SMART FARMER - IOT ENABLED SMART FARMING APPLICATION

NALAIYA THIRAN PROJECT REPORT

IBM – Project – 14325 – 1659580202

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ABSTRACT

Agriculture is the source of living of majority Indians and it also has a countless influence on economy of the country. The objective of our project is to reduce this manual involvement by the farmer by using an automated irrigation system which purpose is to enhance water use for agricultural crops. This paper presents the design and implementation of wireless sensor network that can monitor the air temperature, Humidity, light intensity in a crop field and from remote places also. The system consists of nodes, which are equipped with small size application specific sensors and radio frequency modules. The inspiration for this project came from the countries where economy is based on agriculture and the climatic conditions prime to shortage of rains & scarcity of water. The farmers working in the farm lands are only dependent on the rains and bore wells for irrigation of the land. Even if the farm land has a water-pump, manual involvement by farmers is required to turn the pump on/off when needed. The project is intended to cultivate an automatic irrigation system which controls the pump motor ON/OFF on sensing the moisture content of the soil. In the field of agriculture, use of appropriate technique of irrigation is essential. The advantage of using this technique is to reduce human intervention and still certify proper irrigation. A software application was developed by predetermining the threshold values of soil moisture, temperature and water level that was programmed into an arm controller. This paper presents the controlling and monitoring the level of water and detecting the soil moisture content.

1.INTRODUCTION:

1.1 PROJECT OVERVIEW:

As we know that Indian economy is one of the largest developing economies of the world. The agricultural sector has its largest contribution in the Indian economy. To achieve maximum utilisation of man power and to obtain maximum profit in a given stipulated there is a need in the upgradation of various engineering techniques that are being used today. Thus maintaining proper amount of water level in the soil is one of the necessary requirements to harvest a good crop that can be a source of various types of nutrients whether micro or macro for their proper growth. If we talk about Indian farmers they are worst hit by the famines that occurs due to failure of crops depending upon various drought factors. Rain plays the key role in deciding the future of these crops as well as the farmers every year. The over utilisation of ground water has drastically reduced the ground water level in the last 15 years.So it is the need of hour to utilise each and every drop of water wisely so that it can also be used by our coming generations also. Also we should develop some new methods that use the renewable sources of energy. The development of these new techniques are going to reach our goal of sustainable development as well as to cut off the emission of greenhouse gases to a minimum level.As the name of our project that is AUTOMATIC IRRIGATION SYSTEM with the help of the Solar power is a step to utilise some new engineering techniques. This technique will be a very good option for the small and medium farmers who suffer every year just because of failure of crops that took place every year. The implementation of this technology has a wide scope in the nearby future.

1.2 PURPOSE:

The main objective of this project was to design a small scale irrigated system that would use water in more well-organized way in order to prevent excess water loss and minimize the cost of labor. The following aspects were considered in the choice of design solution

- Installation cost
- Water saving
- Human intervention

- Reliability
- Power consumption
- Maintenance
- Expandability

A critical Consideration in the segment costs, since cost define the viability and feasibility of a project. The water saving was also an important feature, since there is demand to decrease

2.LITERATURE SURVEY:

2.1 EXISTING PROBLEM :

1.Remote Monitoring of Crop Field Using Wireless Sensor Network

This paper presents the design and implementation of wireless sensor network that can monitor the air temperature, Humidity, light intensity in a crop field and from remote places also. The system consists of nodes, which are equipped with small size application specific sensors and radio frequency modules. The sensor data is transmitted via radio frequency link to the centrally localized computer terminal for data logging and analysis. This data can be monitor from the remote places by uploading the data into the internet, also the sensor nodes can additionally be programmed from the computer terminal itself according to the changing needs of farmers thus preventing the need for redeployment of the wireless sensor network every time some changes are to be made. Since the energy is the main operating constraint sleep mode of the core component is utilized

2.AUTOMATIC IRRIGATION CONTROL SYSTEM FOR EFFICIENT USE OF WATER RESOURCES BY USING ANDROID MOBILE

Agriculture is a source of livelihood of majority Indians and has great impact on the economy of the country. In dry lands or in case of insufficient rainfall, irrigation becomes difficult. So, it needs to be automation required for proper yield and handled remotely for farmer usage and safety. In this paper we suggest a Wireless sensor network and Embedded based technique to control water flow level for sectored, sprinkler or drip method section irrigation system. This system will be very economical in terms of the hardware cost, man power, and power consumption. In places such as agriculture land areas must be a continuous need for monitoring the water level at particular field. In places such as drip irrigation for coconuts, bananas and some vegetable plants, the water is let out through pipes directly to each field. A person has to carefully watch the water level at regular intervals. His job becomes difficult at night times and for frequent power cut. Sometimes there is wastage of water and electricity due to negligence and other times there is a hard job for the formers. This is highly helpful in places such as drip irrigation system where there are many flow pipes but does not require any change in the agricultural fields. When the motor is switched on the sensors are activated and the fields are irrigated automatically without man power. Once the water reaches a particular level which may take several hours, this system takes appropriate steps to regulate or even stop the water flow.

3.GSM based Automated Irrigation Control using Rain gun Irrigation System

The green house based modern agriculture industries are the recent requirement in every part of agriculture in India. In this technology, the humidity and temperature of plants are precisely controlled. Due to the variable atmospheric conditions sometimes may vary from place to place in large farmhouse, which makes very difficult to maintain the uniformity at all the places in the farmhouse manually .The proposed system implemented GSM is used to report the detailed about irrigation. The report from the GSM is send through the android mobile. The keil software is used for simulated the result

4.Automated Irrigation System using ZigBee – GSM

In recent years, Distributed Wireless sensor technology becomes very popular and extensively used in the scientific world. The WSN helps in the advancement of the current developing and rapidly changing technology. Power management, cost-saving and labor saving is always a major issue in the research field of wireless sensor networks. This paper gives a review of some existing or proposed systems based on the different technologies and also focuses on generic automated irrigation system based on WSN with GSM-ZigBee for remote monitoring and
controlling devices. The objective is to make use of wireless sensor network and communication technology such as ZigBee and GSM in industrial field to make low-cost automated irrigation system to monitor the condition of the soil
and to lower the energy consumption. The system helps the farmer to monitor and control the parameters of the soil such as air temperature, humidity, soil moisture. At any abnormal condition, the farmer is informed and will be able to
take actions remotely by using GSM. Due to its lower energy consumption and low cost, the system has the potential to be useful in semiarid or arid areas.

5.Microcontroller based Controlled Irrigation System for Plantation

The population of India has reached beyond 1.2 billion. If the population goes on increasing with the present rate then after 25-30 years there will be a serious problem of food, so in order to meet the demand of food one has to give more

emphasis on the development of agriculture. Today, man has occupied all the suitable land but the land located far away from the human settlement is not developed properly and not utilized fully because it requires more manpower, time and expenditure. But now a day it is possible to pay more attention with the help

of modern available controlled devices like computer, microprocessor, sensor, integrated circuits and microcontroller. In the present work a Microcontroller based

controlled remote irrigation system is developed for the agricultural plantation. The developed system is placed at the remote location and required water provides for plantation whenever the humidity of the soil goes below the set-point value.

Humidity sensor provides proportional amount of output with mchange in humidity, which is compared, to the set-point and the data is taken through the channel. If the set-point data is high, then after motor is turned ON, which provides water to the plant till the humidity goes above set-point value. After reaching

the humidity above set-point value motor is turned OFF and scans the next channel. This provides right amount of water at right time. The required software program is developed in assembly level language.

6.Remote Sensing and Control of an Irrigation System Using a Distributed Wireless Sensor Network

Efficient water management is a major concern in many cropping systems in semiarid and arid areas. Distributed in-field sensor-based irrigation systems offer a potential solution to support site-specific irrigation management that allows producers to maximize their productivity while saving water. This paper describes details of the design and instrumentation of variable rate irrigation, a wireless sensor network, and software for real-time in-field sensing and control of a site-specific precision linear-move irrigation system. Field conditions were site-specifically monitored by six in-field sensor stations distributed across the field based on a soil property map, and periodically

sampled and wirelessly transmitted to a base station. An irrigation machine was converted to be electronically controlled by a programming logic controller that updates georeferenced location of sprinklers from a differential Global Positioning System (GPS) and wirelessly communicates with a computer at the base station. Communication signals from
the sensor network and irrigation controller to the base station were successfully interfaced using low-cost Bluetooth wireless radio communication. Graphic user interface-based software developed in this paper offered stable remote access to field conditions and real-time control and monitoring of the variable-rate irrigation
controller.

7.A wireless application of drip irrigation automation supported by soil moisture sensors

highly increasing demand for freshwater, optimal usage of water resources has been provided with greater extent by automation technology and its apparatus such as solar power, drip irrigation, sensors and remote control. Traditional instrumentation based on discrete and wired solutions, presents many difficulties on measuring and control systems especially over the large geographical areas. This paper describes an application of a wireless sensor network for low-cost wireless controlled irrigation solution and real time monitoring of water content of soil. Data acquisition is performed by using solar powered nwireless acquisition stations for the purpose of control of valves for irrigation. The designed system has 3 units namely: base station unit (BSU), valve unit (VU) and sensor unit (SU).The obtained irrigation system not only prevents the moisture stress of trees and calcification, but also provides an efficient use of fresh water resource. In addition, the developed irrigation method removes the need for workmanship for flooding irrigation. The designed system was applied to an area of 8 de cares in a venue located in central Anatolia for controlling drip irrigation of dwarf cherry trees.

2.2 REFERENCES:

S.Gopinath, K.Govindaraju, T.Devika, N.SuthanthiraVanitha, “GSM based Automated Irrigation Control using Raingun Irrigation System”, International Journal of Advanced Research in Computer and Communication Engineering Vol. 3, Issue 2, February 2014.

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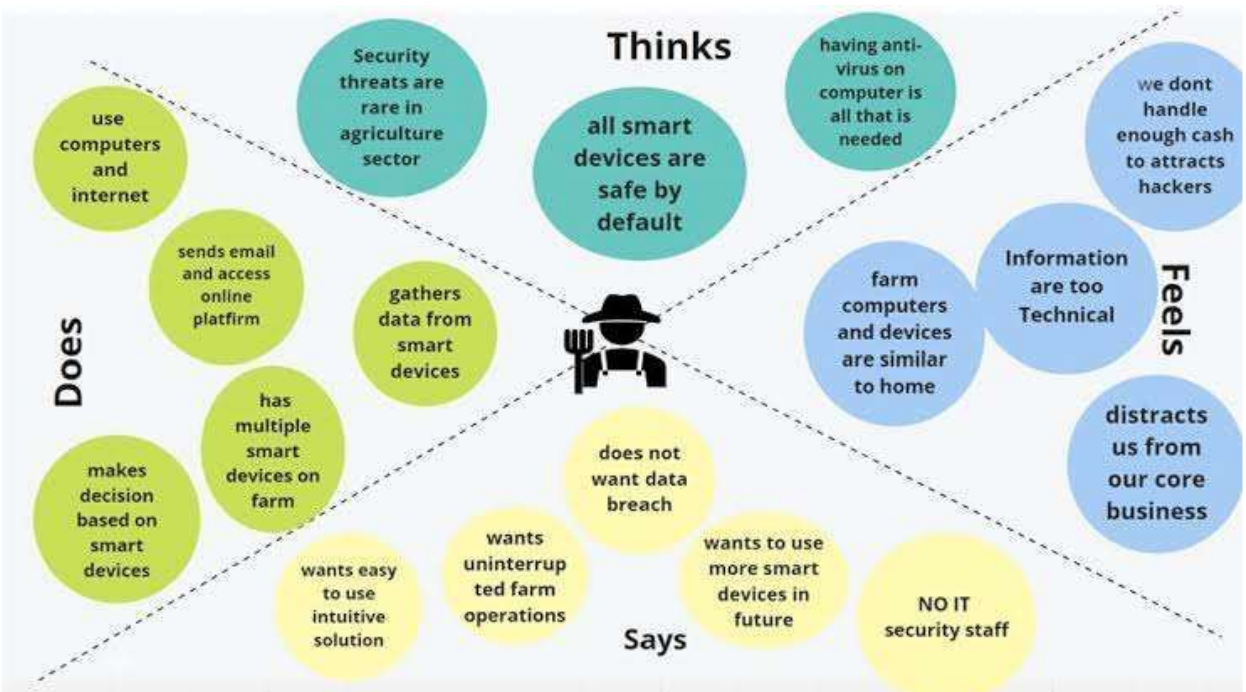
[9] S. Harishankar, R. Sathish Kumar, Sudharsan K.P, U. Vignesh and T.Viveknath, “Solar Powered Smart Irrigation System”, Advance in Electronic and Electric Engineering, Volume 4, Number 4 (2014),

2.3 PROBLEM STATEMENT DEFINITION :

Most of the crop maintenance systems in our country are done manually. Farmers stay in the agricultural lands for longer duration for crops irrigation and field maintenance. The accurate value of the soil moisture level, crop wetness, Water level and growth level are not known. Present there is emerging global water crisis where managing scarcity of water has become a tedious job and there are conflicts between users of water. This is an era where human use and pollution of water resource have crossed the levels which lead to limit food production and low down the ecosystem. The major reason for these limitations is the growth of population which is increasing at a faster rate than the production of food and after a few years this population will sum up to 3-4 billion. Thos growth can be seen in countries which have shortage of uniform crop maintenance and are economically poor. Because of growth in population there is a huge demand to raise food production by 50% in the next half century to maintain the capita, based on an assumption that productivity of existing farm land does not decline. The crop water stress index called as CWSI existed around 30 years ago. This crop water stress index was then integrated using measurements of infrared canopy temperatures, ambient air temperatures, and atmospheric vapor pressure values to determine when to irrigate using drip irrigation. The management of these farms which are in greenhouses will require a data acquisition to be located in each greenhouse and the control room where a control unit is located. These are separated from the production area. At present, the data is transferred using wired communication called field bus. This data is transferred between greenhouses and control room. All the problems related here is presented using CAN and ZigBee protocols.

3. IDEATION &PROPOSED SOLUTION :

3.1 Empathy Map Canvas :



3.2 IDEATION & BRAINSTORMING :

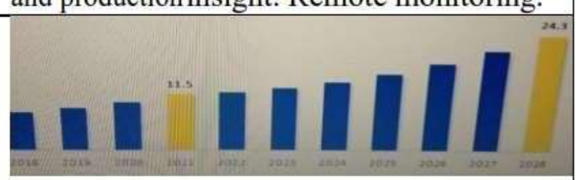
All new business endeavors should start with a good brainstorming session. By working with the people who know your existing farm or business, you can create exciting new means of income and production!

You should start by sitting down (along with your spouse and any partners, financiers or managers) and assessing your situation. Have a brainstorming session; write down your thoughts or record the session. Don't be afraid to dream, to imagine some pretty wild ideas. Think big. Imagine you could do anything; don't be limited by practicality at this stage. Think of goals. Try to fill needs or supply possible markets. Think of new ways to use a resource you already have—like corn cobs. Can corn cobs be made into toys—or paper—or alcohol? Combine elements from widely different sources.

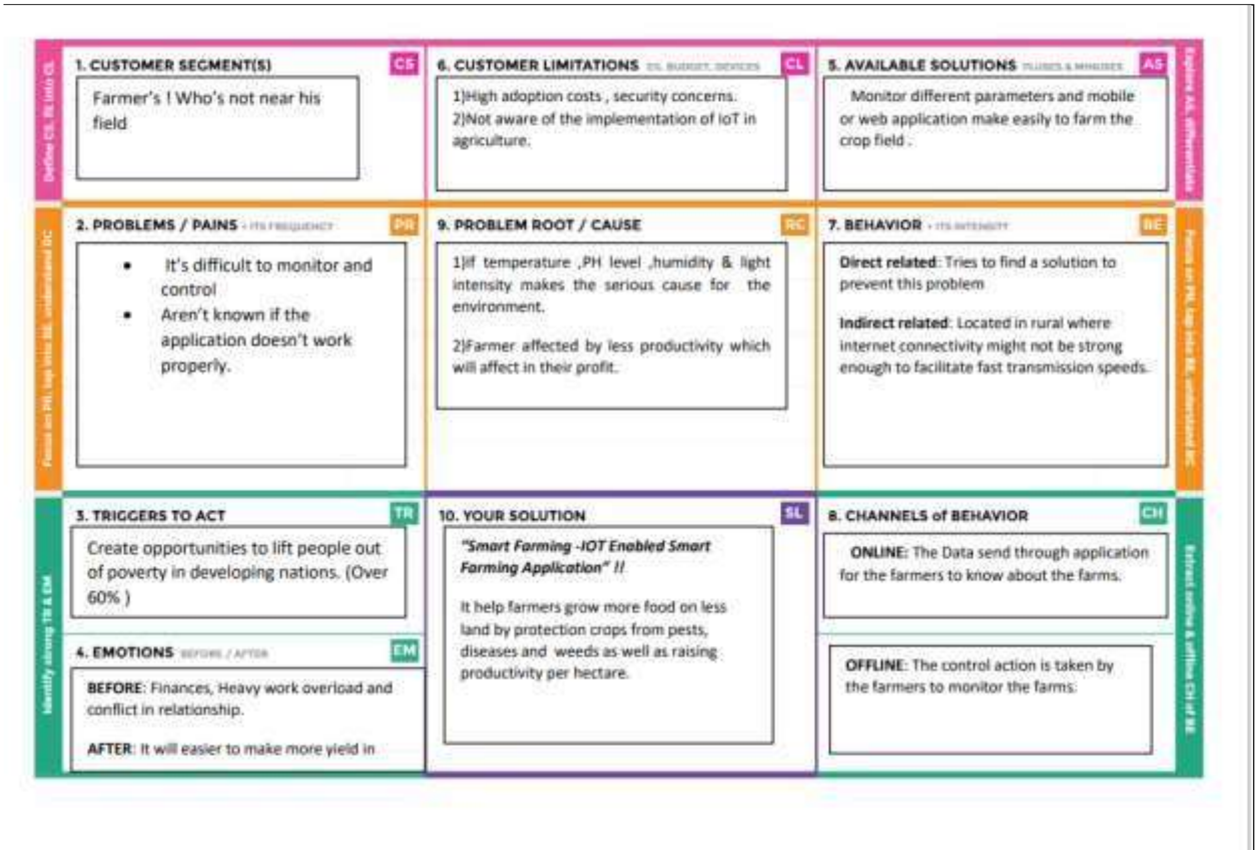
Get additional ideas from what others are doing and from published resources, such as Acres U.S.A. and Mother Earth News. Watch for new and developing trends, such as public concerns about saturated fats, or growing biofuels

3.3 PROPOSED SOLUTION :

Project team shall fill the following information in proposed solution template.

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Watering the plants and crops is the most important cultural practice and one of the labour intensive tasks in daily greenhouse operation. Watering system case the burden of getting water to plants when they need it.
2.	Idea / Solution description	Smart Farming has enabled farmers to reduce waste and enhance productivity with the help of sensors (light, humidity, temperature, soil moisture, etc..).
3.	Novelty / Uniqueness	Knowing when and how much to water is two important aspects of watering process. This project on "system of automatic irrigation "automated irrigation mechanisms which turns the pumping motor ON and OFF on detecting the moisture content of the earth.
4.	Social Impact / Customer Satisfaction	Water conservation . Saves lot of time . Increased quality of production. Real time data and production insight. Remote monitoring.
5.	Business Model (Revenue Model)	

3.4 PROBLEM SOLUTION FIT :



4.REQUIREMENT ANALYSIS :

4.1 FUNCTIONAL REQUIREMENT :

By automatic crop monitoring process, farmers would be able to know the right amount of water and Nutritionists at the right time thus to maintain the growth of crop. The farmer can measure the water level, Water level and crop growth at any place. These values in agricultural land are measured by using sensors. It also assists the farmer to maintain the crop. The WSN for remote monitoring of crop field consists of set of wireless sensor nodes distributed in an area called end devices or sensor nodes. They have a stronger battery, a larger memory and more computation power, the sensor nodes collects the data from the field by using sensors and this data is send to he path between end devices. The collected data is send to the internet and pc through WSN.

Here in this paper an experimental scale within rural areas where there is an enormous disposition of irrigation system which is executed using arm controller and wireless communication. The main of this implementation was to demonstrate that the automatic irrigation system can be used to optimize /reduce water usage. The system has a water level sensor which will indicate the presence of water level in tank. A software application was advanced by programming the verge values of soil moisture water level that was automated into a microcontroller.

The proposed hardware of this system includes arduino, Temperature, humidity,Water level and soil moisture sensors, LCD. The system is low cost & low power consuming so that anybody can afford it. The data monitored is collected at the server. It can be used in precision farming. The system should be designed in such a way that even illiterate villagers can operate it. They themselves can check different parameters of the soil like salinity, acidity, moisture etc. from time to time. During irrigation period they have to monitor their distant pump house throughout the night as the electricity supply is not consistent.

4.2 NON FUNCTIONAL REQUIREMENTS

Usability

The system shall allow the users to access the system with pc using web application. The system uses a web application as an interface. The system is user friendly which makes the system easy

Availability

The system is available 100% for the user and is used 24 hrs a day and 365 days a year. The system shall be operational 24 hours a day and 7 days a week.

Scalability

Scalability is the measure of a system's ability to increase or decrease in performance and cost in response to changes in application and system processing demands.

Security

A security requirement is a statement of needed security functionality that ensures one of many different security properties of software is being satisfied.

Performance

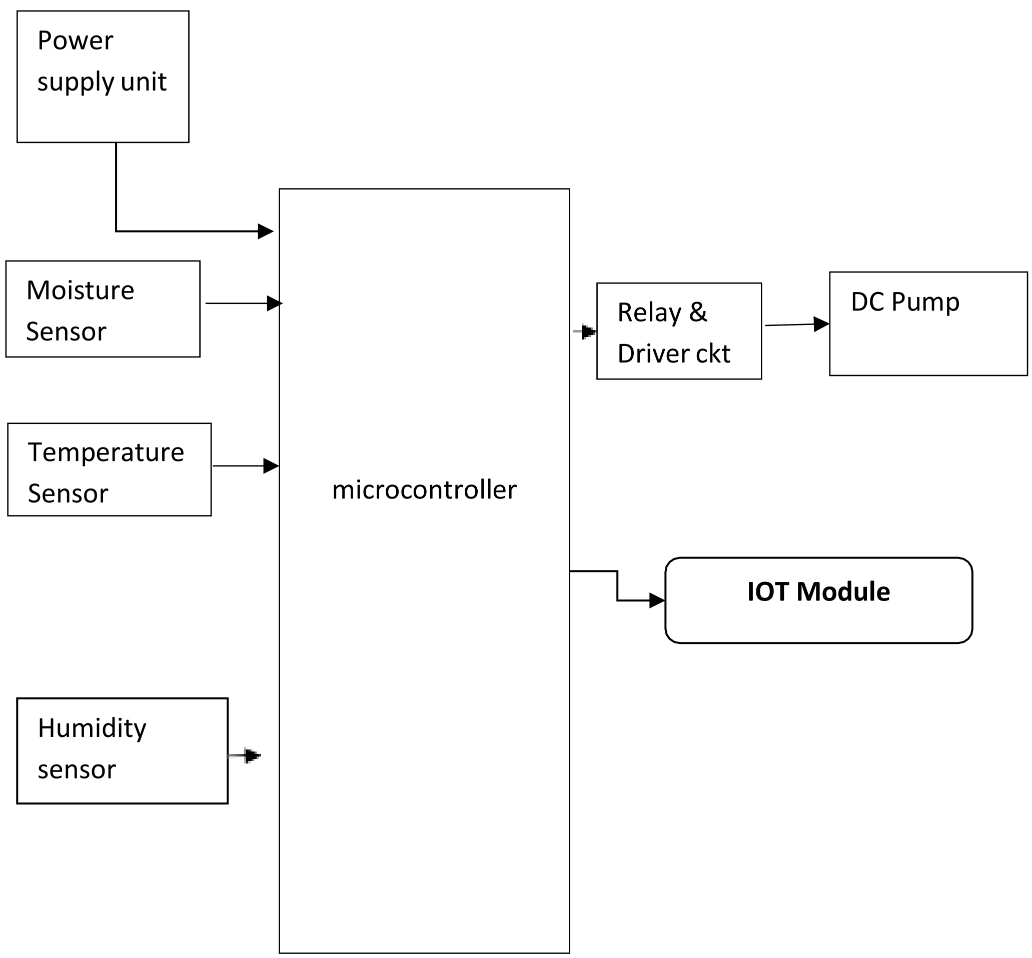
The information is refreshed depending upon whether some updates have occurred or not in the application. The system shall respond to the member in not less than two seconds from the time of the request submittal. The system shall be allowed to take more time when doing large processing jobs. Responses to view information shall take no longer than 5 seconds to appear on the screen.

Reliability

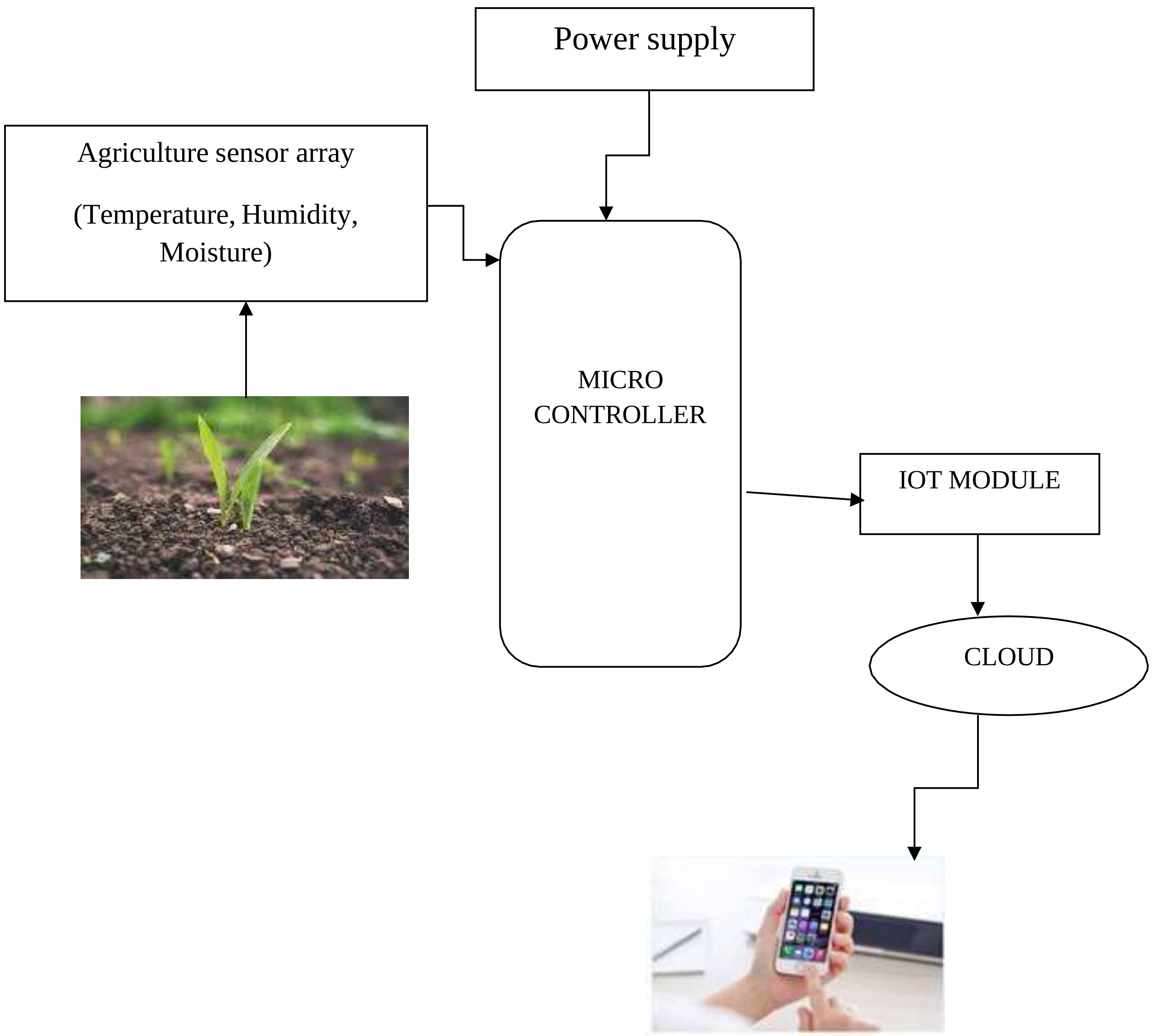
The system has to be 100% reliable due to the importance of data and the damages that can be caused by incorrect or incomplete data. The system will run 7 days a week. 24 hours a day.

5. PROJECT DESIGN

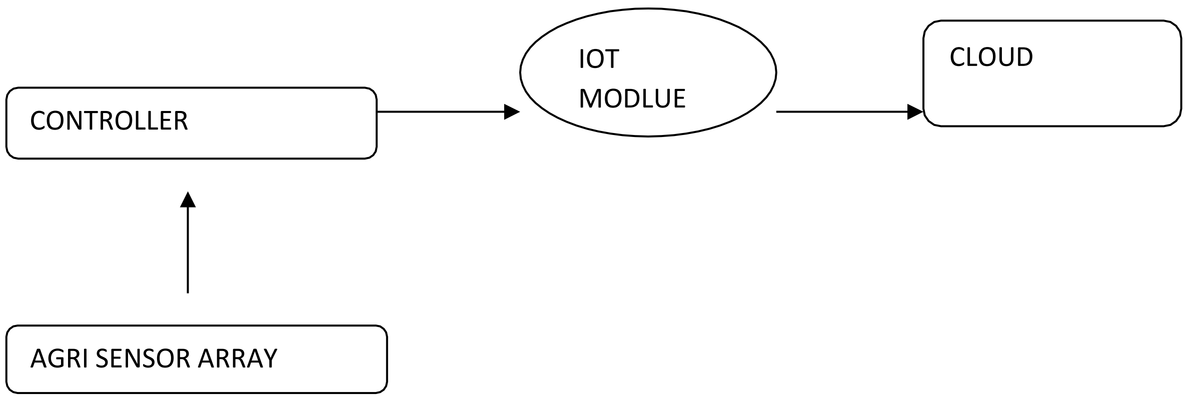
5.1 DATA FLOW DIAGRAMS



5.2 SOLUTION & TECHNICAL ARCHITECTURE



MODULE 1



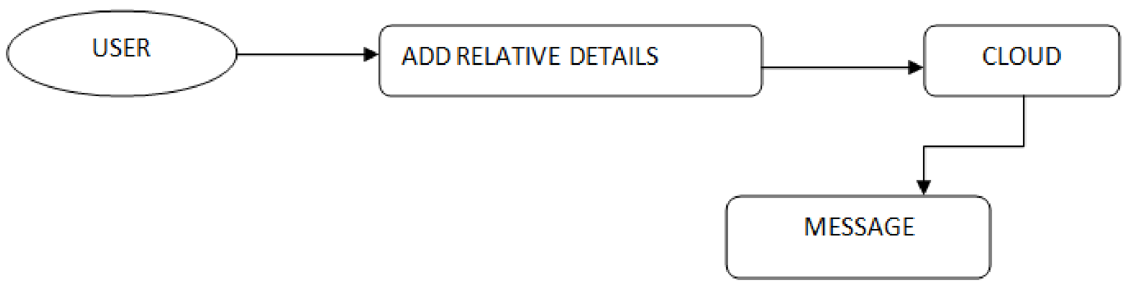
The Internet of things refers to a type of network to connect anything with the Internet based on stipulated protocols through information sensing equipments to conduct information exchange and communications in order to achieve smart recognitions, positioning, tracing, monitoring, and administration. In this paper we briefly discussed about what IOT is, how IOT enables different technologies, about its architecture, characteristics & applications, IOT functional view & what are the future challenges for IOT.

Internet of Things is a new revolution of the Internet. Objects make themselves recognizable and they obtain intelligence by making or enabling context related decisions thanks to the fact that they can communicate information about themselves. They can access information that has been aggregated by other things, or they can be components of complex services. This transformation is concomitant with the emergence of cloud computing capabilities and the transition of the Internet towards IPv6 with an almost unlimited addressing capacity

MODULE 2

Today we are going to build a registration system that keeps track of which users are admin and which are normal users. The normal users in our application are not allowed to access admin pages. All users (Admins as well as normal users) use the same form to login. After logging in, the normal users are redirected to the index page while the admin users are redirected to the admin pages.

MODULE 3



Smart phones are basic needs of our daily life. It's like a small computer which gives you many facilities such as web browsing, downloading and many more but small data storage space and backup are major problem. On the other hand cloud computing provides efficient computational resources and secure data hosting services. But the data transmission amongtwo secure networks is performed over unsecured network. Soneed a design to secure data transfer.

5.3 USER STORIES :

FR No	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Visibility	Sensor nearing the crop field and to check the soil moisture and temperature with the help of humidity sensor
FR-2	User Reception	The Data like values of Temperature, Humidity, Soil moisture sensors are received via SMS
FR-3	User Understanding	Based on the sensor data value to get the information about present of farming land
FR-4	User Action	The user needs take action like destruction of crop residues, deep plowing, crop rotation, fertilizers, strip cropping, scheduled planting operations.

6. PROJECT PLANNING & SCHEDULING :

6.1 SPRINT PLANNING &ESTIMATION :

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1		US-1	Create the IBM Cloud services which are being used in this project.	6	High	S Subashini S Swathi P Varalakshmi R Vasuki
Sprint-1		US-2	Configure the IBM Cloud services which are being used in completing this project.	4	Medium	S Subashini S Swathi P Varalakshmi R Vasuki
Sprint-2		US-3	IBM Watson IoT platform acts as the mediator to connect the web application to IoT devices, so create the IBM Watson IoT platform.	5	Medium	S Swathi P Varalakshmi R Rathna

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
						R Vasuki
Sprint-2		US-4	In order to connect the IoT device to the IBM cloud, create a device in the IBM Watson IoT platform and get the device credentials.	5	High	S Subashini S Swathi P Varalakshmi R Vasuki
Sprint-3		US-1	Configure the connection security and create API keys that are used in the Node-RED service for accessing the IBM IoT Platform.	10	High	S Subashini S Swathi P Varalakshmi R Rathna
Sprint-3		US-2	Create a Node-RED service.	10	High	S Subashini S Swathi P Varalakshmi R Vasuki
Sprint-3		US-1	Develop a python script to publish random sensor data such as temperature, moisture, soil and humidity to the IBM IoT platform	7	High	R Rathna S Swathi P Varalakshmi R Vasuki
Sprint-3		US-2	After developing python code, commands are received just print the statements which represent the control of the devices.	5	Medium	S Swathi P Varalakshmi R Vasuki

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
						R Rathna
Sprint-4		US-3	Publish Data to The IBM Cloud	8	High	S Swathi, P Varalakshmi, R Rathna, R Vasuki.
Sprint-4		US-1	Create Web UI in Node- Red	10	High	S Swathi, P Varalakshmi, R Rathna, R Vasuki.
Sprint-4		US-2	Configure the Node-RED flow to receive data from the IBM IoT platform and also use Cloudant DB nodes to store the received sensor data in the cloudant DB	10	High	S Subashini S Swathi P Varalakshmi R Vasuki

6.2 SPRINT DELIVERY SCHEDULE :

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

6.3 REPORTS FROM JIRA :

VELOCITY : SPRINT – 1

Sprint duration = 5 days

Velocity of team = 20 points

Average Velocity (AV) = Velocity / Sprint Duration

AV = 20/5 = 4

Average Velocity = 4

VELOCITY : Sprint 1-4

Sprint duration = 20 days

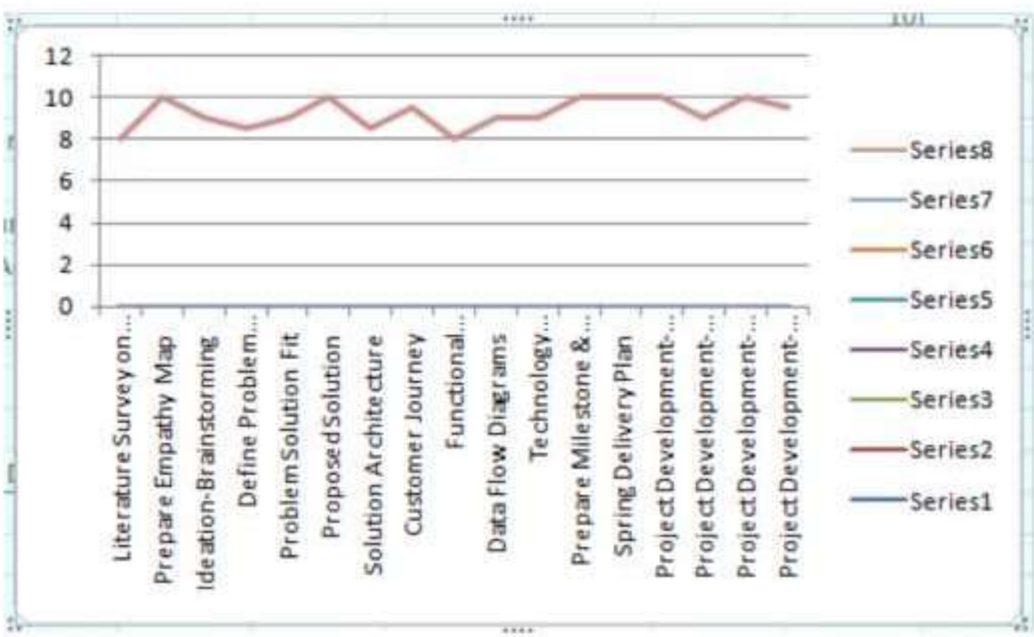
Velocity of team = 80 points

Average Velocity (AV) = Velocity / Sprint Duration

AV = 80 /20 = 4

Total Average Velocity = 4

BURNDOWN CHART :



7. CODING & SOLUTIONING :

7.1 FEATURE 1 :

Android is a powerful open-source operating system which provides a lot of great features, those are

- It’s open-source and we can customize the OS based on our requirements.
- It supports connectivity for GSM, CDMA, WIFI, NFC, Bluetooth, etc. for telephony or data transfer. It will allow us to make or receive a calls / SMS messages and we can send or retrieve data across mobile networks
- By using WIFI technology we can pair with other devices using apps
- Android has multiple APIs to support location-based services such as GPS
- We can perform all data storage related activities by using lightweight database SQLite.
- It has a wide range of media supports like AVI, MKV, FLV, MPEG4, etc. to play or record a variety of audio/video and having a different image format like JPEG, PNG, GIF, BMP, MP3, etc.
- It has extensive support for multimedia hardware control to perform playback or recording using camera and microphone
- It has an integrated open-source Web Kit layout-based web browser to support HTML5, CSS3
- It supports a multi-tasking; we can move from one task window to another and multiple applications can run simultaneously
- It will give a chance to reuse the application components and the replacement of native applications.
- We can access the hardware components like Camera, GPS, and Accelerometer
- It has support for 2D/3D Graphics

7.2 Feature :

AVRs offer a wide range of features:

- Multifunction, bi-directional general-purpose I/O ports with configurable, built-in pull-up resistors
- Multiple internal oscillators, including RC oscillator without external parts
- Internal, self-programmable instruction flash memory up to 256 kB (384 kB on XMega)
- In-system programmable using serial/parallel low-voltage proprietary interfaces or JTAG
- Optional boot code section with independent lock bits for protection
- On-chip debugging (OCD) support through JTAG or debugWIRE on most devices
- The JTAG signals (TMS, TDI, TDO, and TCK) are multiplexed on GPIOs. These pins can be configured to function as JTAG or GPIO depending on the setting of a fuse bit, which can be programmed via ISP or HVSP. By default, AVRs with JTAG come with the JTAG interface enabled.
- debug WIRE uses the /RESET pin as a bi-directional communication channel to access on-chip debug circuitry. It is present on devices with lower pin counts, as it only requires one pin.
- Internal data EEPROM up to 4 kB
- Internal SRAM up to 16 kB (32 kB on XMega)
- External 64 kB little endian data space on certain models, including the Mega8515 and Mega162.
- The external data space is overlaid with the internal data space, such that the full 64 kB address space does not appear on the external bus and accesses to e.g. address 010016 will access internal RAM, not the external bus.
- In certain members of the XMega series, the external data space has been enhanced to support both SRAM and SDRAM. As well, the data addressing modes have been expanded to allow up to 16 MB of data memory to be directly addressed.
- AVRs generally do not support executing code from external memory. Some ASSPs using the AVR core do support external program memory.
- 8-bit and 16-bit timers
- PWM output (some devices have an enhanced PWM peripheral which includes a dead time generator)
- Input capture that record a time stamp triggered by a signal edge

- Analog comparator
- 10 or 12-bit A/D converters, with multiplex of up to 16 channels
- 12-bit D/A converters
- A variety of serial interfaces, including
- I²C compatible Two-Wire Interface (TWI)
- Synchronous/asynchronous serial peripherals (UART/USART) (used with RS-232, RS 485, and more) • Serial Peripheral Interface Bus (SPI)
- Universal Serial Interface (USI): a multi-purpose hardware communication module that can be used to implement an SPI I 2C or UART interface.
- Brownout detection
- Watchdog timer (WDT)
- Multiple power-saving sleep modes
- Lighting and motor control (PWM-specific) controller models
- CAN controller support
- USB controller support
- Proper full-speed (12 Mbit/s) hardware & Hub controller with embedded AVR.
- Also freely available low-speed (1.5 Mbit/s) (HID) bit banging software emulations
- Ethernet controller suppor
- LCD controller support
- Low-voltage devices operating down to 1.8 V (to 0.7 V for parts with built-in DC–DC up converter)
- PicoPower devices
- DMA controllers and "event system" peripheral communication.
- Fast cryptography support for AES and DES

7.3 Database Schema (if Applicable) :

The present chapter introduces the operation of power supply circuits built using filters, rectifiers, and then voltage regulators. Starting with an ac voltage, a steady dc voltage is obtained by rectifying the ac voltage, then filtering to a dc level, and finally, regulating to obtain a desired fixed dc voltage. The regulation is usually obtained from an IC voltage regulator unit, which takes a dc voltage and provides a somewhat lower dc voltage, which remains the same even if the input dc voltage varies, or the output load connected to the dc voltage changes. A block diagram containing the parts of a typical power supply and the voltage at various points in the unit is shown in fig 19.1. The ac voltage, typically 120 V rms, is connected to a transformer, which steps that ac voltage down to the level for the desired dc output. A diode rectifier then provides a full-wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation. A regulator circuit can use this dc input to provide a dc voltage that not only has much less ripple voltage but also remains the same dc value even if the input dc voltage varies somewhat, or the load connected to the output dc voltage changes. This voltage regulation is usually obtained using one of a number of popular voltage regulator IC units.

RS232 Line Type & Logic Level	RS232 Voltage	TTL Voltage to/from MAX232
Data Transmission (Rx/Tx) Logic 0	+3 V to +15 V	0 V
Data Transmission (Rx/Tx) Logic 1	-3 V to -15 V	5 V
Control Signals (RTS/CTS/DTR/DSR) Logic 0	-3 V to -15 V	5 V
Control Signals (RTS/CTS/DTR/DSR) Logic 1	+3 V to +15 V	0 V

IC Part	Output Voltage (V)	Minimum Vi (V)
7805	+5	7.3
7806	+6	8.3
7808	+8	10.5
7810	+10	12.5
7812	+12	14.6
7815	+15	17.7
7818	+18	21.0
7824	+24	27.1

8. TESTING :

Software Testing is a method to check whether the actual software product matches expected requirements and to ensure that software product is Defect free. It involves execution of software/system components using manual or automated tools to evaluate one or more properties of interest. The purpose of software testing is to identify errors, gaps or missing requirements in contrast to actual requirements.

Some prefer saying Software testing definition as a White Box and Black Box Testing. In simple terms, Software Testing means the Verification of Application Under Test (AUT). This Software Testing course introduces testing software to the audience and justifies the importance of software

8.1 TEST CASES :

A Use Case Diagram in the Unified Modeling Language (UML) is a type of behavioral diagram defined by and created from a Use-case analysis. Its purpose is to present a graphical overview of the functionality provided by a system in terms of actors, their goals (represented as use cases), and any dependencies between those use cases.

The main purpose of a use case diagram is to show what system functions are performed for which atr Roles of the actors in the system can be depicted. A use case diagram is a type of behavioral diagram created from a Use-case analysis. Its purpose is to present a graphical overview of the functionality provided by a system in terms of actors, their goals (represented as use cases), and any dependencies between those use cases.

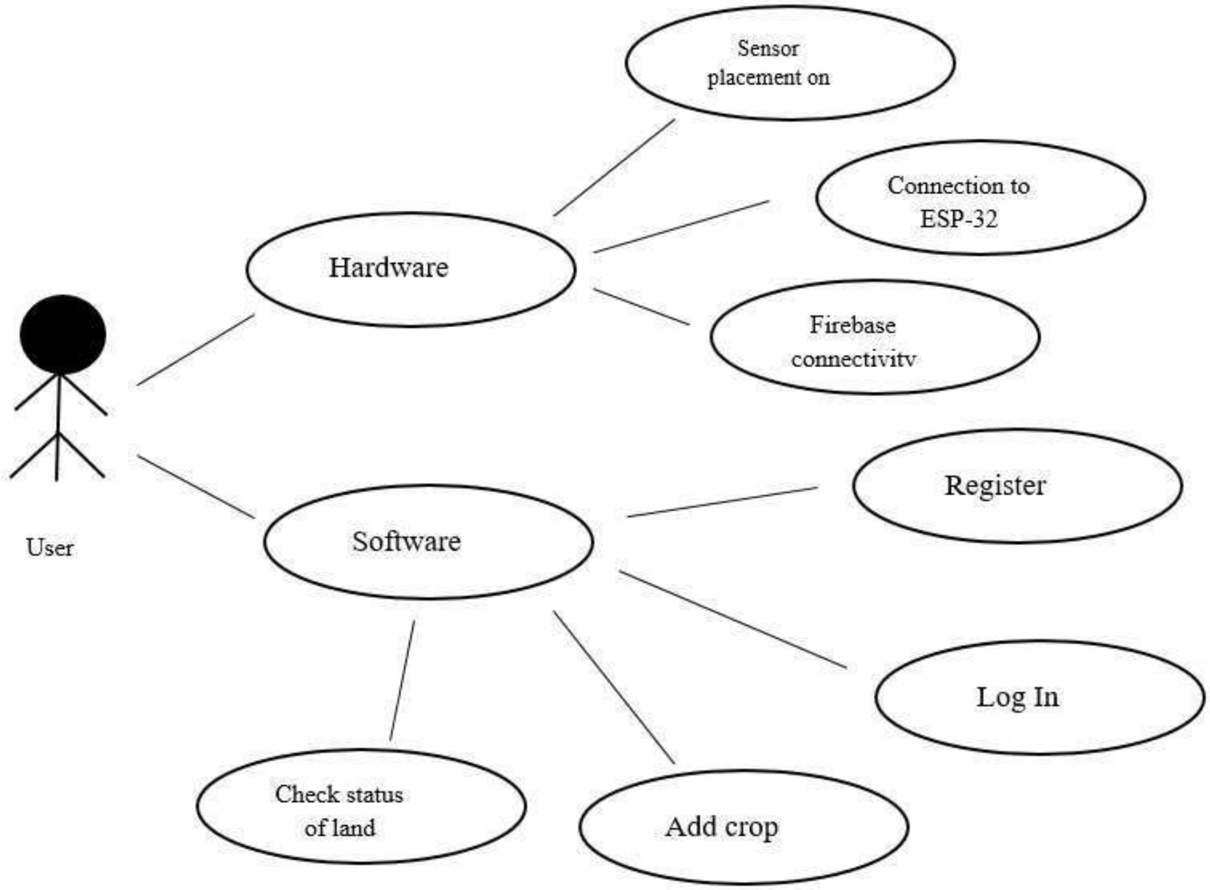


Fig. 3.5.1 Use case Diagram

A strategy for system testing integrates system test cases and design techniques into a well-planned series of steps that results in the successful construction of software. The testing strategy must cooperate test planning test case design, test execution, and the resultant data collection and evaluation. A strategy for is testing must accommodate low-level tests that are necessary to verify that a small source segment has been correctly implemented as well as high level tests that validate major system functions against user requirements.

Software testing is a critical element of software quality assurance and represents the ultimate review of cation design and coding. Testing represents an interesting anomaly for the software. Thus, a series testing is performed for the proposed system before the system is ready for user acceptance testing

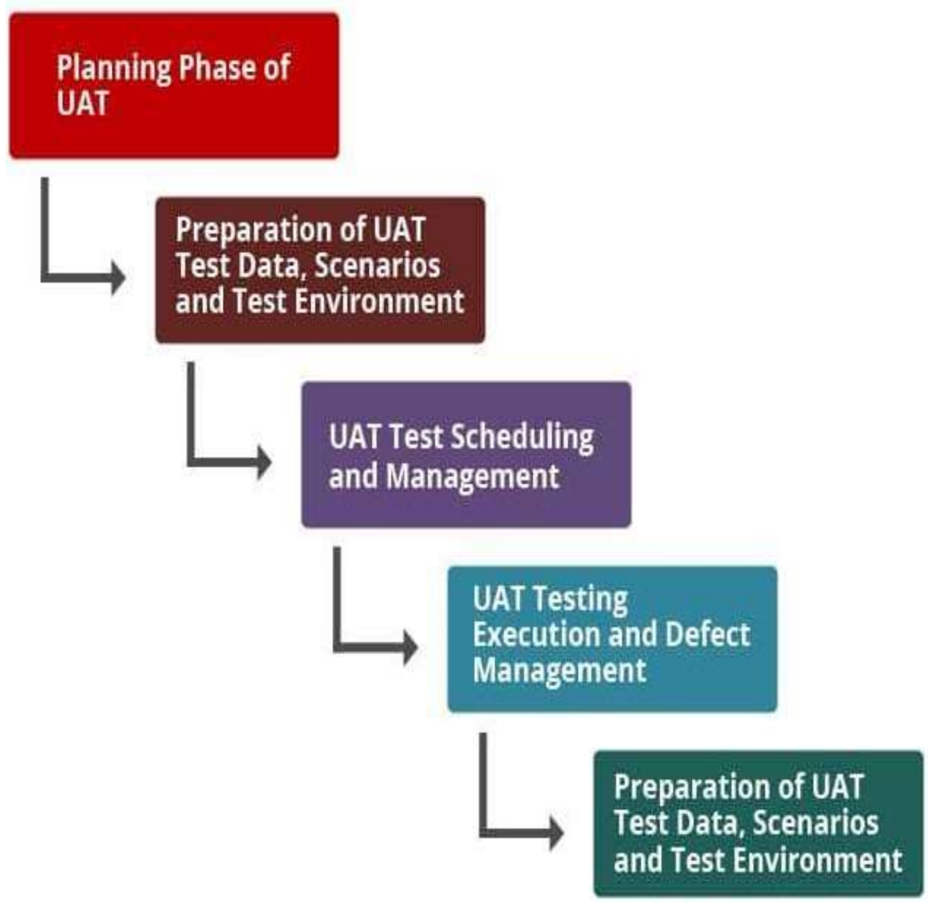
Server Module

Sr. No	Test Case	I/P Procedure	Expected Result	Result Obtained	Status
1	Application open	Click on the application	Application open without any error	Application opens successfully	Pass
2	Application does not open	Click on the application	Application open without any error	Application failure to open	Fail
3	Sign Up	User click on Sign up button	Profile should be created successfully	Profile created Successfully	Pass
4	Log In with Username	User click on Log in button	Logged in Successfully	Logged in Successfully	Pass
5	Not logged in	User click on Log in button	System Failed to Log In	System is not Capable to log in	Fail
6	Click Add Crop	User click on the add button	Shows details to fill crop information	Give details to fil crop information	Pass
7	Click on Added Crop	User click on added crop profile	Shows values of the soil constraints	Displaying o/p successfully	Pass
8	Logout	Click On logout	Logged Out from System	Logged Out from System	Pass

8.2 User Acceptance Testing :

User Acceptance Testing (UAT) is a type of testing performed by the end user or the client to verify/accept the software system before moving the software application to the production environment. UAT is done in the final phase of testing after functional, integration and system testing are done.

Phases of UAT Testing :



1. Planning Phase of UAT:

Assigning a UAT Test Manager to oversee the entire process of UAT is essentially done in this stage. Proper planning and execution strategy are outlined here. Identification of critical resources is done and preparation of a critical resource plan is done.

2. Preparation of UAT Test Data, Scenarios and Test Environment:

UAT readiness is ensured in this phase as the UAT test environment is set up, preparation of test management plan along with test data, interfaces, data, authorization along with scenario readiness is done here.

3. UAT Test Scheduling and Management:

Proper action plans with UAT priorities are done in this phase. A triage process is kept in place to prioritize the assessments of defects blocking if any. An effective mechanism to track test scenarios and test scripts based on the requirements defined is taken up.

4. UAT Testing Execution and Defect Management:

This is an important phase and proper identification of priority defects is taken up and more focus is placed on performing root cause analysis assessments. A trial run of UAT processes is done to validate execution and defects assignment and assessment is taken up for proper and quick resolution.

5. UAT, Sign-off, and Reporting:

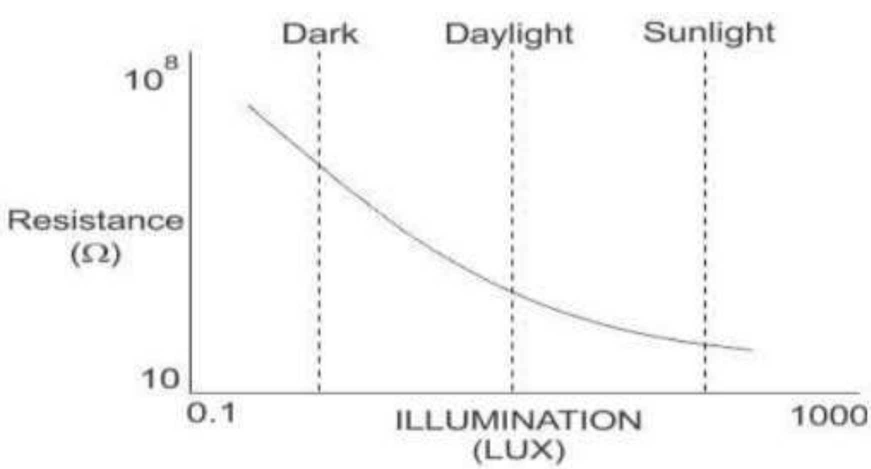
In this final phase of UAT, accurate defect and testing status reports and defect reporting is generated from the test management system. Finally, a sign-off when all bugs have been fixed indicates the acceptance of the software. This final phase ensures and validates that the application developed meets the user requirements and is ready to be moved to production.

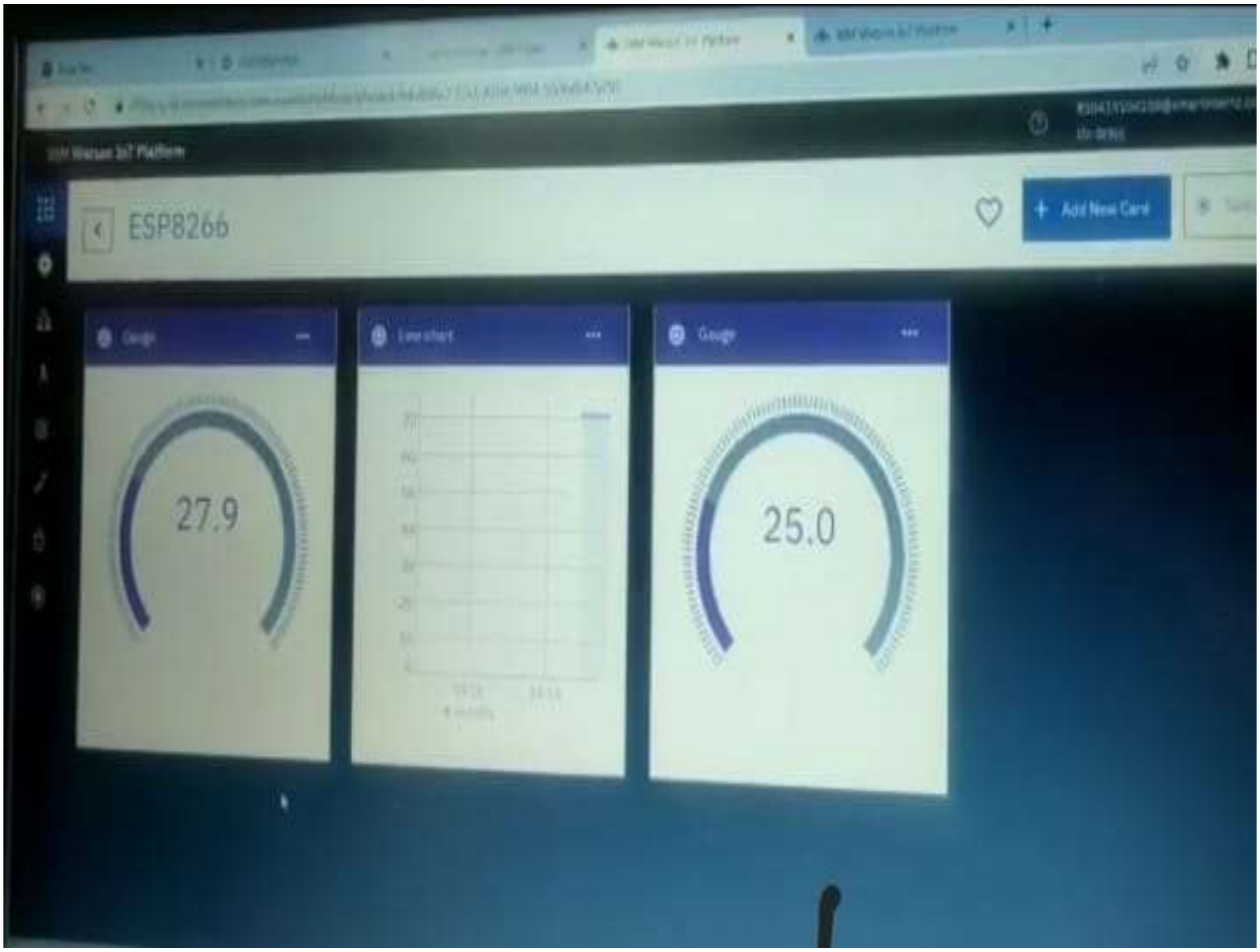
9. RESULT :

9.1 Performance Metrics :

The present chapter introduces the operation of power supply circuits built using filters, rectifiers, and then voltage regulators. Starting with an ac voltage, a steady dc voltage is obtained by rectifying the ac voltage, then filtering to a dc level, and finally, regulating to obtain a desired fixed dc voltage. The regulation is usually obtained from an IC voltage regulator unit, which takes a dc voltage and provides a somewhat lower dc voltage, which remains the same even if the input dc voltage varies, or the output load connected to the dc voltage changes. A block diagram containing the parts of a typical power supply and the voltage at various points in the unit.

The ac voltage, typically 120 V rms, is connected to a transformer, which steps that ac voltage down to the level for the desired dc output. A diode rectifier then provides a full-wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation.





A regulator circuit can use this dc input to provide a dc voltage that not only has much less ripple voltage but also remains the same dc value even if the input dc voltage varies somewhat, or the load connected to the output dc voltage changes. This voltage regulation is usually obtained using one of a number of popular voltage regulator IC units.

Hardware and software are implemented in this project. Firstly, there will a discussion with the supervisor to get a title for the project and how to proceed with it. Then, different related work and literature reviews had to go through to get good information on the project. Next, design the circuits and figure out the platforms which going to be used to develop the system. In the end, this system will be integrated with the IoT platform. Soil moisture, humidity, temperature

10. ADVANTAGES

- Saves water, time, electricity and human energy.
- Discourage weeds.
- Farmer income is increased.
- Crop growth, Water level, water level is intimated alternatively.

DISADVANTAGES

- The human energy is wasted.
- Uniform maintenance is difficult to the formers.
- Farmer to verify the growth of the crop is not easy.

11. CONCLUSION :

IOT based crop field monitoring system serves as a reliable and efficient system for monitoring agricultural parameters. The corrective action can be taken. Wireless monitoring of field not only allows user to reduce the human power, but it also allows user to see accurate changes in it. It is cheaper in cost and consumes less power. The GDP per capita in agro sector can be increased.Agriculture is a backbone of human civilization since man has started agriculture. As the generation evolved, man developed many methods of crop monitoring to provide growth to the crop. In the present scenario on conservation of water is of high importance. Present work is attempts to save the natural resources available for human kind. By continuously monitoring the status of the soil, we can control the flow of water and thereby reduce the wastage. This review is proposed to supports aggressive water management for the agricultural land. Microcontroller in the system promises about increase in systems life by reducing the power consumption resulting in lower power consumption.

After completing this project, it can be concluded that the system works perfectly as planned. It fulfills the two objectives stated at the beginning of this project which is to develop a smart farming application that can monitor the parameters such as temperature, humidity, soil moisture, and pH value, to optimize the use of water by using the controlling system and to analyze vegetative traits of plants using the suitable value of temperature, humidity, soil moisture and pH using Thing Speak. Furthermore, the smart farming system is an efficient method of applying nutrient solutions in which the irrigation system is used as the carrier and the distributor for the plants. In a nutshell, the smart farming system using IoT is well suited for commercial agriculture to maximize profits and yields.

12. FUTURE SCOPE :

Future work would be focused more on increasing sensors on this system to fetch more data especially with regard to Pest Control and by also integrating GPS module in this system to enhance this Agriculture IoT Technology to full-fledged Agriculture Precision ready product.

Smart farming refers to managing farms using modern Information and communication technologies to increase the quantity and quality of products while optimizing the human labor required.

Among the technologies available for present-day farmers are: Sensors: soil, water, light, humidity, temperature management.

Agriculture graduates can explore the sea of opportunities in both the public and private sectors.

They can start their career as Agriculture Officer, Assistant Plantation Manager, Agricultural Research Scientist, Marketing Executive, Business development executive, and many more.

Smart farming is a management concept focused on providing the agricultural industry with the infrastructure to leverage advanced technology – including big data, the cloud and the internet of things (IoT) – for tracking, monitoring, automating and analyzing operations.

"Smart farming" is an emerging concept that refers to managing farms using technologies like IoT, robotics, drones and AI to increase the quantity and quality of products while optimizing the human labor required by production.

13. APPENDIX :

Source Code :

```
#include <ESP8266WiFi.h>
#include <WiFiClient.h>
#include <PubSubClient.h>
#include "DHT.h"

const char* ssid = "SMART-G";
const char* password = "10112019";

#define DHTPIN D6
#define G D0
#define DHTTYPE DHT11
DHT dht(DHTPIN, DHTTYPE);

#define ID "0t9jrj"
#define DEVICE_TYPE "ESP8266"
#define DEVICE_ID "TEST"
#define TOKEN "TEST-12345"

char server[] = ID ".messaging.internetofthings.ibmcloud.com";
```

```
char publish_Topic1[] = "iot-2/evt/Data1/fmt/json";
char publish_Topic2[] = "iot-2/evt/Data2/fmt/json";
char publish_Topic3[] = "iot-2/evt/Data2/fmt/json";
char authMethod[] = "use-token-auth";
char token[] = TOKEN;
char clientId[] = "d:" ID ":" DEVICE_TYPE ":" DEVICE_ID;

WiFiClient wifiClient;
PubSubClient client(server, 1883, NULL, wifiClient);

void setup() {
  pinMode(D0,OUTPUT);
  digitalWrite(D0,HIGH);
  Serial.begin(115200);
  dht.begin();
  Serial.println();
    WiFi.begin(ssid, password);
    while (WiFi.status() != WL_CONNECTED) {
      delay(500);
      Serial.print(".");
    }
    Serial.println("");
```

```
  Serial.println(WiFi.localIP());

  if (!client.connected()) {
    Serial.print("Reconnecting client to ");
    Serial.println(server);
    while (!client.connect(clientId, authMethod, token)) {
      Serial.print(".");
      delay(500);
    }
    Serial.println("Connected TO IBM IoT cloud!");
  }
}

long previous_message = 0;
void loop() {
  client.loop();
  long current = millis();
  if (current - previous_message > 3000) {
    previous_message = current;
     float hum = dht.readHumidity();
     float temp = dht.readTemperature();
     float MOI =  map(analogRead(A0), 0, 1023, 100, 0);
```

```
    if (isnan(hum) || isnan(temp) ){
  Serial.println(F("Failed to read from DHT sensor!"));
  return;
}

Serial.print("Temperature: ");
Serial.print(temp);
Serial.print("°C");
Serial.print(" Humidity: ");
Serial.print(hum);
Serial.print("%");
Serial.print("SOIL MOITURE: ");
Serial.print(MOI);
if(MOI<=10)
{
   digitalWrite(D0,LOW);
   delay(100);
   digitalWrite(D0,HIGH);
  }
  else
  {
   digitalWrite(D0,HIGH);
```

```
}



  String payload = "{\"d\":{\"Name\":\"" DEVICE_ID "\"";
       payload += ",\"Temperature\":";
       payload += temp;
       payload += "}}";

   Serial.print("Sending payload: ");
   Serial.println(payload);

   if (client.publish(publish_Topic1, (char*) payload.c_str())) {
      Serial.println("Published successfully");
   } else {
      Serial.println("Failed");
   }
   String payload1 = "{\"d\":{\"Name\":\"" DEVICE_ID "\"";
       payload1 += ",\"Humidity\":";
       payload1 += hum;
       payload1 += "}}";
       Serial.print("Sending payload: ");
       Serial.println(payload1);
```

```
      Serial.println('\n');

 if (client.publish(publish_Topic2, (char*) payload1.c_str())) {
    Serial.println("Published successfully");
} else {
    Serial.println("Failed");
}



String payload3 = "{\"d\":{\"Name\":\"" DEVICE_ID "\"";
      payload3 += ",\"Moiture\":";
      payload3 += MOI;
      payload3 += "}}";

 Serial.print("Sending payload: ");
 Serial.println(payload3);

 if (client.publish(publish_Topic3, (char*) payload3.c_str())) {
    Serial.println("Published successfully");
} else {
    Serial.println("Failed");
}
```

```
    }
}
```

GITHUB LINK :

IBM-EPBL/**IBM-Project-14325-1659580202**

DEMO VEDIO LINK :

https://drive.google.com/file/d/19EEtapbYky_KsFL4xrScKAt1zqLz_uFA/view?usp=drivesdk