PROJECT REPORT

PROJECT TITTLE: Smart Farmer - IoT Enabled Smart Farming Application

TEAM ID: PNT2022TMID37002

INTRODUCTION

Overview:

* *Agriculture plays vital role to build country economy as it provides food for the whole population. In this way, it connects and communicates with all of the country's important businesses. If a country's agricultural foundation is quite vast, it is considered socially and economically wealthy. As a result, the agri-industry must implement IoT in order to feed this huge population. Major problems, such as rising food demand, climate change, extreme weather conditions, and environmental effects, must be overcome.*
* *The main objective of this project is to increase production quantity and quality, by making maximum use of resources and minimizing the environmental impact. IoT smart farming solutions is a system that is built for monitoring the crop field with the help of sensors (light, humidity, temperature, soil moisture, crop health, etc.) and automating the irrigation system.*

PURPOSE:

* *Smart farming based on IoT technologies enables growers and farmers to reduce waste and enhance productivity ranging from the quantity of fertilizer utilized to the number of journeys the farm vehicles have made, and enabling efficient utilization of resources such as water, electricity, etc.*
* *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.*
* *IoT-enabled agricultural solutions allow farmers to monitor the conditions.  The quick collection of data allows farmers to get insights fast and predict issues even before they happen.*

LITERATURE SURVEY

**Components of IOT:**

*The architecture of IoT was composed of three layers. The front end layer collects weather parameters generated by different agricultural operations. The intermediate layer works as a gateway layer, connecting the front end layer to the Internet. The back end layer collects all of the front end data [14].*

**I. Sensors/Devices**

*Devices and sensors are the components of the device connectivity layer. These smart sensors are continuously collecting data from the environment and transmit the information to the next layer.Some of the most common devices used in IOT are optical sensors to measure soil properties, photodiodes and photo detectors to determine soil, organic matter, and soil moisture, moisture sensors to measure the amount of water in the soil, and geo-positioning devices to determine latitude, length, and altitude It's important to keep in mind that geolocation devices are a crucial component of precision agriculture[10].*

*Common sensors are:*

*Temperature sensors and thermostats*

*Pressure sensors*

*Humidity / Moisture level*

*Light intensity detectors*

*Soil nutrient sensors*

*Proximity detection*

*RFID tags*

**II. Connectivity**

*Data from sensors is transferred to a cloud infrastructure, but it requires a medium for transit. Sensors can be linked to the cloud using a variety of communication and transport mediums, including cellular networks, satellite networks, Wi-Fi, wide-area networks (WAN), low power wide area network LoRAWAN, ZigBee, Bluetooth, Z-wave, and others.*

*The advancement of wireless communication technology results in lower costs, lower power consumption, and small-scale multifunctional sensors that allow for short-range communication*

**III. Gateway**

*The IoT Gateway handles bidirectional data flow between various networks and protocols. Another role of a gateway is to translate various network protocols and ensure the compatibility of linked devices and sensors. Gateways can be set to do local pre-processing of data obtained through various sensors before sending it to the next step. It protects the system from harmful threats and unauthorized access by acting as an intermediate layer between devices and the cloud.*

**IV. Cloud**

*The Internet of Things generates vast amounts of data from devices, apps, and users, which must be managed efficiently. IoT cloud provides capabilities for collecting, processing, managing, and storing vast amounts of data in real time. These data may be easily accessed remotely by industries and services, allowing them to make vital choices as needed.*

**V. Data Processing and analytics**

*Once the data has been gathered then sent to the cloud, the software processes it. This might range from something as easy as ensuring that the temperature reading on equipment like thermometer is within an acceptable range. It may also be highly complicated, such as employing computer vision on video to detect pests. Each alternative has its own set of characteristics and exchange between energy consumed, range, and bandwidth. As a result, selecting the optimum connectivity choice in the IOT system is essential. The process of converting analog output from various smart devices and sensors into usable insights that can be analyzed and used for deep analysis is known as analytics. Smart analytics solutions are necessary for IoT systems in order to manage and enhance system.*

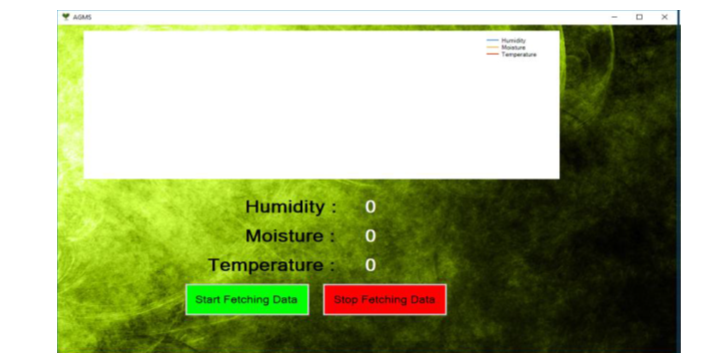
**VI. User Interface**

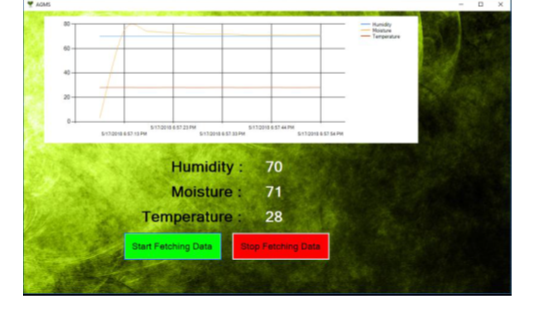
*Next, the information made available to the end-user in some way. This can achieve by triggering alarms on their phones or notifying through texts or emails. User interfaces are the visible, physical components of an IoT system that users may access. Designers will need to provide a well-designed user interface that requires the least amount of work from users*

***IMPLEMENTATION***

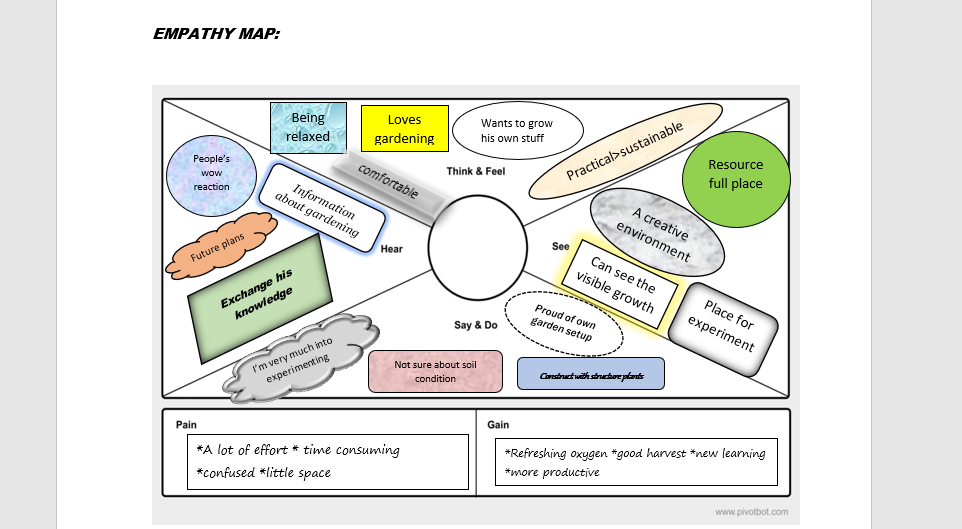
*This project can be implemented in a real greenhouse for growing good agricultural produce like ornamental flowers (Gerbera, Carnation, Anthurium etc.), which can be of export quality. The system will take care of automatic irrigation control and various parameters of the greenhouse can be monitored like Temperature, Humidity and Soil Moisture.*

*The Android Application will form the user interface and to record the parameter details we use an application server module. This recorded data can be used for analysis and help in taking decisions.*

**

**

IDEATION PHASE & PROPOSED SOLUTIONS



***Brainstorm***

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Spectral image

Moisture sensor

Weather forecasting

Data analytics solutions

Software application

Sensing technologies

Weed and past management

Polyculture

Crop rotation

Suggest amount of fertilizers to be used

Provide better crop yield

Soil nutrition monitoring

Weather forecasting

Telematics, positioning technologies

Hardware and software system

pesticides

Biodynamic farming

Urban agriculture

Keep the data design

For scheduling watering of crops

Energy

Industry

Communications system

Water

Land

Climate effect

**stella**

Using in the real time application

Pesticides

Micro nutrient

Automation

Resource optimization

Quality food

Weather and geographical effect

Animals

Higher population

***Proposed Solution Template:***

|  |  |  |
| --- | --- | --- |
| **S.No.** | **Parameter** | **Description** |
|  | Problem Statement (Problem to be solved) | * ***Check the humidity levels of plants in order to plan the irrigation of the land in relation to the weather*** * ***Check the soil moisture and hydration*** * ***Most common problem is connectivity. Every area doesn’t have proper internet connectivity.*** |
|  | Idea / Solution description | * ***It will provide insights and stats for crops and livestock.*** * ***Improvised stock management.*** * ***Smart contracts-Bill of landing.*** |
|  | Novelty / Uniqueness | * ***Smart Green House*** * ***Smart pest management*** * ***Smart meals*** * ***Unique deals and trade options*** * ***Remote management*** |
|  | Social Impact / Customer Satisfaction | * ***Livestock-rearing Increases production rates.*** * ***Process like pest control, fertilizing and irrigation are becoming automated.*** * ***Dependency of manual labour has reduced.*** |
|  | Business Model (Revenue Model) | * ***Precision agriculture*** * ***Agriculture drone*** * ***Livestock monitoring*** * ***Machine for routine operation*** |
|  | Scalability of the Solution | * ***Integrated with thousands of IOT devices for large farms.*** * ***Integrated with different types of IOT devices*** * ***Easier to collect and collate large volumes of data.*** |

**Functional Requirements:**

Following are the functional requirements of the proposed solution.

|  |  |  |
| --- | --- | --- |
| **FR No.** | **Functional Requirement (Epic)** | **Sub Requirement (Story / Sub-Task)** |
| **FR-1** | * ***User Registration*** | * ***Registration through Gmail*** * ***Registration through phone number*** |
| **FR-2** | * ***User Confirmation*** | * ***Confirmation via Email*** * ***Confirmation via OTP*** * ***Confirmation via verification link sent to registered mail id*** |
| **FR-3** | * ***Roles and service*** | * ***Choose roles (ex: farmer, student etc.)*** * ***Enter the personal details.*** * ***Choose the type of service or options (ex: irrigation, pest management, crop management etc.)*** |
| **FR-4** | * ***Terms and conditions*** | * ***Accepts the terms and condition for the chosen role and options*** |
| **FR-5** | * ***Details of farm and plans*** | * ***Enter the details of farming land and vegetation.*** * ***Choose the crop you want to plant*** * ***Choose the types of plans (ex: regular and premium)*** |
| ***FR-6*** | * ***Details according to farm information*** | * ***Check the weather information*** * ***Enter the soil nutrient and pH value*** * ***click SAVE*** * ***Soon the details will share to registered mail*** * ***EXIT*** |

**Non-functional Requirements:**

Following are the non-functional requirements of the proposed solution.

|  |  |  |
| --- | --- | --- |
| **FR No.** | **Non-Functional Requirement** | **Description** |
| ***NFR-1*** | * ***Usability*** | * ***A system is built for monitoring the crop field with the help of sensors and automating the irrigation system and helps the farmer to understand the important aspects.*** |
| ***NFR-2*** | * ***Security*** | * ***Applications must be designed with the security of their use in mind. This includes personal data and their user’s well-being.*** |
| ***NFR-3*** | * ***Reliability*** | * ***It allows farmers to maximize yields using minimum resources such as water, fertilizers, seeds etc.*** |
| ***NFR-4*** | * ***Performance*** | * ***It increases efficiency and reduce the environmental impacts and to implement technology properly to minimize cost.*** |
| ***NFR-5*** | * ***Availability*** | * ***This concept focused on providing the agricultural industry with the infrastructure to leverage advanced technology.*** |
| ***NFR-6*** | * ***Scalability*** | * ***It provides the recognition of each object that makes up a solution and ensure communication. The system must remain operational regardless.*** |

**Data Flow Diagrams:**

**2G/3G/4G wireless wireless**

**6low PAN cloud service**

**WSN**

RFIO

WLAN

WBAN Agriculture Server Database

NFC wireless

Gateway Real time

monitoring

User Terminal Farmer Farm Record Keeping

Fire alarm  **IOT**

MoonMonitor

Live stock crop monitoring sensor  *FARM*

*PYTHON CODE:*

*import wiotp.sdk.device*

*import time*

*import os*

*import datetime*

*import ramdom*

*myConfig = {*

*"identity": {*

*"orgid": "p62hjr"*

*"typeId": "NodeMCU"*

*"deviceId": "12345"*

*},*

*"auth": {*

*"token": "12345678"*

*}*

*}*

*client = wiotp.sdk.device.DeviceClient(config=myconfig, logHandlers=None)*

*client.connect()*

*def myCommandCallback(cmd):*

*print("Message received from IBM IoT platform: %s" %cmd.data['command'])*

*m=cmd.data['command']*

*if (m=="motoron"):*

*print("Motor is switched on")*

*elif(m=="motoroff"):*

*print("Motor is switched OFF")*

*print(" ")*

*while True:*

*soil=random.randint(0,100)*

*temp=random.randint(-20,125)*

*hum=radom.randint(0,100)*

*myData=('Soil moisture': soil, 'temperature': temp, 'humidity':hum)*

*client.publishEvent (eventId="status", myData)*

*time.sleep(2)*

*client.commandCallback = myCommandCallback*

*client.disconnect*

**Aurdino code for C :**

**//include libraries #include <dht.h>**

**#include <SoftwareSerial.h>**

**//define pins**

**#define dht\_apin A0 // Analog Pin sensor is connected SoftwareSerial mySerial(7,8);//serial port of gsm**

**const int sensor\_pin = A1; // Soil moisture sensor O/P pin int pin\_out = 9;**

**//allocate variables dht DHT;**

**int c=0;**

**void setup()**

**{**

**pinMode(2, INPUT); //Pin 2 as INPUT pinMode(3, OUTPUT); //PIN 3 as OUTPUT pinMode(9, OUTPUT);//output for pump**

**}**

**void loop()**

**{**

**if (digitalRead(2) == HIGH)**

**{**

**digitalWrite(3, HIGH); // turn the LED/Buzz ON delay(10000); // wait for 100 msecond digitalWrite(3, LOW); // turn the LED/Buzz OFF delay(100);**

**}**

**Serial.begin(9600); delay(1000);**

**DHT.read11(dht\_apin); //temprature float h=DHT.humidity;**

**float t=DHT.temperature; delay(5000); Serial.begin(9600);**

**float moisture\_percentage;//moisture int sensor\_analog;**

**sensor\_analog = analogRead(sensor\_pin);**

**moisture\_percentage = ( 100 - ( (sensor\_analog/1023.00) \* 100 ) );**

**float m=moisture\_percentage; delay(1000);**

**if(m<40)//pump**

**{**

**while(m<40)**

**{**

**digitalWrite(pin\_out,HIGH);//open pump sensor\_analog = analogRead(sensor\_pin);**

**moisture\_percentage = ( 100 - ( (sensor\_analog/1023.00) \* 100 ) ); m=moisture\_percentage;**

**delay(1000);**

**}**

**digitalWrite(pin\_out,LOW);//closepump**

**}**

**if(c>=0)**

**{**

**mySerial.begin(9600); delay(15000); Serial.begin(9600); delay(1000); Serial.print("\r"); delay(1000); Serial.print("AT+CMGF=1\r"); delay(1000);**

**Serial.print("AT+CMGS=\"+XXXXXXXXXX\"\r"); //replace X with 10 digit mobil e number**

**delay(1000); Serial.print((String)"update-**

**>"+(String)"Temprature="+t+(String)"Humidity="+h+(String)"Moisture="+m); delay(1000);**

**Serial.write(0x1A); delay(1000);**

**mySerial.println("AT+CMGF=1");//Sets the GSM Module in Text Mode delay(1000);**

**mySerial.println("AT+CMGS=\"+XXXXXXXXXX\"\r"); //replace X with 10 digit mobile number**

**delay(1000); mySerial.println((String)"update-**

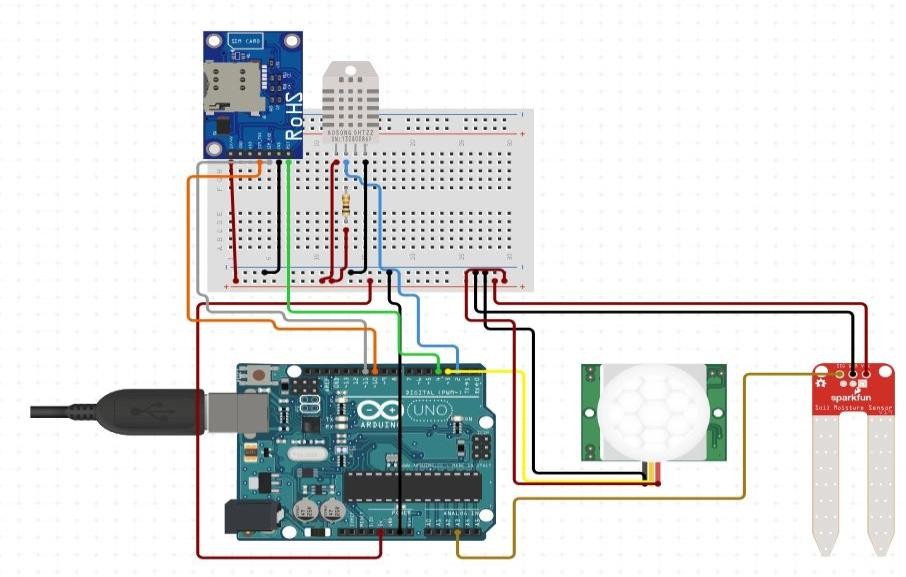
**>"+(String)"Temprature="+t+(String)"Humidity="+h+(String)"Moisture="+m);// message format**

**mySerial.println(); delay(100); Serial.write(0x1A); delay(1000);**

**c++;**

**}**

**}**



**Advantages of IoT in Agriculture**

* Intelligent data collection. Sensors installed on IoT devices are able to collect a large volume of useful information for farmers. ...
* Waste reduction. ...
* Process automation. ...
* Animal monitoring. ...
* Competitive advantage.

Disadvantages:

* The main disadvantage is the **time it can take to process the information**.
* Farmers are so busy with harvesting and caring for their crops that they may not have time to process data.
* There are also issues with the water supply, as well as issues with the cost of the technology, which can be quite expensive.
* The risk to the farming industry when using precision agriculture solutions could include: **Business and customer information** data theft. Stealing resources controlled by sensors and devices.

FUTURE SCOPE:

* **Smart farming is certainly a leading enabler in producing more food with less for an increasing world population**.
* 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**

CONCLUSION:

* Smart farming **reduces the ecological footprint of farming**.
* Minimized or site-specific application of inputs, such as fertilizers and pesticides, in precision agriculture systems will mitigate leaching problems as well as the emission of greenhouse gases