SMART FARMER- IOT ENABLED SMART FARMING APPLICATIONS

A PROJECT REPORT

Submitted by

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BONAFIDE CERTIFICATE

Certified that this report titled **"SMART FARMER – IOT ENABLED SMART FARMING APPLICATIONS "** is the bona fide work of " **K.VANASUNDARI (952319106035), J.MANISHA (952319106018), M.SUBA (952319106034), I.ESAI MALATHI (952319106008), I.ARTHI (952319106002), "** Who carried out the project work under my supervision**.**

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ABSTRACT

Agriculture sector in India contributes 16% of GDP and 10% of export earnings. Agriculture sector dominates the Indian economy along with industries and services sector, which determines the growth and sustainability. About 65 per cent of the population relies on agriculture for employment and livelihood.

Application of science and technology in agriculture is being practiced in several parts of the country.

This project aims at making smart agriculture using IOT technologies. It includes IOT (Internet of Thing) based system to controlled and monitored soil moisture sensing, and DHT 11 humidity and temperature sensor is measure the environmental condition. Attempts have been made to use IOT in improving agricultural yield, monitoring environmental conditions like soil moisture, automated irrigation monitoring the growth of the crop etc.

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INTRODUCTION

OVERVIEW

Agriculture is the primary occupation in our country for ages. But now due to migration of people from rural to urban there is hindrance in agriculture. There are many techniques available for the precision agriculture to monitor and control, environment for the growth of many crops. Due to unequal distribution of rain water, it is very difficult to satisfy the requirement needed by farmer to manage the water equally to all the crops in whole farm so it requires some irrigation method that suitable for any weather condition, soil types and variety

of crops. So to overcome this problem we go for smart agriculture techniques using IOT. Agriculture is the major source of income for the largest population in India and is major contributor to Indian economy.

However, technological involvement and its usability have to be grown still and cultivated for agro sector in India. Although few initiatives have also been taken by the Indian Government for providing online and mobile messaging services to farmers related to agricultural queries and agro vendor's information to farmers. Based on the survey it is observed that agriculture contributes 27% to GDP, and Provides employment to 70% of Indian population. IoT is changing the agriculture

domain and empowering farmers to fight with the huge difficulties they face. The agriculture must overcome expanding water deficiencies, restricted availability of lands, while meeting the expanding consumption needs of a world population. New innovative IoT applications are addressing these issues and increasing the quality, quantity, sustainability and cost effectiveness of agricultural production. Agriculture is the backbone of Indian Economy. In today's world, as we see rapid growth in global population, agriculture becomes more important to meet the needs of the human race. However, agriculture requires irrigation and with every year we have more water consumption than rainfall, it becomes critical for growers to find ways to conserve water while still achieving the highest yield. But in the present era, the farmers have been using irrigation technique through the manual control in which they irrigate the land at the regular interval. According to statistics, agriculture uses 85 percent of available freshwater resources worldwide, and this percentage will continue to be dominant in water consumption because of population growth and increased food demand. There is an urgent need to create strategies based on science and technology for sustainable use of water, including technical, agronomic, managerial and institutional improvements. Agricultural irrigation based on Internet technology is based on crop water requirement rules. By using Internet technology and sensor network technology we can control water wastage and to maximize the scientific technologies in irrigation methods. Hence it can greatly improve the utilization of water and can increase water productivity. Nowadays water scarcity is a big concern for farming. This project helps the farmers to irrigate the farmland in an efficient manner with automated irrigation system based on soil moisture. The proposed system has been designed to overcome the unnecessary water flow into the agricultural lands. Temperature, moisture and humidity readings are continuously monitored by using temperature, moisture and humidity sensor and send these values to the assigned IP address. Android application continuously collects the data from

that assigned IP address. Once the soil moisture values are exceeded the particular limit then the relay, which is connecte This includes motor status, moisture, temperature and humidity values. The motor status indicates the status of the pump.

PURPOSE

IoT based Smart Farming **improves the entire Agriculture system by monitoring the field in real-time**. With the help of sensors and interconnectivity, the Internet of Things in Agriculture has not only saved the time of the farmers but has also reduced the extravagant use of resources such as Water and Electricity.

LITERATURE SURVEY

1.Title:- A Secure intelligent Drip Irrigation System – Using IoT, Cloud and Mobile Application

Author:-Nandan N1, Dr. K. Thippeswamy

Year:-2018

Water is the major base for the agriculture. Due to lack of rainfall and draining of water resources, we need to save the water for future. This paper mainly stresses on intelligence in water saving using soil moisture sensor, securing crop by using camera and PIR sensor and the system is made to operate using solar power supply as well as AC power (AC to DC adapter) supply to send data continuously even on power cut. Internet of Thing is the concept used to effectively communicate with crop by understanding the requirements of the crops. Measuring and monitoring the soil moisture will help us to save the water and plants get required amount of water for the proper growth. By using this system farmer can keep track of the soil moisture through a Smartphone. Farmer is able to control the water flow through the mobile application, monitor the growth of the crop by taking a picture using camera and system helps the farmer to prevent the intruder (humans and animals) by using PIR sensor provided with speaker and invoke the camera to capture the picture of intruder and send to the user

2.Title:- Automation irrigation using IOT

Author:-pavankumar naik.arun kumbi,krithisree Katti,nagaraj telkar

Year:-2018

India is mainly an agricultural country. Agriculture is the most important occupation for the most of the Indian families. It plays vital role in the development of agricultural country. In India, agriculture contributes about 16 percent of total GDP and 10 percent of total exports. Water is main resource for Agriculture. Irrigation is one method to supply water but in some cases there will be lot of water wastage. So, in this regard to save water and time we have proposed project titled automatic irrigation system using IoT. In this proposed system we are using various sensors like temperature, humidity, soil moisture sensors which senses the various parameters of the soil and based on soil moisture value land gets automatically irrigated by ON/OFF of the motor. These sensed parameters and motor status will be displayed on user android application

3.Title:- Intelligent IoT Based Automated Irrigation System

Author:- Yuthika Shekhar, Ekta Dagur, Sourabh Mishra

Year:-2017

Agriculture has a major impact on economy of the country. Lot of Research been carried out in automating the irrigation system by employing wireless sensor and mobile computing. Also research been done in applying machine learning in agricultural system too Recently “Machine to machine (M2M)” communication is an emerging technology which allows devices, objects etc to communicate among each other and send data to Server or Cloud through the Core Network. So accordingly we here have developed an Intelligent IoT based Automated Irrigation system where sensor data pertaining to soil moisture and temperature captured and

accordingly KNN (K- Nearest Neighbor) classification machine learning algorithm deployed for analyzing the sensor data for prediction towards irrigating the soil with water. This is a fully automated where devices communicate among themselves and apply the intelligence in irrigating. This has been developed using low cost embedded devices like Ardiuno Uno, Raspberry Pi3.

4.Title:-Application Of Internet Of Things In Automated Irrigation System (3 Phase)

Author:- Ashwini R, Kruthi P Bhaska r, K.V Rakshith

Year:-2017

Water system is the strategy for watering to the land or soil. Irrigation will help with developing of agrarian products, keeping up of scenes, and dissemination of soils in dry ranges and in times of less supply of water to the land. The improvement innovation of the farming is water system innovation which is a procedure of Automatic water-sparing method. It is fueled by sun oriented vitality and accomplished control purposes by dampness content observing strategies and the variable water system technology. This paper proposes a microcontroller for programmed control of water system framework. It additionally proposes remote sensor organize which is utilized for continuous detecting and control of a water system framework. It additionally gives uniform and required level of water conveyance for the horticultural homestead and it stays away from wastage of water. The Microcontroller based computerized water system framework comprises of dampness sensors, temperature sensors, water level instrument, rodents recognition, moistness sensors, ph estimation of the compost, simple to advanced converter, microcontroller, hand-off driver, solenoid valve, sun oriented board and a battery. This framework additionally gives a fitting message to the client about the all part exercises in system. The message from the GSM is send to the client through the

android portable. Here we utilize keil programming which is utilized for reenacted the outcome

5.Title:- An IOT Based Automatic Agricultural Monitoring and Irrigation System

Author:- Dr. M.Yuvaraju1 , K. J. Priyanga

Year:-2018

Agriculture is the basic source of food supply for all countries in the world. Water is the Essential resources for agriculture. The automated irrigation and crop field monitoring system is used to optimize the use of water resource for agriculture. The system consists of sensor network for humidity, temperature, soil moisture, colour and water level sensors. soil moisture, temperature, water level,colour sensor are placed in the root zone of the crops. The microcontroller of the controller unit is programmed with threshold values of the temperature and moisture content. The controller unit is used to control the irrigation motor thereby controlling the water flow to the field. In addition to that water level sensor is placed in this field, if it is excess water the motor gets automatically pumps the water into the outer area. Colour sensor provides the appropriate colour of leaf and the user give the pesticide before destroying plants. Field measure data about paddy plants. Raspberry pi is used in the controller mode. Internet of the things(IOT) is an ecosystem of connected physical objects that are accessible through the internet. Real time monitoring data can be utilized and the performance can be tracked. Hence high yield can be achieved. This project is mainly focused on improving the agricultural fields yield by providing a monitoring system with effective and efficient usage of water resource. Thus further development in this project will lead to a greater efficiency in the field of agriculture.

EXISTING PROBLEM

a. In existing system farmer has to work physically to control the drip irrigation system. Traditional instrumentation based on discrete and wired solutions, presents many difficulties on measuring and control systems especially over the large geographical areas.

b. Every time excess of water is given to the fields if conventional irrigation system is used.

Limitations:

- Physical work of farmer to control drip irrigation.
- Wastage of water.
- Wastage of time.

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[2] C. Arun, K. Lakshmi Sudha “Agricultural Management using Wireless Sensor Networks – A Survey”2nd International Conference on Environment Science and Biotechnology IPCBEE vol.48 (2012) © (2012) IACSIT Press, Singapore 2012.

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PROBLEM STATEMENT DEFINITION

1. India is a Global agricultural powerhouse which is considered as the key for Human Progress. Farmers are usually involved in watering the crops at scheduled times which requires numerous human intervention, they involve a high degree of guesswork and can be extremely wasteful. To overcome this, we can use precision farming methodologies. They can make the decision whether to water the crop or postpone it by monitoring the sensor parameters and controlling the motor pumps from the mobile application itself. **Automation of watering crops** reduces human intervention.

2. Who does the problem affect?

If the yield gets lower, it affects

- The farmers who have cultivated the crop
- People who are dependent on the crop for food
- Indian Economy - Crop production is one of the most important sources of the income

3. What are the boundaries of the problem?

• The harvest should be good, so that the profit will get improved

• Want reliable data to water the crops periodically

• Over or under watering of field may lead to destruction of the crop

• Drastic climatic changes

4. What is the issue?

• Wrong decisions would be made by the farmer, if the information displayed in dashboard are incorrect. The data collected from the sensors which present in the field.

5. When does the issue occur? The crop yield will be affected if

• The sensors does not work properly

• Any damage in the hardware devices

• Data sparsity problem

6. Where is the issue occurring?

• If they is any malware in the application

• Internet connection is poor

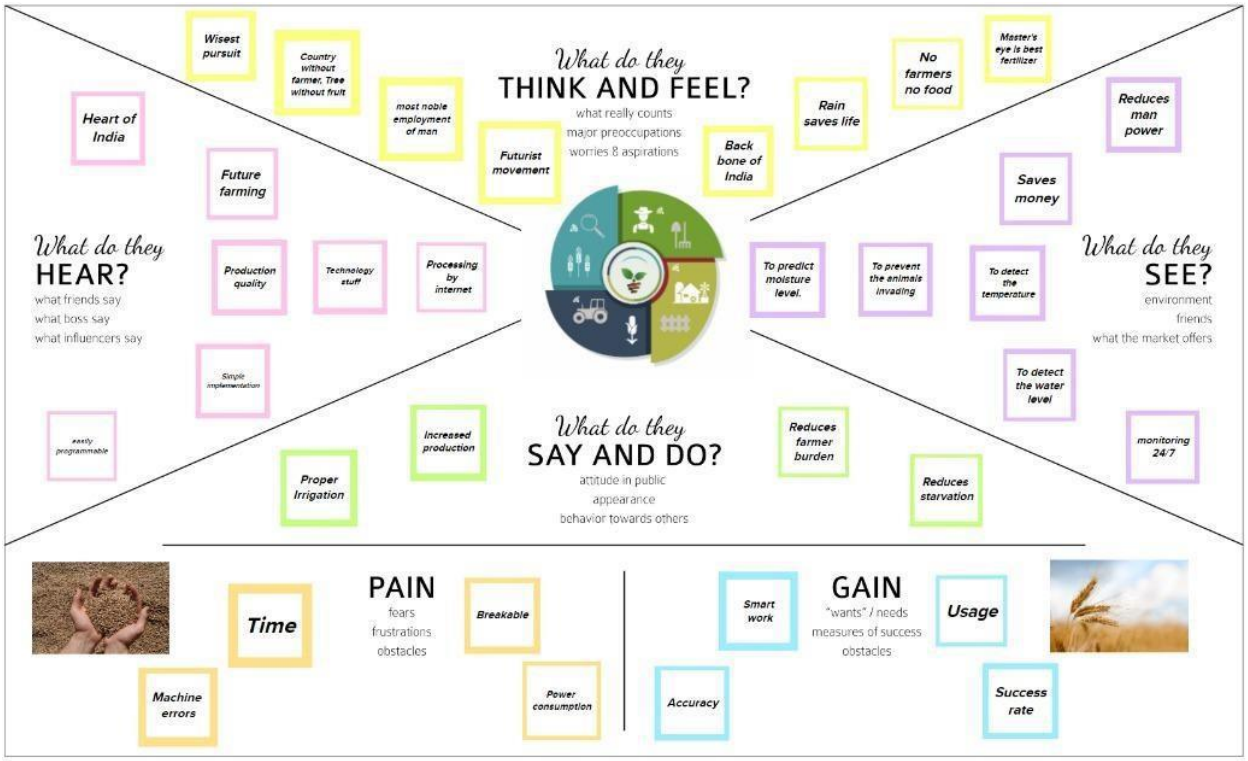
• Any damages in the pipes, motor may lead to leakage

7. Why is it important that we fix the problem?

• Reduces the overflow of water

IDEATION &PROPOSED SOLUTION

EMPATHY MAP CANVAS



3.2 IDEATION $ BRAINSTORMING

Step 1: Team Gathering, Collaboration and Select the Problem Statement

Brainstorm & idea prioritization

Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.

- **10 minutes** to prepare
- **1 hour** to collaborate
- **2-8 people** recommended

Before you collaborate

A little bit of preparation goes a long way with this session. Here's what you need to do to get going.

10 minutes

A **Team gathering**
Define who should participate in the session and se
Invite. Share relevant information or pre-work ahead

B **Set the goal**
Think about the problem you'll be focusing on solvir
the brainstorming session.

C **Learn how to use the facilitation tools**
Use the Facilitation Superpowers to run a happy an
productive session.

Open article →

1 Define your problem statement

What problem are you trying to solve? Frame your problem as a How Might We statement. This will be th
focus of your brainstorm.

5 minutes

PROBLEM

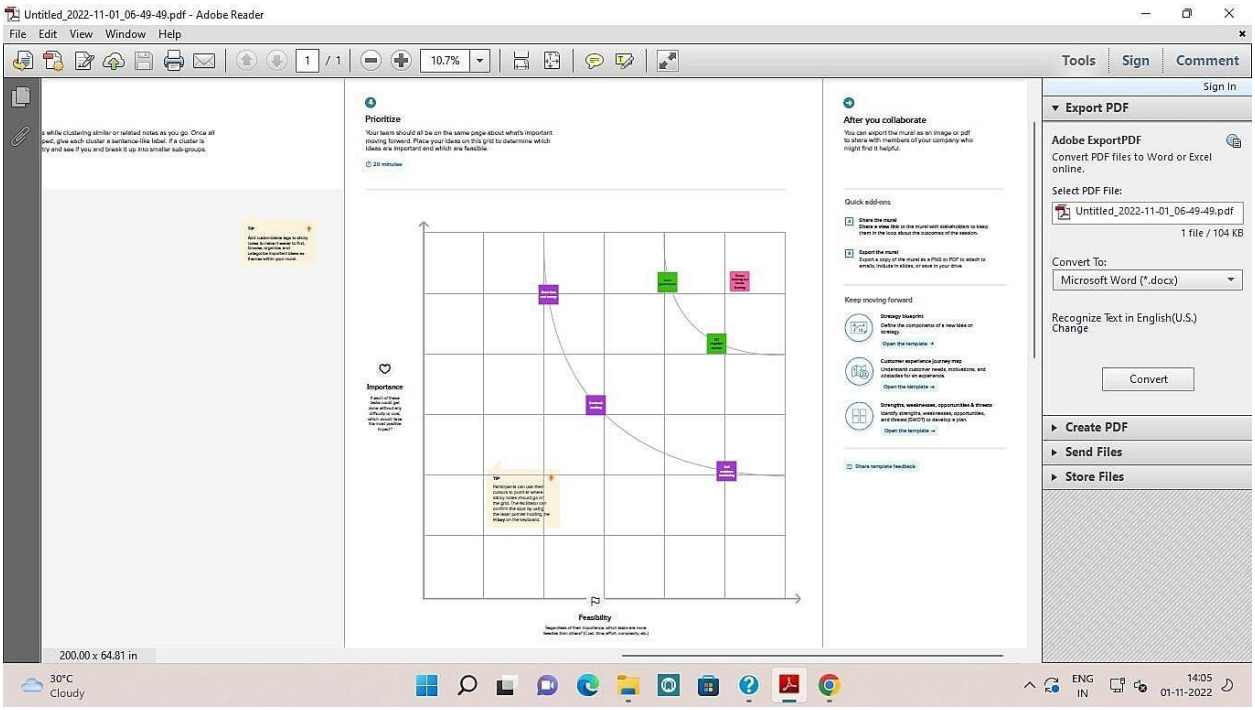
How might we [your problem statement]?

Key rules of brainstorming

To run an smooth and productive session

- Stay in topic.
- Encourage wild ideas.
- Defer judgment.
- Listen to others.
- Go for volume.
- If possible, be visual.

Step 2: Idea Prioritization



Proposed Solution

Problem Statement (Problem to be solved)

a. The water scarcity problem is solved.
b. The animal invading is prohibited.
c. Temperature is maintained.
d. Humidity is checked

Idea / Solution description

1.To Minimize the usage of water of the problem to the solved are

The soil temperature and humidity can be detected ,if there is a deviation from the normal circumstance the water will be sprinkled from sprinkler. When once again it meets the normal circumstances. The sprinkler will stop sprinkling the water

2. Animals Invading

The PIR sensor is used ,in which it detects the motion of the animals or other living beings and it will intimate the farmers by an alarm sound and the minimum electric current is released

3. Temperature

The temperature can be maintained by monitoring. When the temperature is low, heat bulb is used to increase the temperature .When the temperature is high, an outer cover is used to prevent the heat.

4. Humidity

The humidity sensor is used to maintain the moisture content in soil.

Social Impact / Customer Satisfaction

* The cost for implementation is low.
* It saves time and energy.
* The failures of any physical components can be easily replaced.

Business Model (Revenue Model)

Approval from the government.

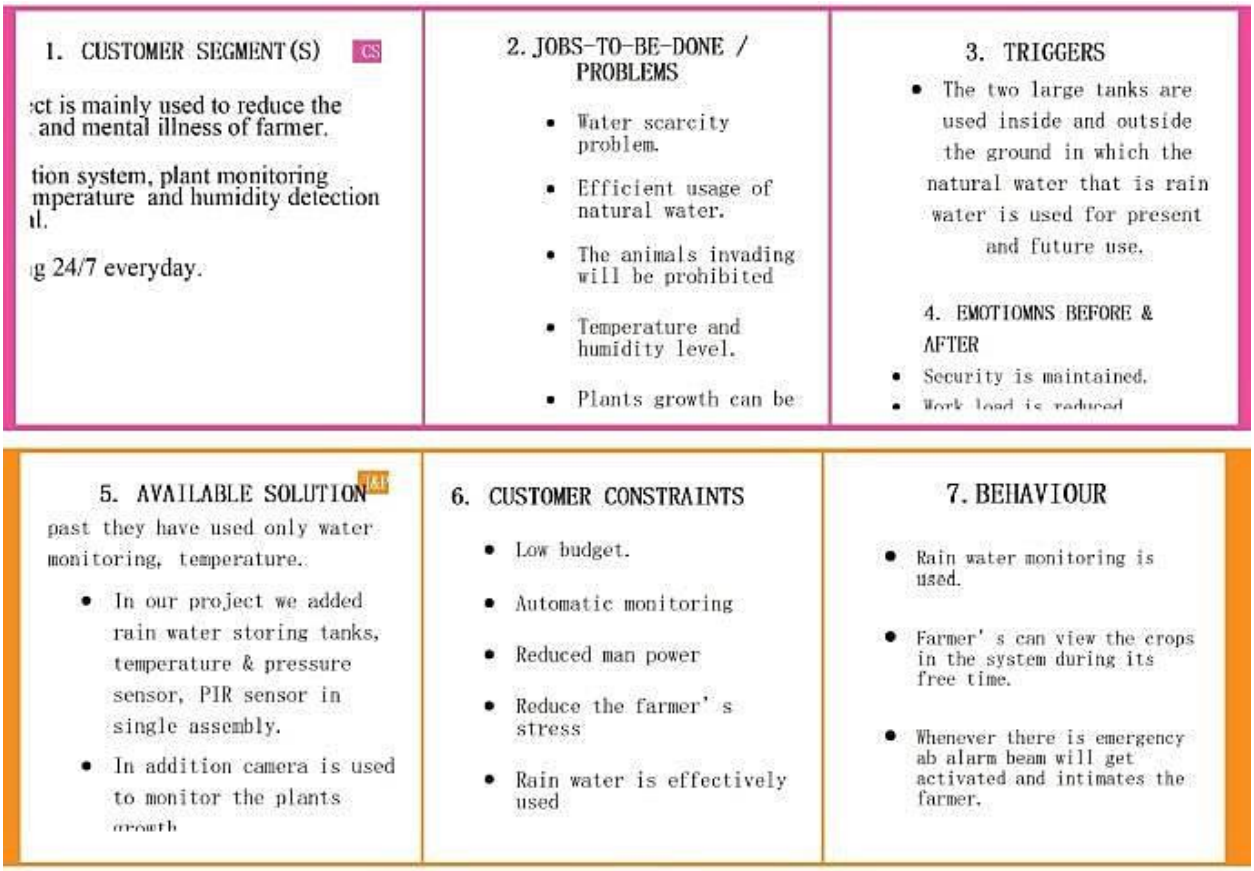
New features

1) Animal invading
2) Water Storage.

Scalability of the Solution

It takes three to four months to finish the project.

PROBLEM SOLUTION



REQUIREMENT ANALYSIS

FUNCTIONAL REQUIREMENT

The functional requirements indicate the functions and services of the present system. They describe the behaviour of the system the needs:

a. Measure Temperature.
b. Measure soil moister.
c. Display the sensor readings on the LCD screen.
d. Calculating the date and time.
e. Irrigating the soil if needed.
f. Turning on the fan if needed

NON FUNCTIONAL REQUIREMENTS

The non-functional requirements for the present system consider the following:

One) Availability: The proposed product can be available and operable successfully all the time.

2) Reliability: The system provides an accurate measurement of data, and it can have a longer lifespan.

3) Maintainability: The present system can be improved easily by integrating new Components with enhanced features.

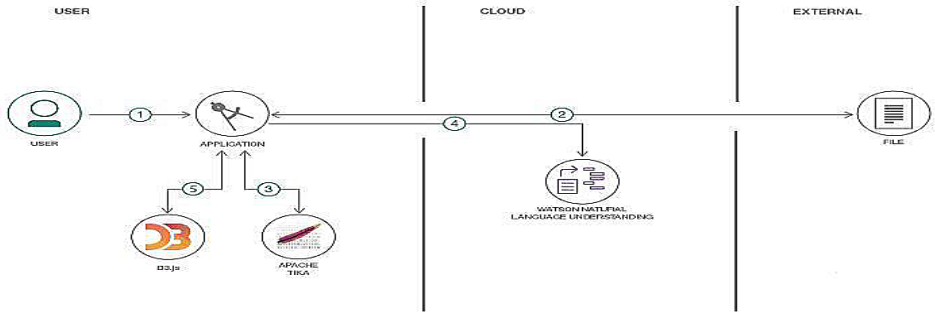
4) Simplicity: The proposed system is user friendly. The usage of this product doesn't require any prior learning.

PROJECT DESIGN

DATA FLOW DIAGRAMS

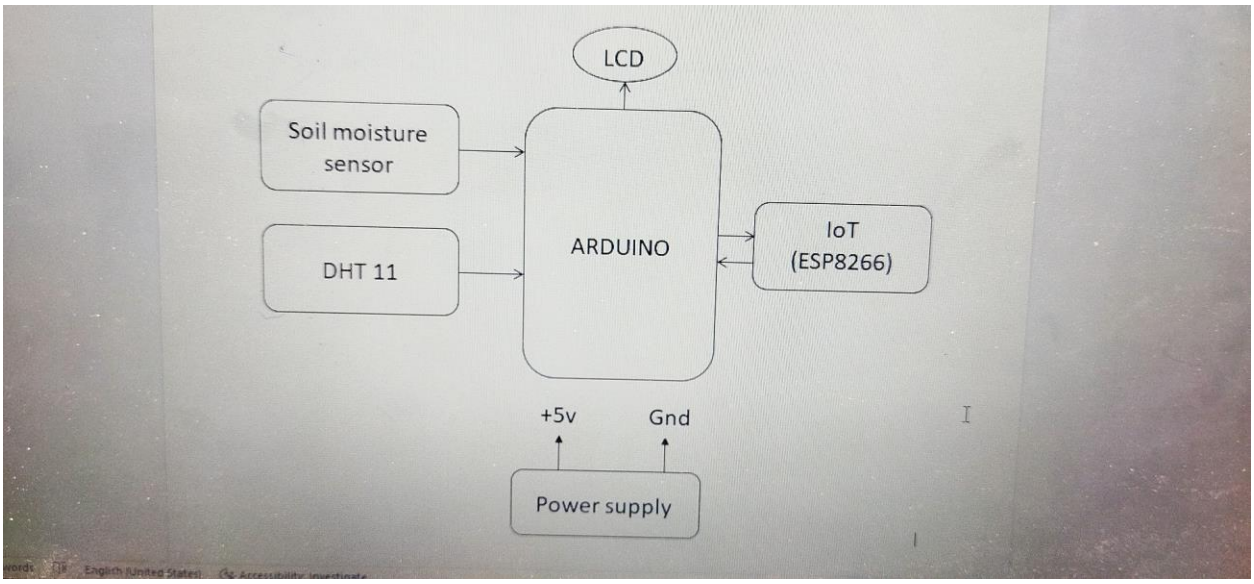
A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters andleaves the system, what changes the information, and where data is stored

Flow



1. User configures credentials for the Watson Natural Language Understanding service and starts the app.
2. User selects data file to process and load.
3. Apache Tika extracts text from the data file.
4. Extracted text is passed to Watson NLU for enrichment.
5. Enriched data is visualized in the UI using the D3.js library.

BLOCK DIAGRAM



BLOCK DISCRIPTION

Power supply is used to convert AC to constant DC voltage. ATMEGA 328 microcontroller, which acts as a processor for the Arduino board. It consists of 28

pins; the inputs can be controlled by transmitting and receiving the inputs to the external device. It also consists of pulse width modulation (PWM). Soil moisture sensors measure the volumetric water content in soil. Soil moisture sensor has two probes through which current passes in soil, then read the resistance of soil for reading moisture level. A humidity sensor senses, measures and reports the relative humidity in the air. It therefore measures both moisture and air temperature. Controller receive the sensor signal a to update the information in webpage through IOT during serial communication of microcontrollers with modem. LCD we use 16*2 LCD . Which use to display the project title message and information message.

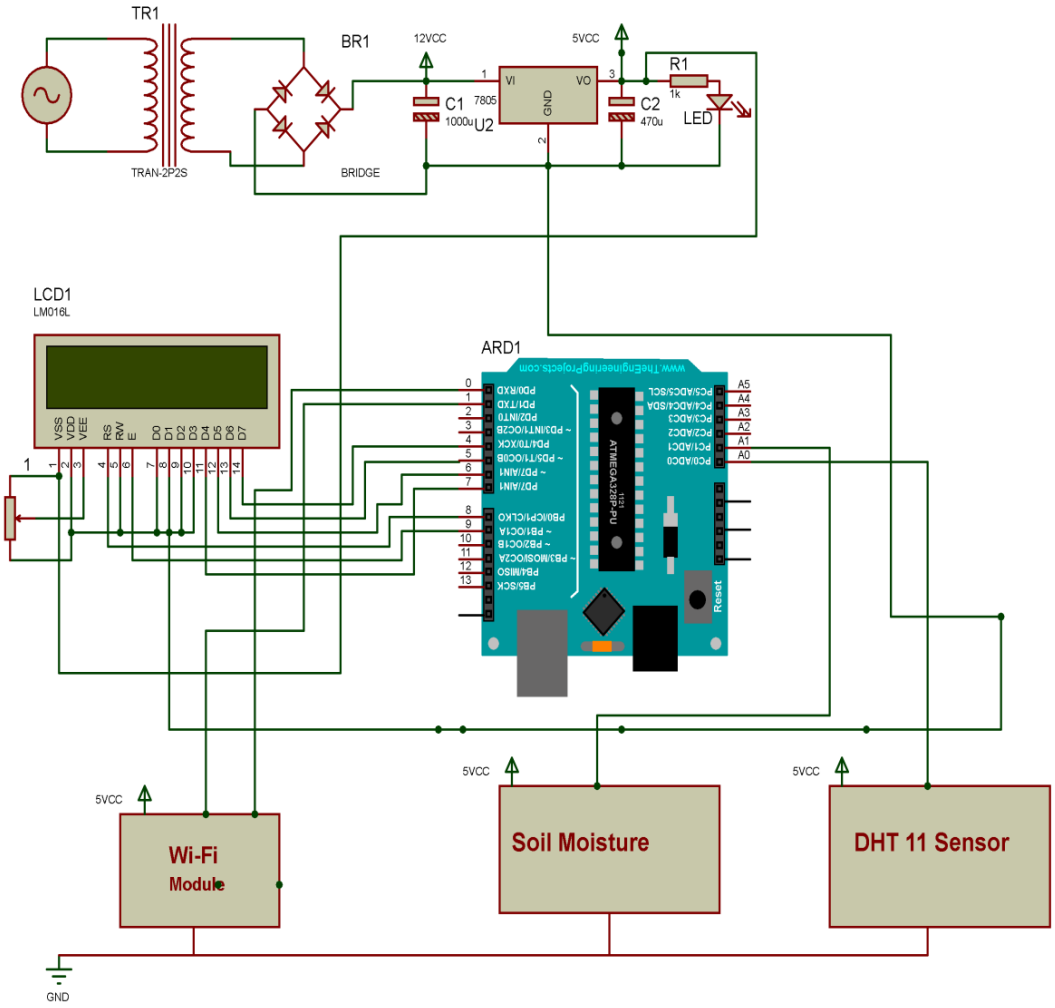
SOLUTION & TECHNICAL ARCHITECTURE

● The different soil parameters temperature, soil moistures and then humidity are sensed using
● Different sensors and obtained value is stored in the IBM cloud. Arduino UNO is used as a processing Unit that process the data obtained from the sensors and whether data from the weather API

● NODE-RED is used as a programming tool to write the hardware, software, and APIs. The MQTT protocol is followed for the communication. All the collected data are provided to the user through a mobile application that was developed using the MIT app inventor.

● The user could decide through an app, weather to water the crop or not depending upon the sensor values. By using the app, they can remotely operate the motor switch.

USER STORIES



CIRCUIT DIAGRAM DESCRIPTION

Power supply gives supply to all components. It is used to convert AC voltage into DC voltage. Transformer used to convert 230V into 12V AC.12V AC is given to diode. Diode range is 1N4007, which is used to convert AC voltage into DC voltage. AC capacitor used to charge AC components and discharge on ground. LM 7805 regulator is used to maintain voltage as constant. Then signal will be given to next capacitor, which is used to filter unwanted AC component. Load will be LED and

resister. LED voltage is 1.75V.Atmega 328 microcontrollers was used. It has 28 pins. Soil moisture sensor is connected with controller port A0.Soil moisture sensors measure the volumetric water content in soil. Soil moisture sensor has two probes through which current passes in soil, then read the resistance of soil for reading moisture level. . A humidity sensor DHT11 senses, measures and reports the relative humidity in the air. It therefore measures both moisture and air temperature. Humidity sensor DHT 11 is connected in port A1 an embedded controller. ESP 8266 is connected with controller port 2 & port 3.Max 232Tx, Rx is connected with IOT modem. LCD interfaced with controller. LCD is used for display the message.

PROJECT PLANNING & SCHEDULINGSPRINT PLANNING&ESTIMATION

S.NO	ACTIVITY TITLE	ACTIVITY DESCRIPTION
1	**Understanding the project**	Assign the team members after that create repository in the GitHub and then assign task to each member and guide them how to access the GitHub while submitting the assignments

2	**Staring The Project**	Team Members to Assign All the Tasks Based on Sprints and Work on It Accordingly.
3	**Completing Every Task**	Team Leader should ensure that whether every team member have completed the assigned task or not
4	**Stand Up Meetings**	Team Lead Must Have a Stand-Up Meeting with The Team and Work on The Updates and Requirement Session
5	**Deadline**	Ensure that team members are completing every task within the deadline
6	**Budget and Scope of project**	Analyze the overall budget which must be within certain limit it should be favorable to every person

SPRINT DELIVERY SCHEDULE

sprint	**Functional Requirement (Epic)**	**User Story Number**	**User Story /Task**	**Story Points**	**Priority**	**Team Member**
Sprint-1	Registration (Farmer Mobile User)	UNS-1	As a user, I can register for the application by entering my email, password,	2	High	Vanasundari . K (Leader)

			and confirming my password.			
Sprint-1	Login	UNS-2	As a user, I will receive confirmation email once I have registered for the application	1	High	Manisha..J (Member 1)
Sprint-2	User Interface	UNS-3	As a user, I can register for the application through Facebook	3	Low	Suba.M (Member 2)
Sprint-1	Data Visualization	UNS-4	As a user, I can register for the application through GMAIL	2	Medium	Esai malathi .I (Member 3)
Sprint-3	Registration (Farmer -Web User)	USN - 1	As a user, I can log into the application by entering email and password	3	High	Arthi I (Member 4)
Sprint - 2	Login	USN - 2	As a registered user, I need to easily login log into my registered account via the web page in minimum time	3	High	Manisha.J (Member 1)

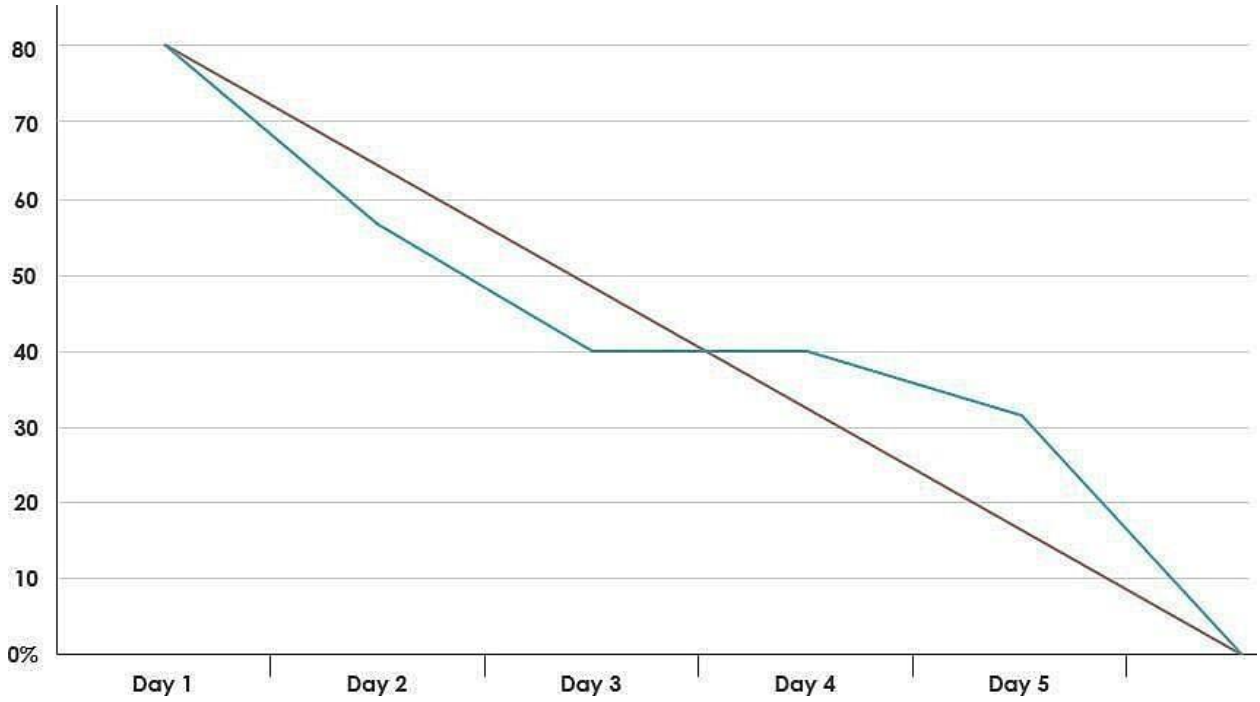
Sprint - 4	Web UI	USN - 3	As a user, I need to have a friendly user interface to view easily and access the resources	3	Medium	Suba.M (Member2)
Sprint - 1	Registration (Chemical Manufacturer - Web user)	USN - 1	As a new user, I want to first register using my organization email and create a password for the account.	2	High	Esai malathi.I (Member 3)
Sprint - 4	Login	USN - 2	As a registered user, I need to easily log in using the registered account via the web page.	3	High	Vanasundari.K (Leader)
Sprint - 3	Web UI	USN - 3	As a user, I need to have a user-friendly interface to view easily and access the resources.	3	Medium	Arthi.I (Member 4)
Sprint - 1	Registration (Chemical Manufacturer - Mobile User)	USN - 1	As a user, I want to first register using my email and create a password for the account.	1	High	Suba.M (Member 2)

Sprint - 1	Login	USN - 2	As a registered user, I need to log in to the application.	2	Low	Esai malathi.I (Member 3)

Velocity:

AV for sprint 1= Sprint Duration /velocity =12/6=2 AV for sprint 2= Sprint Duration/Velocity=6/6=1 AV for Sprint 3=Sprint Duration/Velocity=6/6=1 AV for Sprint 4=Sprint Duration/Velocity=6/6=1

BURNDOWN CHART



HARDWARE DETAILS

SOIL MOISTURE SENSOR

Soil moisture sensors measure the volumetric water content in soil. Since the direct gravimetric measurement of free soil moisture requires removing, drying, and weighting 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.

Soil moisture sensors typically refer to sensors that estimate volumetric water content. Another class of sensors measure another property of moisture in soils called water potential; these sensors are usually referred to as soil water potential sensors and include tension meters and gypsum blocks.

Water is needed for the fundamental growth of plants. When enough water is not present at the time of plant needs, then eventually the plant can prompt lessened quality or demise. Since it is very hectic for human to look after plants all the time, engineers designed soil moisture sensors to lessen the burden. Now using the sensor system designer can build any types of system that can look after the water needs of plant.

Sensor description:

This DF Robot soil moisture sensor has two probes through which current passes in soil, then read the resistance of soil for reading moisture level. We know that water make the soil more prone to electric conductivity resulting less resistance in soil where on the other hand dry soil has poor electrical conductivity thus more resistance in soil. Using these properties of electricity the sensor is designed. Inside the sensor there are circuitry for measuring the resistance and converting it into voltage as output

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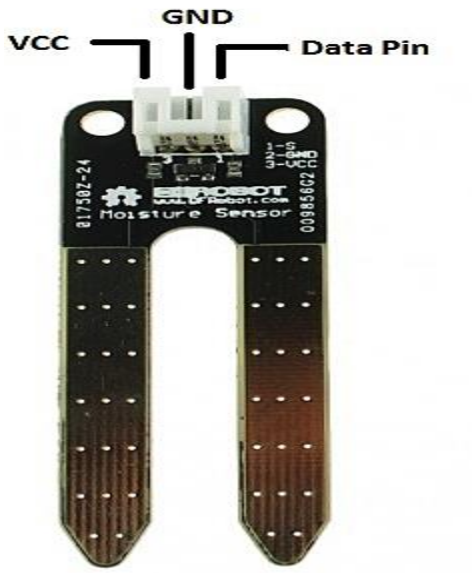
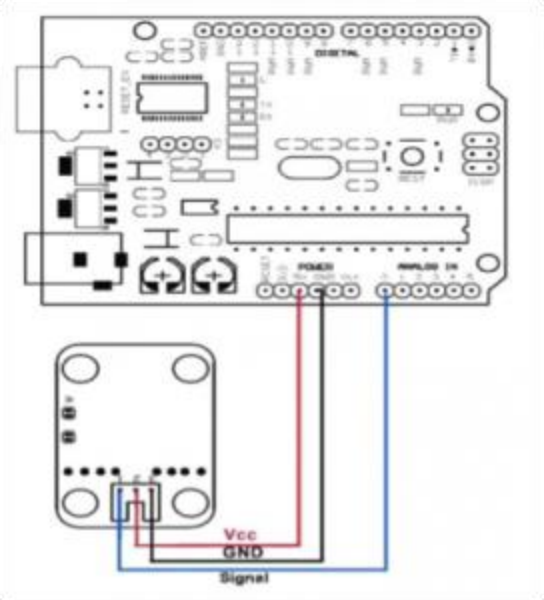


Features:

1. Supply voltage: 3.3v – 5v
2. Output voltage: 0- 4.2 v
3. Current: 35mA
4. Low power consumption

WIRING



For this sensor no extra circuit is not required to construct so the data pin of soil moisture sensor which is pin 3 is directly connected with Ardiuno Uno's analog I/O pin. In this project this pin is connected with Ardiuno Uno's analog pin A0. However the question arises as to why analog pin? The reason behind using analog I/O pin is because the sensor provides analog voltage as output. Since Ardiuno Uno has analog-to-digital converter (ADC), it saves the hobbyist from hassles. Ardiuno Uno do all the task using **analog Read ()** function and show analog value.

Applications

Agriculture

Measuring soil moisture is important for agricultural applications to help farmers manage their irrigation systems more efficiently. Knowing the exact soil moisture conditions on their fields, not only are farmers able to generally use less water to grow a crop, they are also able to increase yields and the quality of the crop by improved management of soil moisture during critical plant growth stages.

Landscape irrigation

In urban and suburban areas, landscapes and residential lawns are using soil moisture sensors to interface with an irrigation controller. Connecting a soil moisture

sensor to a simple irrigation clock will convert it into a "smart" irrigation controller that prevents irrigation cycles when the soil is already wet, e.g. following a recent rainfall event.

Golf courses are using soil moisture sensors to increase the efficiency of their irrigation systems to prevent over-watering and leaching of fertilizers and other chemicals into the ground.

Research

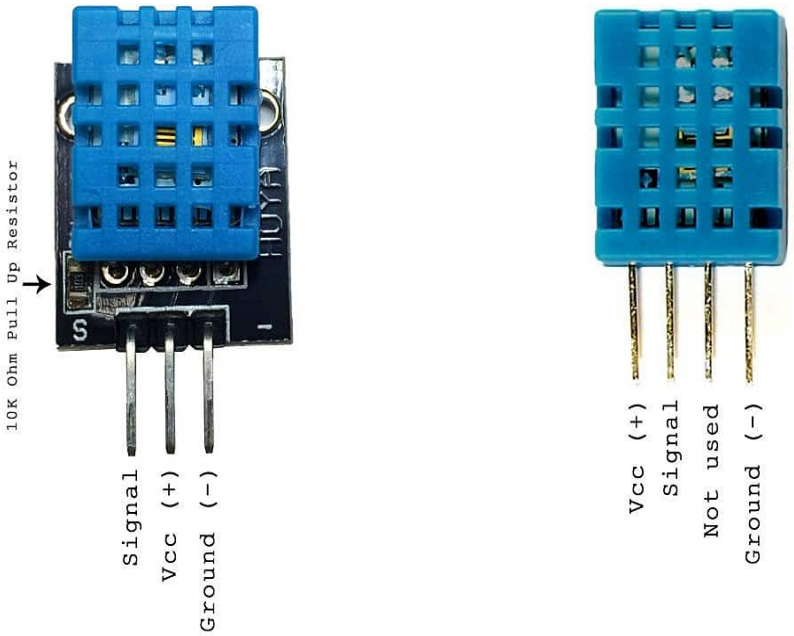
Soil moisture sensors are used in numerous research applications, e.g. in agricultural science and horticulture including irrigation planning, climate research, or environmental science including solute transport studies and as auxiliary sensors for soil respiration measurements.

Simple sensors for gardeners

Relatively inexpensive and simple devices that do not require a power source are available for checking whether plants have sufficient moisture to thrive. After inserting a probe into the soil for approximately 60 seconds, a meter indicates if the soil is too dry, moist or wet for plants

ENVIRONMENTAL TEMPERATURE AND HUMIDITY SENSOR (DHT11)

This module features a humidity and temperature complex with a calibrated digital signal output means DHT11 sensor module is a combined module for sensing humidity and temperature which gives a calibrated digital output signal. DHT11 gives us very precise value of humidity and temperature and ensures high reliability and long term stability. This sensor has a resistive type humidity measurement component and NTC type temperature measurement component with an 8-bit microcontroller inbuilt which has a fast response and cost effective and available in 4-pin single row package.



Sensor DHT11 module works on serial communication i.e. single wire communication. This module sends data in form of pulse train of specific time period. Before sending data to Arduino it needs some initialize command with a time delay. And the whole process time is about 4ms. 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.

APPLICATIONS

This sensor is used in various applications such as measuring humidity and temperature values in heating, ventilation and air conditioning systems. Weather stations also use these sensors to predict weather . The humidity sensor is used as a preventive measure in homes where people are affected by humidity. Offices, cars, museums, greenhouses and industries use this sensor for measuring humidity values and as a safety measure.

ARDUINO MICROCONTROLLER:

A microprocessor is an integrated circuit (IC) which incorporates core functions of a computer's central processing unit (CPU). It is a programmable multipurpose silicon chip, clock driven, register based, accepts binary data as input and provides output after processing it as per the instructions stored in the memory. There a major difference between microcontrollers and microprocessors:
Microprocessor – silicon chip, which includes ALU, register circuits and control circuits Microcontroller – silicon chip, which includes microprocessor, memory and I/O in a single package.

There are many advantages for the microcontrollers such as:

Low Cost Microprocessors are available at low cost due to integrated circuit technology. Which will reduce the cost of a computer system. **High Speed** Microprocessor chips can work at very high speed due to the technology involved in it. It is capable of executing millions of instructions per second.

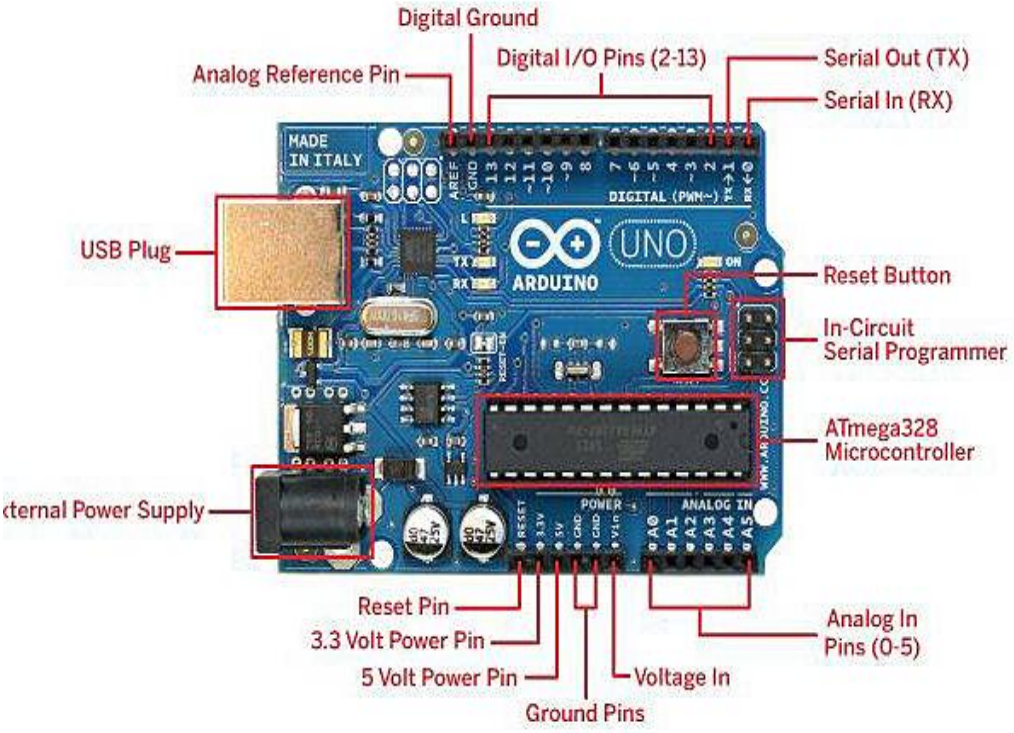
Small Due to very large scale and ultra-large-scale integration technology, a microprocessor is fabricated in a very less footprint. This will reduce the size of the entire computer system.

Low Power Consumption Microcontrollers are usually manufactured using metal oxide semiconductor technology, in which MOSFETs (Metal Oxide Semiconductor Field Effect Transistors) are working in saturation and cut off modes. So the power consumption is meagre compared to others.

Less Heat Generation Compared to vacuum tube devices, semiconductor devices will not emit that much heat.

In our project, we will use a certain type of microcontrollers called **Arduino**; the following figure presents the **Arduino**. In the next chapter, we will provide a solid

explanation for the **Arduino** and its use in our project



ATMEGA 328

ATMEGA 328 microcontroller, which acts as a processor for the arduino board. Nearly it consists of 28 pins. From these 28 pins, the inputs can be controlled by transmitting and receiving the inputs to the external device. It also consists of pulse width modulation (PWM). These PWM are used to transmit the entire signal in a pulse modulation. Input power supply such as Vcc and Gnd are used. These IC mainly consists of analog and digital inputs. These analog and digital inputs are used for the process of certain applications.

DESCRIPTION OF INPUT:

ANALOG INPUT:

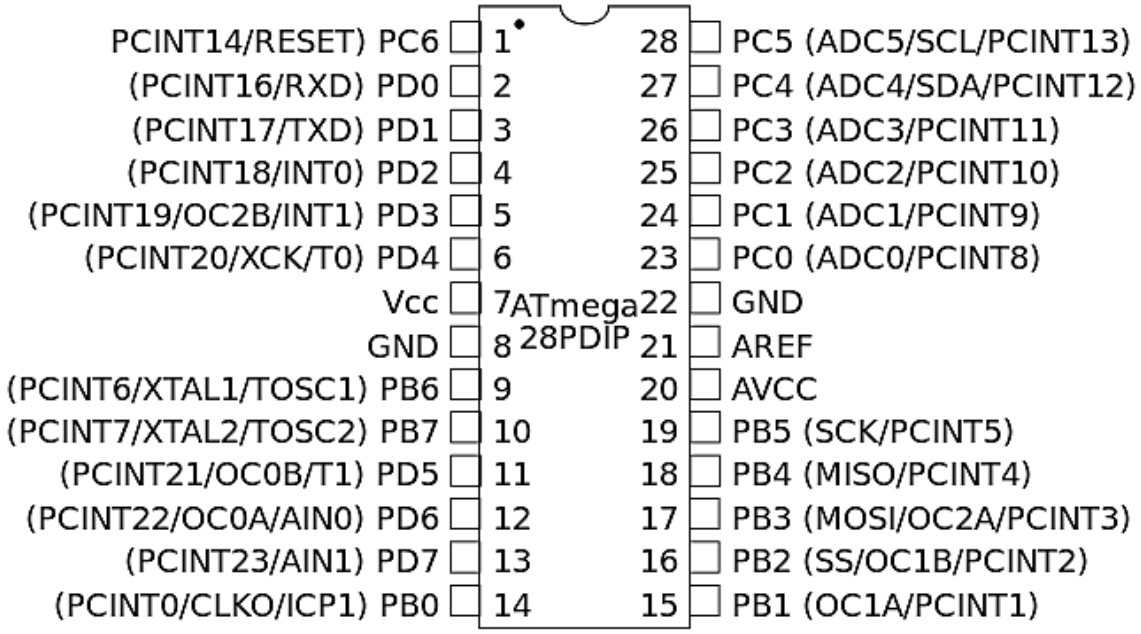
Arduino atmega-328 microcontroller board consist of 6 analog inputs pins. These analog inputs can be named from A0 to A5. From these 6 analog inputs pins, we can do the process by using analog inputs. Analog inputs can be used in the

operating range of 0 to 5V. Analog signal is considered as the continuous time signal, from which these analog signal can be used for certain applications. These are also called as non discrete time signal. Inputs such as voltage, current etc.., are considered to be either analog signal or digital signal only by analysing the time signal properties. Various applications of arduino microcontroller can use only an analog input instead of digital inputs. For these applications, analog input ports or pins can be used.

DIGITAL INPUT:

Digital inputs can be defined as the non continuous time signal with discrete input pulses. It can be represented as 0's and 1's. These digital inputs can be either on state or in off state. Arduino atmega328 microcontroller also consists of 12 digital input pins. It can be stated as D0 to D11. Nearly 12 inputs can be used for digital input/output applications. The working of the digital input ports is where the discrete input pulses can be triggered and supplied to the ports. These ports receive the input and therefore the port can be used for both input and output process. These digital pins can access only the digital inputs.

ATMEGA-328 IC:



This ATMEGA-328 integrated chip consists of 28 pins. It consists of 6 analog inputs that are shown in the pin diagram. Analog inputs can be represented as PC0 to PC5. These analog input pins possess the continuous time signal which acts as an analog input for the system. Further it also consists of 12 digital inputs. It can be represented as PD1 to PD11 which act as a digital input ports based on pulse width modulation (PWM). These PWM, which transmits the signal in the form of discredited form. Both analog and digital input ports can be used for various applications for the input power supply, VCC and GND pins are used. Pins PB6 and PB7, which acts as a crystal to generate a clock signal. By using these crystal, we can generate the clock signals and by these clock signals, we can use this clock signals for input sources. PC6 pin are the one where it can be used for the reset option. Resetting the program can be done by using this PC6 pin.

The table below gives a description for each of the pins, along with their function.

Pin Number	**Description**	**Function**
1	PC6	Reset
2	PD0	Digital Pin (RX)
3	PD1	Digital Pin (TX)
4	PD2	Digital Pin
5	PD3	Digital Pin (PWM)
6	PD4	Digital Pin
7	Vcc	Positive Voltage (Power)
8	GND	Ground

9	XTAL 1	Crystal Oscillator
10	XTAL 2	Crystal Oscillator
11	PD5	Digital Pin (PWM)
12	PD6	Digital Pin (PWM)
13	PD7	Digital Pin
14	PB0	Digital Pin
15	PB1	Digital Pin (PWM)
16	PB2	Digital Pin (PWM)
17	PB3	Digital Pin (PWM)
18	PB4	Digital Pin
19	PB5	Digital Pin
20	AVCC	Positive voltage for ADC (power)
21	AREF	Reference Voltage
22	GND	Ground
23	PC0	Analog Input
24	PC1	Analog Input
25	PC2	Analog Input
26	PC3	Analog Input
27	PC4	Analog Input
28	PC5	Analog Input

Features:

- High Performance, Low Power Design
- 8-Bit Microcontroller Atmel® AVR® advanced RISC architecture
    - 131 Instructions most of which are executed in a single clock cycle
    - Up to 20 MIPS throughput at 20 MHz
    - 32 x 8 working registers
    - 2 cycle multiplier
- Memory Includes
    - 32KB of of programmable FLASH
    - 1KB of EEPROM
    - 2KB SRAM
    - 10,000 Write and Erase Cycles for Flash and 100,000 for EEPROM
    - Data retention for 20 years at 85°C and 100 years at 25°C
    - Optional boot loader with lock bits
        - In System Programming (ISP) by via boot loader
        - True Read-While-Write operation
    - Programming lock available for software security
- Features Include

    - 2 x 8-bit Timers/Counters each with independent prescaler and compare modes
    - A single 16-bit Timer/Counter with an independent prescaler, compare and capture modes
    - Real time counter with independent oscillator
    - 10 bit, 6 channel analog to digital Converter
    - 6 pulse width modulation channels
    - Internal temperature sensor
    - Serial USART (Programmable)
    - Master/Slave SPI Serial Interface – (Philips I2C compatible)
    - Programmable watchdog timer with independent internal oscillator
    - Internal analog comparator
    - Interrupt and wake up on pin change
- Additional Features
    - Internal calibrated oscillator
    - Power on reset and programmable brown out detection
    - External and internal interrupts
    - 6 sleep modes including idle, ADC noise reduction, power save, power down, standby, and extended standby

- I/O and Package
    - 23 programmable I/O lines
    - 28 pin PDIP package
- Operating voltage:
    - 1.8 – 5.5V
- Operating temperature range:
    - -40°C to 85°C
- Speed Grades:
    - 0-4 MHz at 1.8-5.5V
    - 0-10 MHz at 2.7-5.5V
    - 0-20 MHz at 4.5-5.5V
- Low power consumption mode at 1.8V, 1 MHz and 25°C:
    - Active Mode: 0.3 mA
    - Power-down Mode: 0.1 µA
    - Power-save Mode: 0.8 µA (Including 32 kHz RTC)

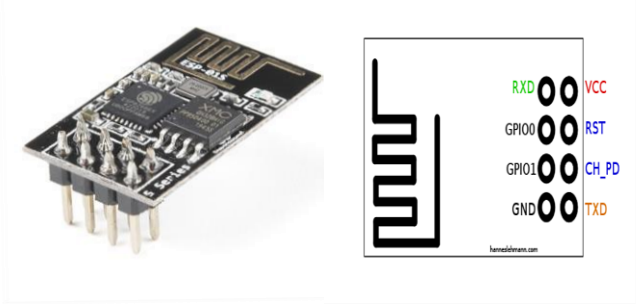
APPLICATION

- DIY project prototyping.
- Developing varied varieties of projects that require a code based control.

- Automation System development.
- Learning AVR programming.
- Entry level circuit designing.

WI-FI MODULE (ESP8266)

The ESP8266 WiFi Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your WiFi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device and get about as much WiFi-ability as a WiFi Shield offers (and that's just out of the box)! The ESP8266 module is an extremely cost effective board with a huge, and ever growing, community



This module has a powerful enough on-board processing and storage capability that allows it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. Its high degree of on-chip integration allows for minimal external circuitry, including the front-end module, is designed to occupy minimal PCB area. The ESP8266 supports APSD for VoIP applications and Bluetooth co-existence interfaces, it contains a self-calibrated RF allowing it to work under all operating conditions, and requires no external RF parts.

The **ESP8266** is a low-cost Wi-Fi microchip with full TCP/IP stack and microcontroller capability produced by Shanghai-based Chinese manufacturer, Espressif Systems.

The chip first came to the attention of western makers in August 2014 with the **ESP-01** module, made by a third-party manufacturer, Ai-Thinker. This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes-style commands. However, at the time there was almost no English-language documentation on the chip and the commands it accepted. The very low price and the fact that there were external components on the module which suggested that it could eventually be very inexpensive in volume, attracted many hackers to explore the module, chip, and the software on it, as well as to translate the Chinese documentation.

The **ESP8285** is an ESP8266 with 1 MiB of built-in flash, allowing for single-chip devices capable of connecting to Wi-Fi.

Wi-Fi Protocols

• 802.11 b/g/n support

• 2 x Wi-Fi interface, supports infrastructure BSS Station mode / P2P mode / SoftAP mode support

• Hardware accelerators for CCMP (CBC-MAC, counter mode), TKIP (MIC, RC4), WAPI (SMS4), WEP (RC4), CRC

• 802.11n support (2.4 GHz)

• Supports MIMO 1×1 and 2×1, STBC, and 0.4 μs guard interval

• WMM

• UMA compliant and certified

• Antenna diversity and selection (software managed hardware)

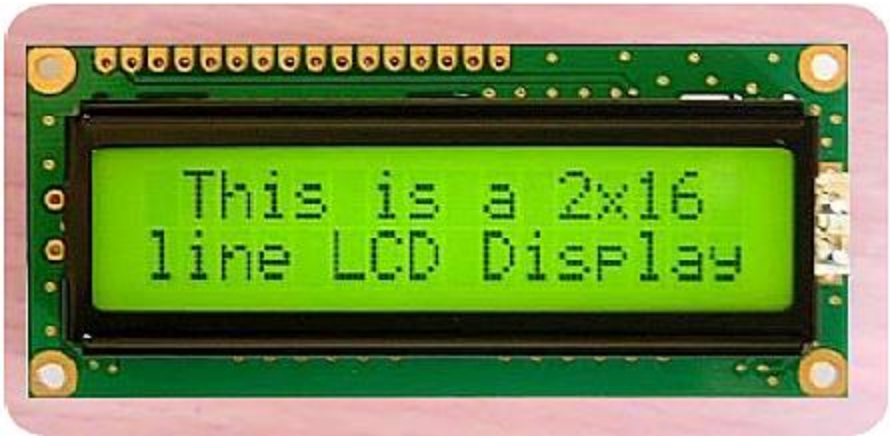
• Configurable packet traffic arbitration (PTA) with dedicated slave processor based design provides flexible and exact timing Bluetooth co-existence support for a widerange of Bluetooth Chip vendor.

3.6.2 Specifications

Table 1-1. Specifications

Categories	Items	Parameters
Wi-Fi	Certification	Wi-Fi Alliance
	Protocols	802.11 b/g/n
	Frequency Range	2.4G ~ 2.5G (2400M ~ 2483.5M)
	Tx Power	802.11 b: +20 dBm
		802.11 g: +17 dBm
		802.11 n: +14 dBm
	Rx Sensitivity	802.11 b: –91 dbm (11 Mbps)
		802.11 g: –75 dbm (54 Mbps)
		802.11 n: –72 dbm (MCS7)
	Antenna	PCB Trace, External, IPEX Connector, Ceramic Chip
Hardware	CPU	Tensilica L106 32-bit processor
	Peripheral Interface	UART/SDIO/SPI/I2C/I2S/IR Remote Control
		GPIO/ADC/PWM/LED Light & Button
	Operating Voltage	2.5V ~ 3.6V
	Operating Current	Average value: 80 mA
	Operating Temperature Range	–40°C ~ 125°C
	Storage Temperature Range	–40°C ~ 125°C
	Package Size	QFN32-pin (5 mm x 5 mm)
	External Interface	-
Software	Wi-Fi Mode	Station/SoftAP/SoftAP+Station
	Security	WPA/WPA2
	Encryption	WEP/TKIP/AES
	Firmware Upgrade	UART Download / OTA (via network)
	Software Development	Supports Cloud Server Development / Firmware and SDK for fast on-chip programming
	Network Protocols	IPv4, TCP/UDP/HTTP/FTP
	User Configuration	AT Instruction Set, Cloud Server, Android/iOS App

LCD – Liquid Crystal Display



Liquid Crystal Displays (LCDs) have materials, which combine the properties of both liquid and crystals. Rather than having a melting point, they have a temperature range within which the molecules are almost as mobile as they would be in a liquid, but are grouped together in an ordered form similar to a crystal. An LCD consists of two glass panels, with the liquid crystal material sand witched in between them. The inner surface of the glass plates are coated with transparent electrodes which define the character, symbols or patterns to be displayed polymeric layers are present in between the electrodes and the liquid crystal, which makes the liquid crystal molecules to maintain a defined orientation angle. One each polarizer are pasted outside the two glass panels. This polarizer would rotate the light rays passing through them to a definite angle, in a particular direction. When the LCD is in the off state, light rays are rotated by the two polarizer and the liquid crystal, such that the light rays come out of the LCD without any orientation, and hence the LCD appears transparent. When sufficient voltage is applied to the electrodes, the liquid crystal molecules would be aligned in a specific direction. The light rays passing through the LCD would be rotated by the polarizer, which would result in activating / highlighting the desired characters.

The LCDs are lightweight with only a few millimeters thickness. Since the LCD’s consume power, they are compatible with low power electronic circuits, and

can be powered for long durations. The LCD does don’t generate light and so light is needed to read the display. By using backlighting, reading is possible . The LCD’s have long life and a wide operating temperature range. Changing the display size of the layout size is relatively simple which makes the LCD’s more customers friendly. The LCD’s used exclusively in watches, calculators and measuring instruments are the simple seven-segment displays, having a limited amount of numeric data. The recent advances in technology have resulted in better legibility, more information displaying capability and a wider temperature range. These have resulted in the LCDs being extensively used in telecommunications and entertainment electronics. The LCDs have even started replacing the cathode ray tubes (CRTs) used for the display of text and graphics, and also in small Television applications.

LCD display use of our project title message and information message. Our project connect to a microcontroller unit data line connected to a ‘PORT 2’ and control lines connected to a P3.5,P3.6,P3.7.

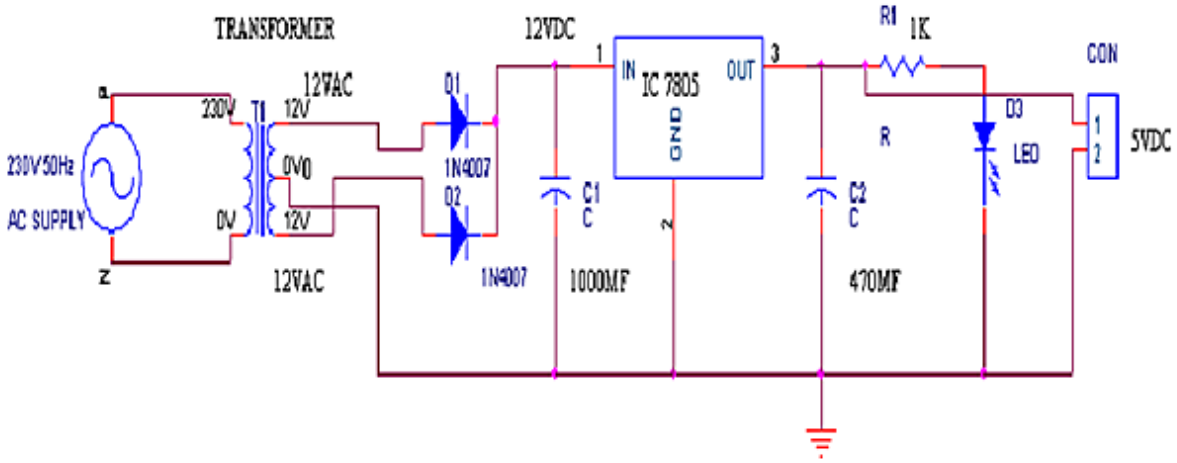
PIN DESCRIPTION

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-

SINGLE POWER SUPPLY:

Power supply gives supply to all components. It is used to convert AC voltage into DC voltage. Transformer used to convert 230V into 12V AC.12V AC is given to diode. Diode range is 1N4007, which is used to convert AC voltage into DC voltage. AC capacitor used to charge AC components and discharge on ground. LM 7805 regulator is used to maintain voltage as constant. Then signal will be given to next capacitor, which is used to filter unwanted AC component. Load will be LED and resister.LED voltage is 1.75V.if voltage is above level beyond the limit, and then it will be dropped on resister.



Coding

// https://github. com/adafruit/Adafruit_ADS1X15
//https://github.com/manrueda/ESP8266HttpClient
//https://github.com/ekstrand/ESP8266wifi

```
 #include <ESP8266WiFi.h>

#include <ESP8266HTTPClient.h>

 #include <Adafruit_ADS1015.h>

WiFiClient client;

String thingSpeakAddress= "http://api.thingspeak.com/update?";

String writeAPIKey;

String tsfield1Name;

String request_string;

 HTTPClient http;

   Adafruit_ADS1115 ads;

void setup()
```

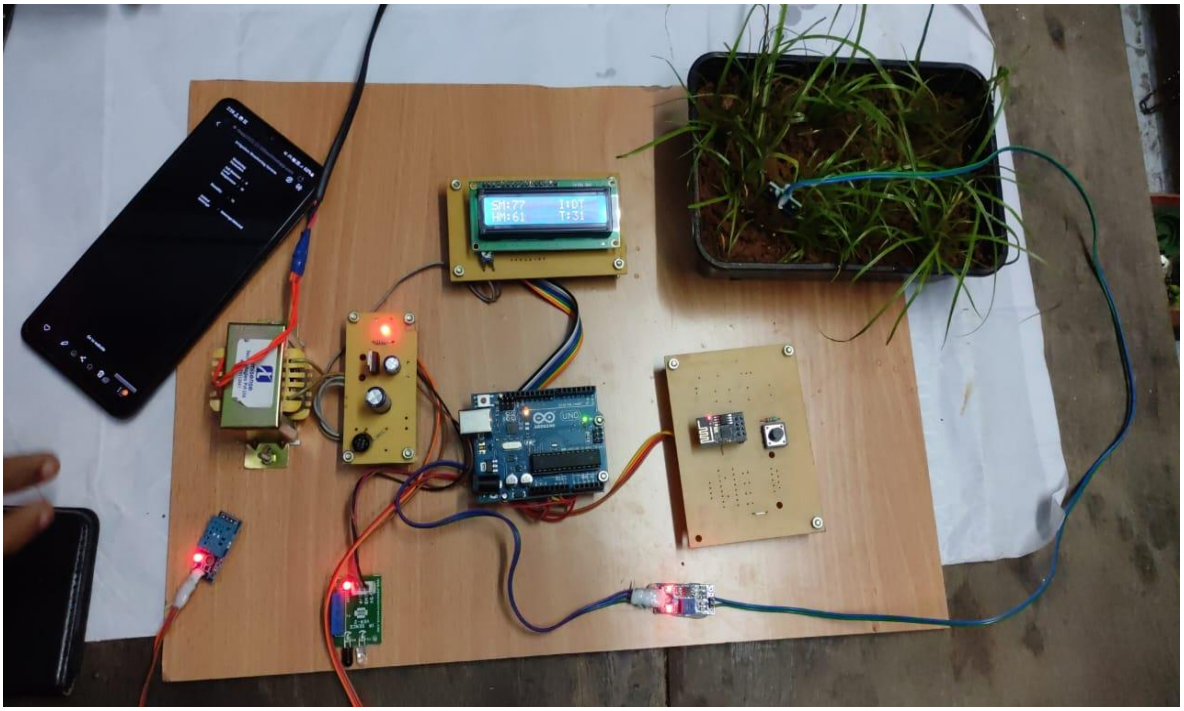
```
 {
Serial.begin(115200);
 delay(3000);
WiFi.disconnect();
Serial.println("START");
WiFi.begin("DESKTOP","asdfghjkl"); // Wifi ("ID","Password")
while ((!(WiFi.status() == WL_CONNECTED))){
delay(300);
Serial.println("...");
}
Serial.println("I AM CONNECTED");
   Serial.println("Hello!");
Serial.println("Getting single-ended readings from AIN0..3"); Serial.println("ADC Range: +/- 6.144V (1 bit = 3mV/ADS1015, 0.1875mV/ADS1115)");
   ads.begin();
}
 void loop()
 {
int16_t adc0, adc1, adc2, adc3;
 Serial.println(" ");
adc0 = ads.readADC_SingleEnded(0);
 adc0 = adc0 / 25;
adc1 = ads.readADC_SingleEnded(1);
adc1 = adc1 / 25;
```

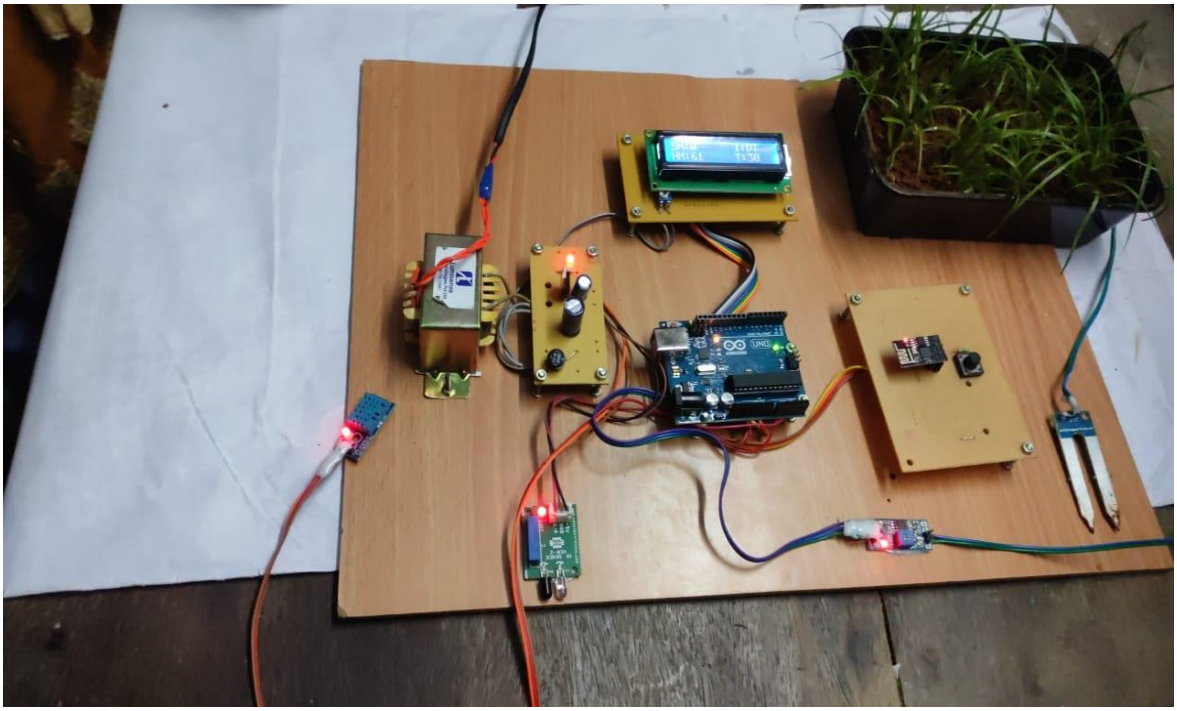
```
adc2 = ads.readADC_SingleEnded(2);

adc2 = adc2 / 25;

adc3 = ads.readADC_SingleEnded(3);

 adc3 = adc3 / 25;

Serial.print("SOIL MOISTURE in persent 1% : "); Serial.println(adc0);
Serial.print("SOIL MOISTURE in persent 2% : "); Serial.println(adc1);
Serial.print("SOIL MOISTURE in persent 3% : "); Serial.println(adc2);
Serial.print("SOIL MOISTURE in persent 4% : "); Serial.println(adc3);
Serial.println(" ");

if (client.connect("api.thingspeak.com",80))

{

  request_string = thingSpeakAddress;

  request_string += "key=";

  request_string += "2YGO2FHN3XI3GFE7";

  request_string += "&";

  request_string += "field1";

  request_string += "=";

  request_string += adc0;

  http.begin(request_string);

  http.GET();

  http.end();

}

 delay(10);

if (client.connect("api.thingspeak.com",80))

{
```

```
  request_string = thingSpeakAddress;
   request_string += "key=";
   request_string += "2YGO2FHN3XI3GFE7";
   request_string += "&";
   request_string += "field2";
   request_string += "=";
   request_string += adc1;
   http.begin(request_string);
   http.GET();
   http.end();
}
delay(10);
   if (client.connect("api.thingspeak.com",80))
{
   request_string = thingSpeakAddress;
   request_string += "key=";
   request_string += "2YGO2FHN3XI3GFE7";
   request_string += "&";
   request_string += "field3";
   request_string += "=";
   request_string += adc2;
   http.begin(request_string);
   http.GET();
```

```
    http.end();
}
 delay(10);
     if (client.connect("api.thingspeak.com",80))
{
    request_string = thingSpeakAddress;
    request_string += "key=";
    request_string += "2YGO2FHN3XI3GFE7";
    request_string += "&";
    request_string += "field4";
    request_string += "=";

    request_string += adc3;
    http.be
gin(request_string);
    http.GET();
    http.end();
 }
 delay(10);
}
```

TESTING


SH:77 IHOT
HM:61 T:31



RESULTS

ADVANTAGES

1. A remote control system can help in working irrigation system valves dependent on schedule. Irrigating remote farm properties can be exceptionally troublesome and labor-intensive. It gets hard to comprehend when the valves were started and whether the ideal measure of water was distributed.

2. For situations where a quick reaction is required, manual valve actuation may not be conceivable constantly. Thus, remote observing and control of irrigation systems, generators or wind machines or some other motor-driven hardware become the next logical step.

3. Various solutions are available to monitor engine statistics and starting or stopping the engine. When the client chooses to begin or stop the motor, the

program transmits a sign to the unit within seconds using of a mobile phone system.

4. Submersible weight sensors or ultrasonic sensors can screen the degree of tanks, lakes, wells and kinds of fluid stockpiling like fuel and compost. The product figures volume dependent on the tank or lake geometry after some time. It conveys alarms dependent on various conditions.

DISADVANTAGE

1. Cost
2. Reliability
3. Increased channel maintenance

CONCLUSION

Agriculture is the main aspects of development countries like India. Due to lack of rainfall and draining of water resources, we need to save water for future. This project is mainly focus agricultural development in our country is increased with less water usage and also make a green environment without any interruption. IoT will help to enhance smart farming. Using IoT the system can predict the soil moisture level and humidity so that the irrigation system can be monitored and controlled. IoT

works in different domains of farming to improve time efficiency, water management, crop monitoring, soil management and control of insecticides and pesticides. This system also minimizes human efforts, simplifies techniques of farming and helps to gain smart farming. Besides the advantages provided by this system, smart farming can also help to grow the market for farmer with single touch and minimum effort.

FUTURE SCOPE

Our project can be improvised by using a sensor to note the soil ph value such that usage of unnecessary Fertilizers can be reduced. 2. A water meter can be installed to estimate the amount of water used for irrigation and thus giving a cost estimation. 3. For future developments it can be enhanced by developing this system for large acres of land.

APPENDIX

Source Code

```
#include "DHT.h"

#define DHTPIN A1

#define DHTTYPE DHT11   // DHT 11

DHT dht(DHTPIN, DHTTYPE);
```

```
#include <LiquidCrystal.h> // initialize the library with the numbers of the interface pins

#include <SoftwareSerial.h>

SoftwareSerial ESP11 = SoftwareSerial(2,3); // RX, TX

LiquidCrystal lcd(8, 9, 4, 5, 6, 7);

#define DEBUG true

int pump = 10;

// WIFI SHIELD DECLARATION

String ssid = "\"wifi002\"";

String pass = "\"12345678\"";

String tcp = "\"TCP\"";

String remoteip = "\"webapp2022-23.000webhostapp.com\"";

String portnum = "80";

int soil=A0;

int sm=0;

int mode=2;

int in=0;

float tp,mv=0;

int cel=0;
```

```
int h=0;
String st="";
void setup() {
  dht.begin();
  lcd.begin(16,2);
  ESP11.begin(115200);
  Serial.begin(115200);

 pinMode(pump,OUTPUT);
 digitalWrite(pump,LOW);

 lcd.setCursor(0,0);
  lcd.print("IRRIGATION IoT");
  lcd.setCursor(0,1);
  delay(2000);
  lcd.clear();
  lcd.setCursor(0,0);
  lcd.print("  Loading!....");
  sendData("AT+CWMODE=3\r\n",2000,DEBUG); // configure as access point
and Client
```

```
lcd.setCursor(0,1);
 lcd.print("      20%   ");
 sendData("AT+RST\r\n",2000,DEBUG); // reset module
lcd.setCursor(0,1);
 lcd.print("      40%   ");

 sendData("AT+CWLAP\r\n",3,DEBUG); // List all available AP's*/
 lcd.setCursor(0,1);
 lcd.print("      60%  ");

 sendData("AT+CWJAP=" + ssid + "," + pass + "\r\n",3,DEBUG); // Connect to
AP

lcd.setCursor(0,1);
 lcd.print("      90%   ");
 sent();
 lcd.clear();
 lcd.setCursor(0,0);
 lcd.print("SM:       I:");
 lcd.setCursor(0,1);
```

```
 lcd.print("HM:       T:");
 }
void loop() {

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

   if(cel>100)
    cel=100;

 lcd.setCursor(12,1);
  lcd.print("     ");
  lcd.setCursor(12,1);
  lcd.print(cel);

  lcd.setCursor(3,1);
  lcd.print("     ");
  lcd.setCursor(3,1);
  lcd.print(h);
```

```
  sm = analogRead(soil);
  sm/=10;
  if(sm>100)
  sm=100;

   sm = 100-sm;

lcd.setCursor(3,0);
lcd.print("     ");
lcd.setCursor(3,0);
lcd.print(sm);

in=digitalRead(A2);
if(in==1)
{
   lcd.setCursor(12,0);
lcd.print("     ");
lcd.setCursor(12,0);
lcd.print("DT");
```

```
    }
 else if(in==0)
  {
      lcd.setCursor(12,0);
  lcd.print("     ");
  lcd.setCursor(12,0);
  lcd.print("ND");
     }

  sent();
}

String sendData(String command, const int timeout, boolean debug)
{

    String response = ""; // ESP8266 sendData String
    Serial.print(command); // send the read character to the esp8266
}
```

```
void sent()
{
  String getStr = "GET http://webapp2022-23.000webhostapp.com/irrigation/update.php?sm="; // Getting info from my online database through my online website
  //int s=1;
  GetStr+=sm;
  getStr+="temp=";
  getStr+=cel;
  getStr+="hum=";
  getStr+=h;
  getStr+="in=";
  getStr+=in;
}
```

GITHUB & PROJECT DEMO LINK

GITHUB LINK: https://github.com/IBM-EPBL/IBM-Project-51885-1660986417

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