**SMART FARMER-IOT ENABLED SMART FARMING APPLICATION**

**A PROJECT REPORT**

*Submitted by*

# E.JEBA SHEEBA 960419205011

# S.ELSY MANISHA 960419205006

# T.GAYATHIRI 960419205007

# R.SANGEETHA 960419205018

# S.JASMINE GRACE 960419205009

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**ABSTRACT**

Internet of Things (IoT) technology has brought revolution to each and every field of common man’s life by making everything smart and intelligent. IoT refers to a network of things which make a self-configuring network. The development of Intelligent Smart Farming IoT based devices is day by day turning the face of agriculture production by not only enhancing it but also making it cost-effective and reducing wastage. The aim / objective of this report is to propose IoT based Smart Farming System assisting farmers in getting Live Data (Temperature, Soil Moisture) for efficient environment monitoring which will enable them to increase their overall yield and quality of products. The IoT based Smart Farming System being proposed via this report is integrated with Arduino Technology mixed with different Sensors and a Wifi module producing live data feed that can be obtained online from Thingsspeak.com. The product being proposed is tested on Live Agriculture Fields giving high accuracy over 98% in data feeds. From farm to fork, information and communication technology sector is being enhanced to facilitate the farmers, croppers and related users of intelligent services. To feed the ever growing global population, the agriculture industry needs to be extended. Internet of Things opens the door wide for smart farming solution to increase the agricultural production. IoT technologies helps the farmers as a service by providing historical and real time data for predicting soil quality, weather conditions and crop’s health. Smart farming provides the enhanced facility for process automation and evaluation and waste reduction. As a result, all these factors drastically increase the quality and quantity of the food products and decrease the production cost. This paper outlines the promising solutions applied in the sphere of agriculture. The IoT, acronym for the Internet of Things, is a coordination of interconnected digital and mechanical devices, people, animals or objects that have been offered with the talent of sharing information without the assistance of human to machine communication, with the help of unique identifiers. The IoT has faced remarkable victory in the fields of business, medicine, defence, smart city and many more. Agriculture is a main sector that has a vast functional potential while considering the Internet of Things. In order to generate environmental states that are compatible for the growth of plants and animals, protected agriculture uses artificial devices and modern development to manipulate best suited climatic behaviours.

**CHAPTER 1**

**1. INTRODUCTION**

**1.1 PROJECT OVERVIEW**

Internet of Things is a dynamic global information network, supports several applications for users such as healthcare organizations, security, smart transports, traffic management, E-payment, smart farming . Researchers estimate that IoT will consist of 50 billion objects by Most of the organizations can be monitored and controlled by smart IoT devices and applications. IoT is a future networking paradigm which interconnects physically distributed physical and logical resources. IoT environment consists of four primary components such as things, mobile devices or back end devices, Gateway node and Internet. The things are the devices which may be sensors, actuators, RFID, mobile devices and smart appliances. Remote users can access these devices and smart applications by connecting with sensing devices in an unattended environment.

The objectives of this report is to proposed IoT based Smart Farming System which will enable farmers to have live data of soil moisture environment temperature at very low cost so that live monitoring can be done. The structure of the report is as follows: chapter I will cover over of overview of IoT Technology and agriculture-concepts and definition, IOT enabling technologies, IOT application in agriculture, benefits of IOT in agriculture and IOT and agriculture current scenario and future forecasts. Chapter II will cover definition of IOT based smart farming system , the components and modules used in it and working principal of it. Chapter III will cover algorithm and flowchart of the overall process carried out in the system and its final graphical output .chapter IV consist of conclusion, future scope and references**.** The Internet of Things is an emerging topic of technical, social, and economic significance. Consumer products, durable goods, cars and trucks, industrial and utility components, sensors, and other everyday objects are being combined with Internet connectivity and powerful data analytic capabilities that promise to transform the way we work, live, and play. At the same time, however, the Internet of Things raises significant challenges that could stand in the way of realizing its potential benefits. Attention-grabbing headlines about the hacking of Internet-connected devices, surveillance concerns, and privacy fears already have captured public attention. Technical challenges remain and new policy, legal and development challenges are emerging.

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**1.2 PURPOSE**

In agricultural industry, technological advancements lead the comfortable pathway for the farmers. Internet of Things is the driving force behind agricultural production at a lower cost in smarter way. Smart farming technologies can remotely detect soil quality, weather conditions, crop growth, and crop damage using wireless monitoring sensors with cloud based platform. 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 With Smart farming, soil moisture levels are monitored continuously, dramatically reducing unnecessary irrigation and watering.The essence of smart farming is the introduction of new technologies in agricultural activities. The use of drones, artificial intelligence, big data, IoT, satellites, and so on makes farming and agriculture “smart,” allowing growers to optimize their work and get better results. 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. IoT in agriculture uses robots, drones, remote sensors, and computer imaging combined with continuously progressing machine learning and analytical tools for monitoring crops, surveying, and mapping the fields, and providing data to farmers for rational farm management plans to save both time and money. Smart farming helps farmers to better understand the important factors such as water, topography, aspect, vegetation and soil types. This allows farmers to determine the best uses of scarce resources within their production environment and manage these in an environmentally and economically sustainable manner. Smart farming based on IoT technologies enables growers and farmers to reduce waste and enhance productivity ranging from the quantity of fertilizer utilized. Ensuring of safety and security of data and information is a specifically essential element of the Future Internet. Most of the users are worried about the unauthorized use of their data and they require that the expected systems and applications should be safe. Prioritization of information is important. Selection of the relevant, important and reliable information and proving its verity is equally important than to collect and distribute more and more information. Services, the equipment, the devices, etc. should be available everywhere and they can operate their business processes remotely from anywhere and it is necessary that the ap-plications and devices should be integrated and standardized.

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**CHAPTER 2**

**2. LITERATURE SURVEY**

**2.1 EXISTING PROBLEM**

Dramatic changes in the climate and natural disasters seriously affect the plant growth and agricultural production.. Variety of environmental conditions can also be collected by many sensors and stored in integrated and heterogeneous information and reported by internet of Things. The main issue which slows the ability of farmers to profit from latest technologies is connectivity. BTRC has stated that although there are more than ninety millions of Internet users, we do not have exact reports of the usage of Internet of smart phones by farmers for the purpose of agriculture. These technologies are used by vast agriculture companies and are not widely famous with rural farmers. The second and subsequent major challenge is awareness. An American research report states that amidst 1600 farmers, only 68% are familiar with IoT. These technologies will be more challenging in small land holdings and crop diversity compared to large farms. However, manufacturing and maintenance expense of these technologies will also be high. In agronomical farms, the software and hardware expense in soaring due to exposure to the unsympathetic atmosphere such as cold, heat, water, storm, wind, sand and physical dents. The consequent challenge will be to identify the suitable business model. Initiating IoT blindly will not provide success. An IoT business model has to be an essential factor for an agro goal achievement. The next issue is IT security. Devices should be secured against theft and wrong exploit as the prospect of farming predictions is possible, product pricing and expenses could also be manipulated and they should be monitored. In the existing system, there is no source of informing the farmer about the condition of his paddy ﬁ eld via SMS. If any of the sensors goes beyond the set limit or any problem occurs to the motor he can only know by opening the web server. To avoid this situation, we are developing the proposed system, in which the farmer can know immediately if any of the sensors goes beyond the threshold level by SMS .

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**2.2 REFERENCES**

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**2.3 PROBLEM STATEMENT DEFINITION**

For the applications to be cost effective, interoperable and scalable, there should be several open architecture solutions from the aspect of IT design. Selected training should be provided to all farmers free of cost in order to make them comprehend the use of IoT devices. Awareness must be spread around the world for the development of Agro-Tech culture. Guidance and development of required human resources in suitable areas must be provided attention. By approaching the farmers with collaboration and open communication, investors of AI technologies and IoT will be able to provide a significant success to their companies, the farmers and agriculture in general. The fear of technology should be dispersed slowly but steadily. There were suggested that integrated collaboration such as “community of contributors” are required, in which the contributors include agriculture academicians, development experts, software, hardware experts, agriculture business practitioners, agricultural input suppliers, dealers and farmers. This needs to be sanctioned by the government in order to establish a safe and legal practice and for the initiation and gradual development of this segment.

In this era, current farmers are able to utilize agricultural technologies such as the following:

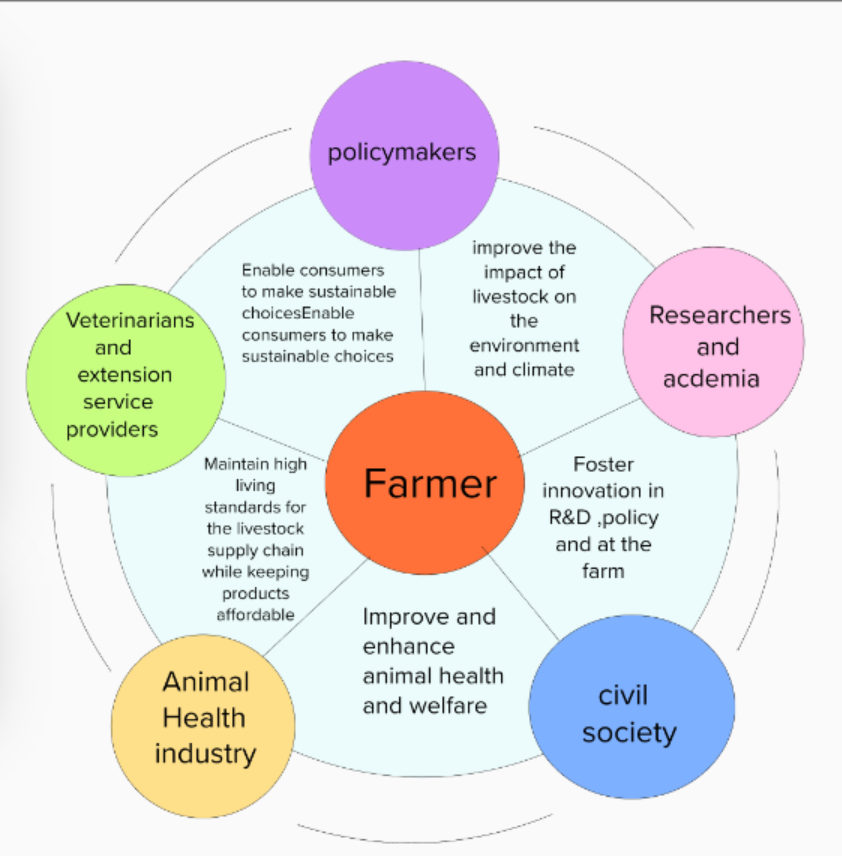
* Sensors: temperature, humidity, light, water, and soil management.
* Software: Tailor made solutions are available in software forms that aims to aid particular farm types with the use of IoT platforms
* Artificial Intelligence: Processing facilities, autonomous tractors, robotics for farm management.
* Location: Satellite, GPS monitoring and recording
* Data analytics: Using data pipelining solution for down streaming, individual analytics solutions.

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**CHAPTER 3**

**IDEATION & PROPOSED SOLUTION**

* 1. **EMPATHY MAP CANVAS**

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* 1. **IDEATION AND BRAINSTORMING**

Identifying new opportunities consist of first and foremost the identification of problems and their context before the generation of solutions, or at least ideas of potential solutions.The objective of the Ideation phase is to generate potential solutions for the problem at stake. In the Ideation phase, the focus is on the ‘what if’ or ‘what could be the future’ after having focused on what the current situation is in the Inspiration phase.While the inspiration phase was in the concrete world the here and the now, the ideation phase is in the abstract world.

|  |  |
| --- | --- |
| **Application Name** | **Description** |
| Crop Water Management | Agriculture IoT is integrated with Web Map Service (WMS) and Sensor Observation Service (SOS) to ensure proper water management for irrigation and in turn reduces water wastage. |
| Precision Agriculture | High accuracy is required is required in terms of weather information which reduces the chances of crop damage. |
| Integraratted Pest Management or Control (IPM/C) | Agriculture IoT systems assures farmers with accurate environmental data via proper live data monitoring of temperature , moisture, plant growth and level of pests so that proper care can be taken during production |
| Other Projects Implemented Till Date | * Cleangrow’s Carbon Nanotube Probe * Temputech’s Wireless Sensor Monitoring * The Phenonet Project by Open IoT. |

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**3.3 PROPOSED SOLUTION**

Controlling water usage for optimal plant growth is enabled by an Internet of Things to monitor tank leveling and schedule irrigation timings. It is also necessary to monitor the unwanted leakages. All these are accessible through the web and mobile applications hosted on enterprise cloud. IoT technologies help the agriculturists and farmers to reduce generated wastes and enhance productivity. It is a practice that makes the farming procedure more controlled and accurate for the growing of crops. After harvesting, for agriculture storage, silos and grain elevators are to be monitored for sensing temperature, pressure, humidity and light levels of the grains.

implementation A. arduino smd

implementation A. arduino smdThe ATmega328/P provides the following features: 32Kbytes of In-System Programmable Flash with Read-While-

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* 1. **PROBLEM SOLUTION FIT**

The advent of technology has helped multiple sectors in attaining profitability. One such sector is agriculture. Internet of Things (IoT) implementation in this field has resulted in the term smart farming. IoT in smart farming is the future of precision farming and results in high quality produce and healthy cattle. With the use of many smart farming sensors, and wearables, one can get real-time update with a touch of the screen.In the next phase of development it would be necessary to develop the design concept at least in three respects: The focus of the pilot development would have to be on an ICT-ecology that co-vers the main challenges and functions of the food chain. Second, it is evident that changes are also required in the methodology of end-user participation. A living lab type of development environment needs to be created, which includes both a technical infrastructure and the social forms of end-user participation. To the latter belongs also a methodology and tool-kit of interact-ing with the end-users and collecting responses and results of their inputs. The third is to develop a conceptual prototype that showcases how the Smart Farming concept should be considered in the light of a constant change in the concept of operations and the role of farming activity in an ICT-based society. It would be very important to involve the policy, government and regulatory aspects into the development work. Even more important would be to consider how the current economic structures and institutions should respond to the changes required in the entire value chain

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**4. REQUIREMENT ANALYSIS**

**4.1 FUNCTIONAL REQUIREMENT**

* Resource discovery
* Resource management
* Data management
* Event management
* Code management

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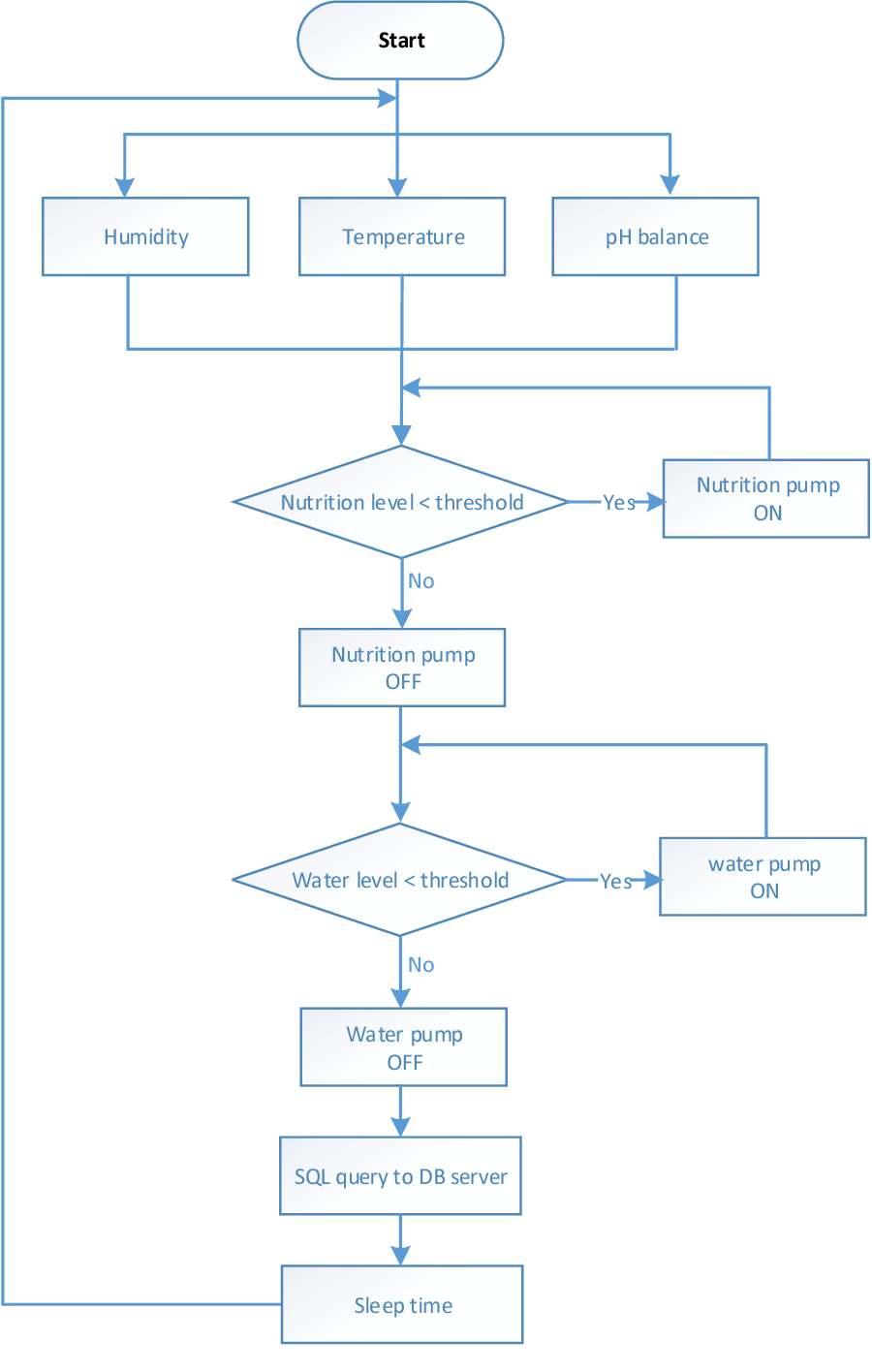
**4.2 NON FUNCTIONAL REQUIREMENTS**

* Scalability
* Real-time or timeliness
* Availability
* Security
* Privacy Ease of deployment, maintenance, and use Interoperability
* Spontaneous interaction
* Multiplicity
* Adaptability and flexibility

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**5. PROJECT DESIGN**

**5.1 DATA FLOW DIAGRAMS**

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**5.2 SOLUTION & TECHNICAL ARCHITECTURE**

The first result of this design step is the set of conceptual models of the Smart Spraying system from the usage point of view. Two types of conceptual models were constructed.

The first model was an overall model that makes explicit the connection of the Smart Spraying Pilot to the overall objectives of the food chain. The second model provided a conceptualisation of the core-task demands of smart spraying, and the innovative technology concept divided into functional requirements and innovative solutions. End user evaluations concerning the main in-novative solutions of the model were received as follows.

**General**

* The Smart spraying project was found challenging because there is already existing infra-structure in farming field and one big concern is how that can be connected to the new in-ternet supported infrastructure.
* Adopting this kind of future internet supported farming system demands a change also in the farming/working culture.
* The farmers did not think it would be impossible to mark their own information in the cloud appropriately. Defined ownership of information is essential if one is going to sell and develop new business around it.

**Solution** : Tailored services: Integration of external and internal data for tailored spraying services

* Potential is seen when local (e.g. micro level) information can be easily connected with the data provided by other service providers/ sources and in this way made even more accurate and suitable for own purposes.
* Micro weather information service would be useful for local farmers and could potentially create some new business. It is important to know if it is going to rain within two hour or eight hours.
* Main challenge is that different equipment does not communicate with each other. All systems so far have been closed.
* It would be useful if it would be possible to collect the weather information from many local actors and aggregate that as an “own weather” service. This could then be used for optimizing own farming process. The farmer could also develop refined services for sale for other purposes (e.g. local holiday weather).

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**5.3 User Stories**

In this step end user needs were conceptualised on the basis of interviews and focus groups which were carried out in five countries within Work Package 700 of SmartAgriFood project. Participants expressed limitations of present farming situation with currently available technical equipment and also brought up their needs and expectations from the future technology.

**Information and data:**

* The most important need is sufficient information (weather and ambient conditions, soil conditions etc.) collected into a connected database.
* Getting the right information or sharing the information and knowledge with the neighboring farmers – via a shared infrastructure - was found important.nd data.

**Communication and data transfer:**

* The communication within a farm or between the partners is too slow.
* Large sized files, photos and videos cannot be transmitted.

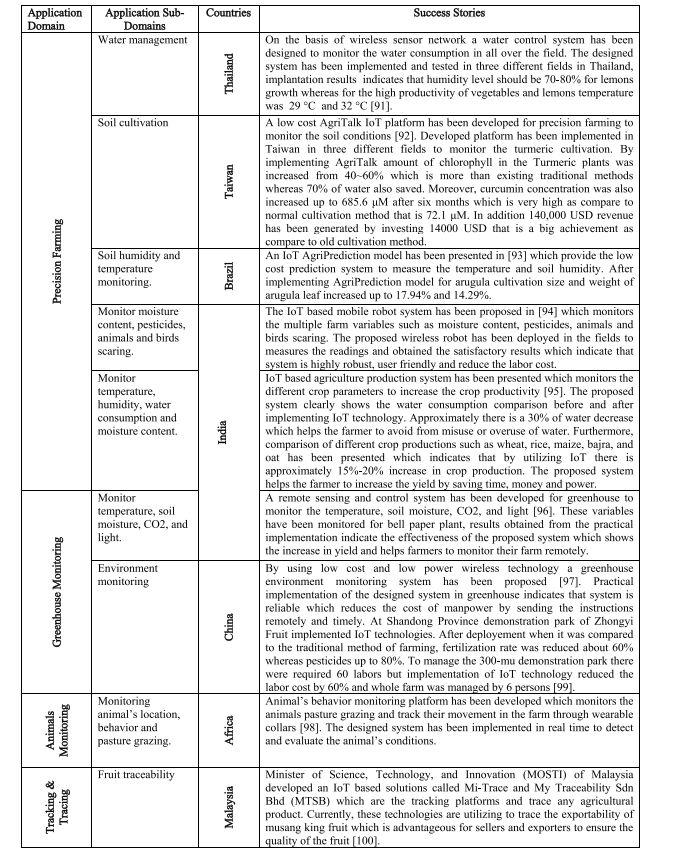
**Applications and devices:**

* The current devices and files cannot be combined with each other and are not standardized. The applications are segregated and are not used, or cannot be organized into a system.
* There are no appropriate applications or the applications and solutions are too expensive,in addition the use of these applications is often very complicated.

**Security, good availability and quality of information:**

* Ensuring of safety and security of data and information is a specifically essential element of the Future Internet. Most of the users are worried about the unauthorized use of their data and they require that the expected systems and applications should be safe.
* Availability of databases should be regulated and controlled to guarantee the data security and protection.

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**CHAPTER 6**

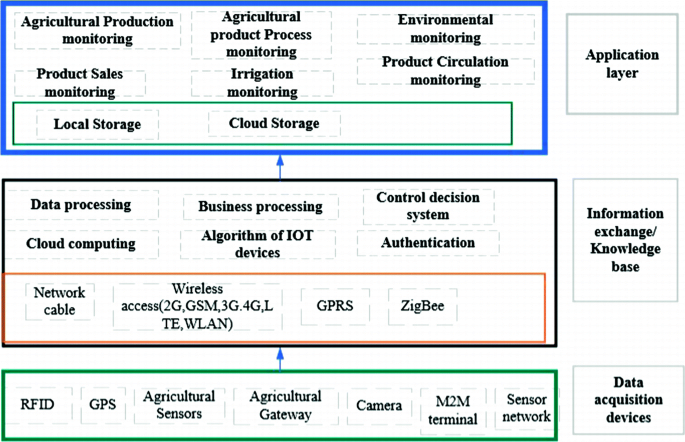
**PROJECT PLANNING & SCHEDULING**

**6.1 SPRINT PLANNING & ESTIMATION**

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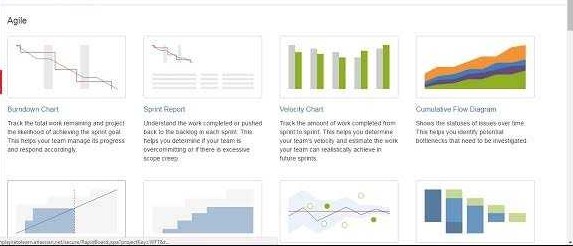
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6.2 SPRINT DELIVERY SCHEDULE



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* 1. **REPORTS FROM JIRA**

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**CHAPTER 7**

**CODING & SOLUTIONING**

**7.1 FEATURE 1**

### Livestock tracking and Geo fencing

Playing an important role in any farm’s sustainability, domestic animals are raised as commodities and produce. With 70% thefts in livestock reported every year, real time geofencing is a boon for farmers.

### Smart logistics and warehousing

Farms are often huge productions. Harvest times results in yield that is a logistics nightmare. With smart agriculture solutions in place, storage and processing in warehouses can be done smoothly.

### Smart pest management

Pesticides help in preventing infestations. But the wrong quantity can result indestroyed crops. In order to avoid such situations, smart pest management provides detailed analytics which predict swarm patterns and alerts on the health of the crops.

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**7.2 FEATURE 2**

### Smart Greenhouses

While growing delicate and exotic flowers or herbs, climate control plays a big hand. Plants grow and thrive in smart green houses with an increase in quality and yield. As demand increases, smart greenhouses become an important tool to meet the output required. Green houses have been industrialized in size and capacity to grow fruits and vegetables.

### Climate monitoring and forecasting

Nature is a fickle friend of the farmers. Climate change, weather forecasts are now key features in in precision farming. They alert the farmer of the impending changes and help ensure preventive measures. With sensors in place to predict and analyze the weather, crops can be saves from being destroyed.

### Predictive analytics for crops and livestock

IoT in smart farming is not restricted to a particular section. Smart farming sensors can be placed right in the ground. There, it shall read and analysis the derived data and help improve farming practices. Primarily, the leaf to soil ratio and soil humidity help increase quantity and quality of the produce. Wearables for cattle are the best bet against poaching and cattle napping.

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7.3 DATABASE SCHEMA

In this framework, the business processes (lower layer) focus on the generation and use of Big Data in the management of farming processes. For this reason, we subdivided this part into the data chain, the farm management and the farm processes. The data chain interacts with farm processes and farm management processes through various decision making processes in which information plays an important role. The stakeholder network (middle layer) comprises all stakeholders that are involved in these processes, not only users of Big Data but also companies that are specialized in data management and regulatory and policy actors. Finally, the network management layer typifies the organizational and technological structures in the network that facilitate coordination and management of the processes that are performed by the actors in the stakeholder network layer. The technology component of network management (upper layer) focuses on the information infrastructure that supports the data c

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**CHAPTER 8**

**TESTING**

**8.1 TEST CASES**

**SOIL TESTING**

There are three different methods has been carried to test the soil, they are moisture test, respiration test and bulk density test.Soil moisture test is to be performed first because it plays a key role in exchange of water and heat energy between the land surface and the atmosphere,through evaporation and plant transpiration. By considering the soil moisture test results we can perform the further tests like soil respiration test.Soil breathes! Soil respiration is an indicator of biological activity or soil life. This activity is as important to the soil ecosystem as healthy lungs are to us. However, more activity is not always better; it may indicate an unstable system (i.e., after tillage).For efficient sampling, the soil respiration test is performed. The best time to run the soil respiration test is when soil moisture is at field capacity. The bulk density measurement should be performed at the soil surface and/or in a compacted zone. Measure the bulk density near the site of the respiration tests. Bulit density is the weight of soil for a given volume. The greater the density, the less

pore space for water movement, root growth and penetration and seedling germination. After the completion of the three tests on the soil the results obtained by them are used to decide which crop is suitable for that particular soil. This can be done by using decision tree algorithms. After sowing the seeds it regularly checks the soil moisture levels and if moisture levels decreases we need to supply fresh water to the field in required quantity. If water is notsupplied to the field the moisture levels of the soil decreases, due to this seed germination cannot be done properly.

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**8.2 USER ACCEPTANCE TESTING**

Internet of things (IoT) systems are becoming ubiquitous and assuring their quality is fundamental. Unfortunately, a few proposals for testing these complex, and often safety-critical, systems are present in the literature. The authors propose an approach for acceptance testing of IoT systems adopting graphical user interfaces as a principal way of interaction. Acceptance testing is a type of black box testing based on test scenarios, i.e. sequences of steps/actions performed by the user or the system. In their approach, test scenarios are derived from a state machine that expresses the behaviour of the system under test, and test cases are derived from them by specifying the actual data and assertions and made executable by implementing the corresponding test scripts. As a case study, they selected a mobile health IoT system for diabetes management composed of local sensors/actuators, smartphones, and a remote cloud-based system. The effectiveness of the approach has been evaluated by measuring the capability of two test suites implemented using different localisation strategies (visual and structure-based) in detecting mutants of the original m-health system. Results show the effectiveness of the test suites implemented by following the proposed approach since 93% of the generated mutants have been detected.

In general, a complete test plan should include a combination of unit testing (components should be isolated and tested early), integration testing (components should be tested as a group, proceeding, e.g. bottom-up), and acceptance testing, and should be conducted at two different levels:

* Testing a *virtualised version of the IoT system*, where real hardware devices are not employed. In their place, virtual devices (e.g. a mock glucose sensor) have to be implemented and used for stimulating the applications under test.
* Testing the *real IoT system* complete of applications and devices (i.e. glucose sensor and insulin pump). The goal here is testing the system under real conditions, i.e. under real world scenarios like communication of the application with hardware, network, and other applications.

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**CHAPTER 9**

**RESULTS**

**9.1 PERFORMANCE METRICS**

* Aligns employee goals, team goals, company goals in one single direction through strategy.
* Metrics help you run more effective and short meetings.
* Help make business decisions by promoting accountability among employees.
* Metrics clarify performance expectations and Motivate employees to perform better at work.
* Metrics drive business execution and helps in Metrics focusing people's attention on what is important.

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**CHAPTER 10**

**ADVANTAGES & DISADVANTAGES**

**ADVANTAGES :**

* Efficiently resource utilization: If we comprehend the characteristics and how any system operates, we can enhance sustainable resource utilization and track natural resources.
* Minimalize human work: IoT devices minimize our labor by connecting and communicating with one another and doing a range of functions for us.
* Save time: It undoubtedly saves time by minimizing energy input. Time is the most essential thing that can be saved by utilizing an loT platform.
* Enhance Data Collection: As devices in IoT continuously communicate with each other so data is always shared by them which enhances the data collection.
* Improve security: We can make our system secure if we have connections between everything in that system.

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**DISADVANTAGES :**

* Security: In IoT systems, all the devices are interlinked and connected to communicate with one another. Even with several safekeeping measures, the device provides control and can be used to launch different sorts of network attacks.
* Privacy: Even though the users don't keenly play a part, the IoT structure offers widespread personal data in great detail.
* Complexity: It is very tough of planning, building, managing, and enabling a broad technology in IoT systems".

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**CHAPTER 11**

**CONCLUSION**

IoT based SMART FARMING APPLICATION for Live Monitoring of Temperature and Soil Moisture has been proposed using Arduino and Cloud Computing . The System has high efficiency and accuracy In fetching the live data of temperature and soil moisture. The IoT based smart farming System being proposed via this report will assist farmers in increasing the agriculture yield and take efficient care of food production as the System will always provide helping hand to farmers for getting accurate live feed of environmental temperature and soil moisture with more than 99% accurate results. All over the globe researchers are exploring technological solutions to enhance the agriculture productivity in a way that complements existing services by deploying IoT technology. In this article, we have presented a comprehensive survey on the state-of-the-art for IoT in agriculture. To this end, we discuss agricultural network architecture, platform, and topology which help to access to IoT backbone and facilitates farmers to enhance the crop productivity. In addition, this article provides an extensive overview on current and continuing advances in IoT agricultural applications, devices/sensors, communication protocols and many innovative technologies. This research considers various IoT agricultural challenges and security requirements for the better understanding of IoT smart farming security. Furthermore, many important dimensions of IoT based agricultural including technologies, industries trends and countries policies have been also been presented to facilitate various stake holders. Government has started patronizing IoT in agriculture and it is anticipated that soon IoT in agriculture will revamp the conventional farming method. It is also clear that many big organizations have started investing and developing new techniques for farm management system using IoT. Finally, it is expected that this comprehensive survey results into a very useful piece of information for researchers, professionals, agriculturists and policy makers who are participating and working in IoT \_eld and agricultural technologies.

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**CHAPTER 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. Therefore, when talking about “big data”, the stakeholders are specifically addressing the FI-driven potentials that are expected to enable the tracking and processing of information in rela-tion to hundreds or even thousands of events of billions of objects that are moving through the agri-food chain, while the monitored data is uniquely identified as well as combined with plain text information or documents and multi-media type of information that would provide the basis for further event processing, reasoning and even enabling business intelligence type of algo-rithms to better predict potential quality problems, logistics issues as well as to assess the trust-worthiness of business partners.

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**CHAPTER 13**

**APPENDIX**

**SOURCE CODE**

#include <ESP8266WiFi.h>

#include <DallasTemperature.h>call

#include <OneWire.h>

#include "DHT.h"

#include "Adafruit\_MQTT.h"

#include "Adafruit\_MQTT\_Client.h"

#include <ArduinoJson.h>

const char \*ssid = "Galaxy-M20"; // Enter your WiFi Name

const char \*pass = "ac312124"; // Enter your WiFi Password

WiFiClient client;

#define MQTT\_SERV "io.adafruit.com"

#define MQTT\_PORT 1883

#define MQTT\_NAME "aschoudhary" // Your Adafruit IO Username

#define MQTT\_PASS "1ac95cb8580b4271bbb6d9f75d0668f1" // Adafruit IO AIO key

const char server[] = "api.openweathermap.org";

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String nameOfCity = "Jaipur,IN";

String apiKey = "e8b22b36da932dce8f31ec9be9cb68a3";

String text;

const char\* icon="";

int jsonend = 0;

boolean startJson = false;

int status = WL\_IDLE\_STATUS;

#define JSON\_BUFF\_DIMENSION 2500

unsigned long lastConnectionTime = 10 \* 60 \* 1000; // last time you connected to the server, in milliseconds

const unsigned long postInterval = 10 \* 60 \* 1000; // posting interval of 10 minutes (10L \* 1000L; 10 seconds delay for testing)

const int ldrPin = D1;

const int ledPin = D0;

const int moisturePin = A0; // moisteure sensor pin

const int motorPin = D8;

float moisturePercentage; //moisture reading

int temperature, humidity, soiltemp;

**33**

#define ONE\_WIRE\_BUS 4 //D2 pin of nodemcu

#define DHTTYPE DHT11 // DHT 11

#define dht\_dpin D4

DHT dht(dht\_dpin, DHTTYPE);

OneWire oneWire(ONE\_WIRE\_BUS);

DallasTemperature sensors(&oneWire);

const unsigned long Interval = 50000;

unsigned long previousTime = 0;

//Set up the feed you're publishing to

Adafruit\_MQTT\_Client mqtt(&client, MQTT\_SERV, MQTT\_PORT, MQTT\_NAME, MQTT\_PASS);

Adafruit\_MQTT\_Publish Moisture = Adafruit\_MQTT\_Publish(&mqtt,MQTT\_NAME "/f/Moisture"); // Moisture is the feed name where you will publish your data

Adafruit\_MQTT\_Publish Temperature = Adafruit\_MQTT\_Publish(&mqtt,MQTT\_NAME "/f/Temperature");

Adafruit\_MQTT\_Publish Humidity = Adafruit\_MQTT\_Publish(&mqtt,MQTT\_NAME "/f/Humidity");

Adafruit\_MQTT\_Publish SoilTemp = Adafruit\_MQTT\_Publish(&mqtt,MQTT\_NAME "/f/SoilTemp");

Adafruit\_MQTT\_Publish WeatherData = Adafruit\_MQTT\_Publish(&mqtt,MQTT\_NAME "/f/WeatherData");

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//Set up the feed you're subscribing to

Adafruit\_MQTT\_Subscribe LED = Adafruit\_MQTT\_Subscribe(&mqtt, MQTT\_NAME "/f/LED");

Adafruit\_MQTT\_Subscribe Pump = Adafruit\_MQTT\_Subscribe(&mqtt, MQTT\_NAME "/f/Pump");

void setup()

{

Serial.begin(9600);

delay(10);

dht.begin();

sensors.begin();

mqtt.subscribe(&LED);

mqtt.subscribe(&Pump);

pinMode(motorPin, OUTPUT);

pinMode(ledPin, OUTPUT);

pinMode(ldrPin, INPUT);

digitalWrite(motorPin, LOW); // keep motor off initally

digitalWrite(ledPin, HIGH);

text.reserve(JSON\_BUFF\_DIMENSION);

Serial.println("Connecting to ");

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Serial.println(ssid);

WiFi.begin(ssid, pass);

while (WiFi.status() != WL\_CONNECTED)

{

delay(500);

Serial.print("."); // print ... till not connected

}

Serial.println("");

Serial.println("WiFi connected");

}

void loop()

{

unsigned long currentTime = millis();

MQTT\_connect();

if (millis() - lastConnectionTime > postInterval) {

// note the time that the connection was made:

lastConnectionTime = millis();

makehttpRequest();

}

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//}

int ldrStatus = analogRead(ldrPin);

if (ldrStatus <= 200) {

digitalWrite(ledPin, HIGH);

Serial.print("Its DARK, Turn on the LED : ");

Serial.println(ldrStatus);

}

else {

digitalWrite(ledPin, LOW);

Serial.print("Its BRIGHT, Turn off the LED : ");

Serial.println(ldrStatus);

}

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

Serial.print("Soil Moisture is = ");

Serial.print(moisturePercentage);

Serial.println("%");

if (moisturePercentage < 35) {

digitalWrite(motorPin, HIGH); // tun on motor

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}

if (moisturePercentage > 38) {

digitalWrite(motorPin, LOW); // turn off mottor

}

temperature = dht.readTemperature();

humidity = dht.readHumidity();

//Serial.print("Temperature: ");

//Serial.print(temperature);

//Serial.println();

//Serial.print("Humidity: ");

//Serial.print(humidity);

//Serial.println();

sensors.requestTemperatures();

soiltemp = sensors.getTempCByIndex(0);

// Serial.println("Soil Temperature: ");

// Serial.println(soiltemp);

if (currentTime - previousTime >= Interval) {

if (! Moisture.publish(moisturePercentage)) //This condition is used to publish the Variable (moisturePercentage) on adafruit IO. Change thevariable according to yours.

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{

}

if (! Temperature.publish(temperature))

{

}

if (! Humidity.publish(humidity))

{

//delay(30000);

}

if (! SoilTemp.publish(soiltemp))

{

}

if (! WeatherData.publish(icon))

{

}

previousTime = currentTime;

}

Adafruit\_MQTT\_Subscribe \* subscription;

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while ((subscription = mqtt.readSubscription(5000))) //Dont use this one until you are conrolling something or getting data from Adafruit IO.

{

if (subscription == &LED)

{

//Print the new value to the serial monitor

Serial.println((char\*) LED.lastread);

if (!strcmp((char\*) LED.lastread, "OFF"))

{

digitalWrite(ledPin, LOW);

}

if (!strcmp((char\*) LED.lastread, "ON"))

{

digitalWrite(ledPin, HIGH);

}

}

if (subscription == &Pump)

{

//Print the new value to the serial monitor

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Serial.println((char\*) Pump.lastread);

if (!strcmp((char\*) Pump.lastread, "OFF"))

{

digitalWrite(motorPin, HIGH);

}

if (!strcmp((char\*) Pump.lastread, "ON"))

{

digitalWrite(motorPin, LOW);

}

}

}

delay(9000);

// client.publish(WeatherData, icon)

}

void MQTT\_connect()

{

int8\_t ret;

// Stop if already connected.

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if (mqtt.connected())

{

return;

}

uint8\_t retries = 3;

while ((ret = mqtt.connect()) != 0) // connect will return 0 for connected

{

mqtt.disconnect();

delay(5000); // wait 5 seconds

retries--;

if (retries == 0)

{

// basically die and wait for WDT to reset me

while (1);

}

}

}

void makehttpRequest() {

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// close any connection before send a new request to allow client make connection to server

client.stop();

// if there's a successful connection:

if (client.connect(server, 80)) {

client.println("GET /data/2.5/forecast?q=" + nameOfCity + "&APPID=" + apiKey + "&mode=json&units=metric&cnt=2 HTTP/1.1");

client.println("Host: api.openweathermap.org");

client.println("User-Agent: ArduinoWiFi/1.1");

client.println("Connection: close");

client.println();

unsigned long timeout = millis();

while (client.available() == 0) {

if (millis() - timeout > 5000) {

Serial.println(">>> Client Timeout !");

client.stop();

return;

}

}

char c = 0;

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while (client.available()) {

c = client.read();

// since json contains equal number of open and close curly brackets, this means we can determine when a json is completely received by counting

// the open and close occurences,

//Serial.print(c);

if (c == '{') {

startJson = true; // set startJson true to indicate json message has started

jsonend++;

}

if (c == '}') {

jsonend--;

}

if (startJson == true) {

text += c;

}

// if jsonend = 0 then we have have received equal number of curly braces

if (jsonend == 0 && startJson == true) {

parseJson(text.c\_str()); // parse c string text in parseJson function

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text = ""; // clear text string for the next time

startJson = false; // set startJson to false to indicate that a new message has not yet started

}

}

}

else {

// if no connction was made:

Serial.println("connection failed");

return;

}

}

//to parse json data recieved from OWM

void parseJson(const char \* jsonString) {

//StaticJsonBuffer<4000> jsonBuffer;

const size\_t bufferSize = 2\*JSON\_ARRAY\_SIZE(1) + JSON\_ARRAY\_SIZE(2) + 4\*JSON\_OBJECT\_SIZE(1) + 3\*JSON\_OBJECT\_SIZE(2) + 3\*JSON\_OBJECT\_SIZE(4) + JSON\_OBJECT\_SIZE(5) + 2\*JSON\_OBJECT\_SIZE(7) + 2\*JSON\_OBJECT\_SIZE(8) + 720;

DynamicJsonBuffer jsonBuffer(bufferSize);

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// DynamicJsonDocument(bufferSize);

// FIND FIELDS IN JSON TREE

JsonObject& root = jsonBuffer.parseObject(jsonString);

if (!root.success()) {

Serial.println("parseObject() failed");

return;

}

JsonArray& list = root["list"];

JsonObject& nowT = list[0];

JsonObject& later = list[1];

JsonObject& tommorow = list[2];

// String conditions = list.weather.main;

// including temperature and humidity for those who may wish to hack it in

String city = root["city"]["name"];

String weatherNow = nowT["weather"][0]["description"];

String weatherLater = later["weather"][0]["description"];

String list12 = later["weather"][0]["list"];

Serial.println(list12);

Serial.println(weatherLater);

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if(weatherLater == "few clouds"){

icon = "Few Clouds";

Serial.print(icon);

}

else if(weatherLater == "rain"){

icon = "Rain";

Serial.print(icon);

}

else if(weatherLater == "broken clouds"){

icon = "Broken Clouds";

Serial.print(icon);

}

else {

icon = "Sunny";

}

}

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**GITHUB & PROJECT DEMO LINK**

<https://github.com/IBM-EPBL/IBM-Project-44118-1660722368/invitations>

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