measure

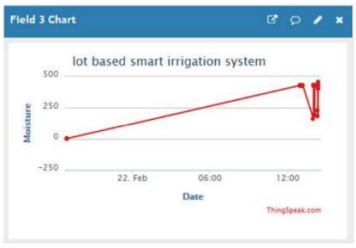


Fig 3.4: Moisture Measure

The above figures show the temperature, humidity & moisture measures according to time.

3.6 CONCLUSIONS:

The paper proposes an idea of combining the latest technology into the agricultural field to turn the traditional methods of irrigation to modern methods thus making easy productive and economical cropping. Some extent of automation is introduced enabling the concept of monitoring the field and the crop conditions within some long-distance ranges using cloud services. The advantages like water saving and labor-saving are initiated using sensors that work automatically as they are programmed. This concept of modernization of agriculture is simple, affordable and operable. Thus, the paper proposes an idea of combining the latest technology into the agricultural field to turn the traditional methods of irrigation to modern methods thus making easy productive, and economical cropping. Some extent of automation is introduced enabling the concept of monitoring the field and the crop conditions within some long-distance ranges using cloud services. The advantages like water saving and labor-saving are initiated using sensors that work automatically as they are programmed. This concept of modernization of agriculture is simple, affordable and operable.

3.7 FUTURE WORK:

Large potential of our Indian agriculture is yet untapped and we still have miles to travel in this arena of research as we have different soil textures in different regions of our state. Farmers can be benefitted by the actual implementation of this projected program. Real challenges that were faced and that are yet to be overcome in reality are the inter-networking of the nodes in an agricultural field and in designing a user friendly application that is easily understandable for the farmers.

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