GALGOTIAS UNIVERSITY
(Established under Galgotias University Uttar Pradesh Act No. 14 of 2011)

IOT Based Smart Agriculture System

A Report for the Evaluation 3 of Project 2

Submitted by

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IN

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SCHOOL OF COMPUTING SCIENCE AND ENGINEERING

Under the Supervision of

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GALGOTIAS UNIVERSITY
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SCHOOL OF COMPUTING AND SCIENCE AND ENGINEERING

BONAFIDE CERTIFICATE

Certified that this project report" IOT BASED SMART AGRICULTURE SYSTEM" is the bonafide work

of "MOHD AHTESHAM (1613101407)" who carried out

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ABSTRACT

Abstract: Smart agriculture is an emerging concept, because IOT sensors are

capable of providing information about agriculture fields and then act upon based

on the user input. In this Paper, it is proposed to develop a Smart agriculture

System that uses advantages of cutting edge technologies such as Arduino, IOT

and Wireless Sensor Network. The paper aims at making use of evolving

technology i.e. IOT and smart agriculture using automation. Monitoring

environmental conditions is the major factor to improve yield of the efficient

crops. The feature of this paper includes development of a system which can

monitor temperature, humidity, moisture and even the movement of animals which

may destroy the crops in agricultural field through sensors using Arduino board

and in case of any discrepancy send a SMS notification as well as a notification on

the application developed for the same to the farmer's smartphone using Wi-

Fi/3G/4G. The system has a duplex communication link based on a cellular -

Internet interface that allows for data inspection and irrigation scheduling to be

programmed through an android application. Because of its energy autonomy and

low cost, the system has the potential to be useful in water limited geographically

isolated areas.

1. INTRODUCTION

Overall introduction

The Agriculture Parameters are utilizing an IOT Technology and system

availability that draw in these objects to assemble and deal information. "The IOT

enables things selected recognized or potentially forced remotelycrosswise

over completed the process of existing configuration merge of the substantial earth

into PC based frameworks, in addition to acknowledging overhauled capacity,

precision and cash interconnected favoured stance. Precisely when IOT is

extended with sensors and actuators, the improvement modify into an occasion of

the all the extra wide category of electronic physical structures, which in like

manner incorporates headways, for instance, clever grids, splendid homes, canny

moving and smart urban groups [1]. All is especially specific through its

introduced figuring configuration anyway can interoperate within the current

Internete stablishment.

India has agriculture as its primary occupation. According to IBEF (India Brand

Equity Foundation), 58% of the people living in rural areas in India are dependent

on agriculture. As per the Central Statistics Office 2nd advised estimate, the

contribution of agriculture to the Gross Value Addition (India) is estimated to be

roughly around 8% which is very significant contribution. Under such a scenario,

the usage of water especially the fresh water resource by agriculture will

be enormous and according to the current market surveys it is estimated that

agriculture uses 85% of available freshwater resources worldwide, and this

percentage will continue to be dominant because of population growth and

increased food demand. This calls for planning and strategies to use water sensibly

by utilizing the advancements in science and technology. There are many systems to achieve water savings in various crops, from basic ones to more technologically

advanced ones. One of the existing systems use thermal imaging to monitor

the plant water status and irrigation scheduling. Automation of irrigation systems

is also possible by measuring the water level in the soil and control actuators to

irrigate as and when needed instead of predefining the irrigation schedule, thus

saving and hence utilizing the water in a more sensible manner. An irrigation

controller is used to open a solenoid valve and apply watering to bedding plants

(impatiens, petunia, salvia, and vinca rosea) when the volumetric water content of

the substrate drops below a setpoint.

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List of Abbreviation

ACRONYM	EXPANSION
IF	Isolation Forest
IT	Information Technology
LOF	Local Outlier Factor
SP	Service Provider
IDP	Identity Provider
kNN	K Nearest Neighbor
RFA	Random Forest Algorithm
DF	Data Frame

2.Hardware Configuration

- Servers: We will need a local host to implement an algorithm to tackle the situation. The local server will get implemented on any browser present on the system.
- Terminals: Jupyter .
- Processor Pentium –IV and above
- RAM 128 MD SD EAM
- Monitor 800* 600 resolution
- Hard disk 10 GB
- Processor 64 bit Intel core I3 and above
- Recent dataset uploaded by any bank
- Key board Standard 102 keys
- Mouse 3 buttons, scroll able
- Software – Windows 10,7,8.
- Prompt- Anaconda prompt.

3. Software Requirements

- Operating system Windows 10,7,8
- Coding Language Python
- Text editor- Jupyter
- Platform – Anaconda Prompt
- Machine Learning Algorithms

4. PURPOSE

Also known as precision agriculture, precision farming can be thought of as

anything that makes farming practice more controlled and accurate when it comes

to raising livestock and growing crops. In this approach of farm management, a

key component is the use of IT and various items like sensors, control systems,

robotics, autonomous vehicles, automated hardware, variable rate technology, and

so on.This will hopefully stop the fraud because this type of fraud is staying with us for decades and no successful solution has come through to stop it.

Technology has changed over time and agricultural drones are a very good

example of this. Today, agriculture is one of the major industries to incorporate

drones. Drones are being used in agriculture in order to enhance various

agricultural practices. The ways ground-based and aerial-based drones are being

used in agriculture are crop health assessment, irrigation, crop monitoring, crop

spraying, planting, and soil and field analysis.

5. Motivation and scope

Mohd Ahtesham utilized IoT and picture handling to locate the supplement and mineral insufficiencies that influence the yield development . Mohd Ahtesham and Sanchit Sapra have proposed a technique to picture and follow rural items in inventory network . Ahtesham centre around the equipment engineering, arrange design and programming process control of the exactness water system framework. Ahtesham have proposed an approach to direct water in rural fields .Ahtesham have proposed an approach to measure the soil moisture and temperature in rural fields.

6. PROBLEM WITH CURRENT SYSTEM

- Horticulture is the foundation of our Nation. In long time past days agriculturists used to figure the ripeness of soil and influenced presumptions to develop which to kind of product.

- They didn't think about the level of water and especially climate condition which horrible an agriculturist more.

- They utilize pesticides in view of a few suspicions which made lead a genuine impact to the yield if the supposition isn't right .

- The profitability relies upon the last phase of the harvest on which agriculturistdepends.

- To replace the current method there should be competitions that should be held regularly so that talent from various parts of the world could come forward and we can get something.

7. PROPOSED SYSTEM

To improve the efficiency of the product there by supporting country we need to utilize the innovation which appraises the nature of harvest and giving recommendations. The Internet of things (IOT) is revamping the agribusiness engaging the farmers by the broad assortment of techniques, for instance, accuracy and conservative cultivation to go up against challenges in the field. IOT advancement aids in social affair information on conditions like atmosphere, temperature and productivity of soil, harvest web watching. IOT utilize farmers to get related with his residence from wherever and at whatever point. Remote sensor frameworks are used for checking the farm conditions.

In this paper a Precision Agriculture has the advantage of giving continuous

criticism on various distinctive yield and site factors. As its name suggests, Precision Agriculture is exact in both the extent of the product territory it screens

and in addition in the conveyance measures of water, compost, and so forth. This

innovation can separate a solitary plant for checking in the tens or several square

feet. The WSN framework requires a brought together control unit with UI.

Exactness Agriculture requires a novel programming model for each land territory,

he development of a smart agriculture system using sen-sors, microcontroller

within an IOT system is presented. Theaim of the implementation is to

demonstrate the smart andintelligent capabilities of the microcontroller to allow

thedecisions to be taken on watering the plants based on thecontinuous monitoring

of the environmental conditions in thefield. The system is as shown in Fig. 1. It

also aims at apredefined irrigation schedule as per the farmers

convenience,uploaded into the application developed for the same.

Theimplementation is a photovoltaic powered automated irrigationsystem that

consists of a distributed wireless network ofsoil moisture and temperature sensors

deployed in plant rootzones. These sensors continuously monitor the parameters

andsend it to the Arduino board for further processing whichacts as an IOT

gateway. This gateway has been given thewireless capability by installing a

WiFi

module which willbe updating the data to the cloud. The IOT gateway alsohas the

GSM capability through the module connected. Thisreceiver unit also has a duplex

communication link basedon a cellular-Internet interface, using general packet

radioservice (GPRS) protocol, which is a packet-oriented mobiledata service used

in 2G and 4G cellular global system formobile communications (GSM).The data

being uploaded to the cloud allows the user tocontinuously view the parameters

from the comforts of his/he home or wherever on the go. The system has the

capacity toadapt based on the user input which the farmer can inputthrough the

smart agriculture application. The farmer canselect a profile based on the season

and the crop for irrigationand schedule and plan the water resource utilization

sensiblyas shown in Fig. 2. The volumetric water content in the soilis a primary

factor which gives a suggestion that the water isrequired for the crops. In the

absence of this system the farmerhas to manually inspect these for all the crops by

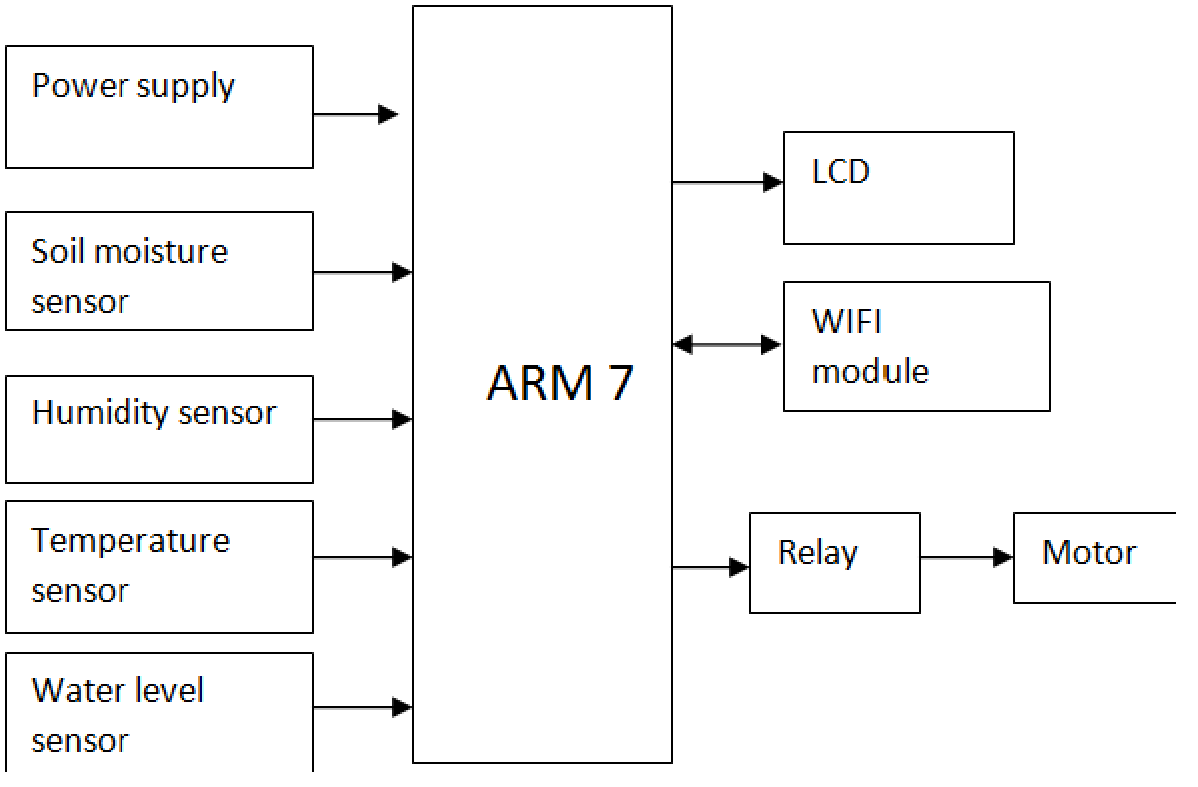

Figure 1

inspectingthe soil in the fields which is tedious, time consuming andstraining. This

can be taken care by the intelligent systemwhich informs the user whenever the

water content goes belowthe threshold set by the farmer himself.Intrusion of

animals especially cows, monkeys, dogs etc tothe fields is a very common issue

and one of the factors fordisruption or disturbance to the yield. This requires one

personto continuously guard the fields at all the times which willnot be accurate

and the productivity of one person is wasted.This can be overcome by this system

which has a motionsensor to detect the presence of any animal in the fields

andsend notifications to the farmer in their presence. The distancerange for which the farmer needs to detect the animals can beallowed to set by the farmer himself

in the application in the beginning

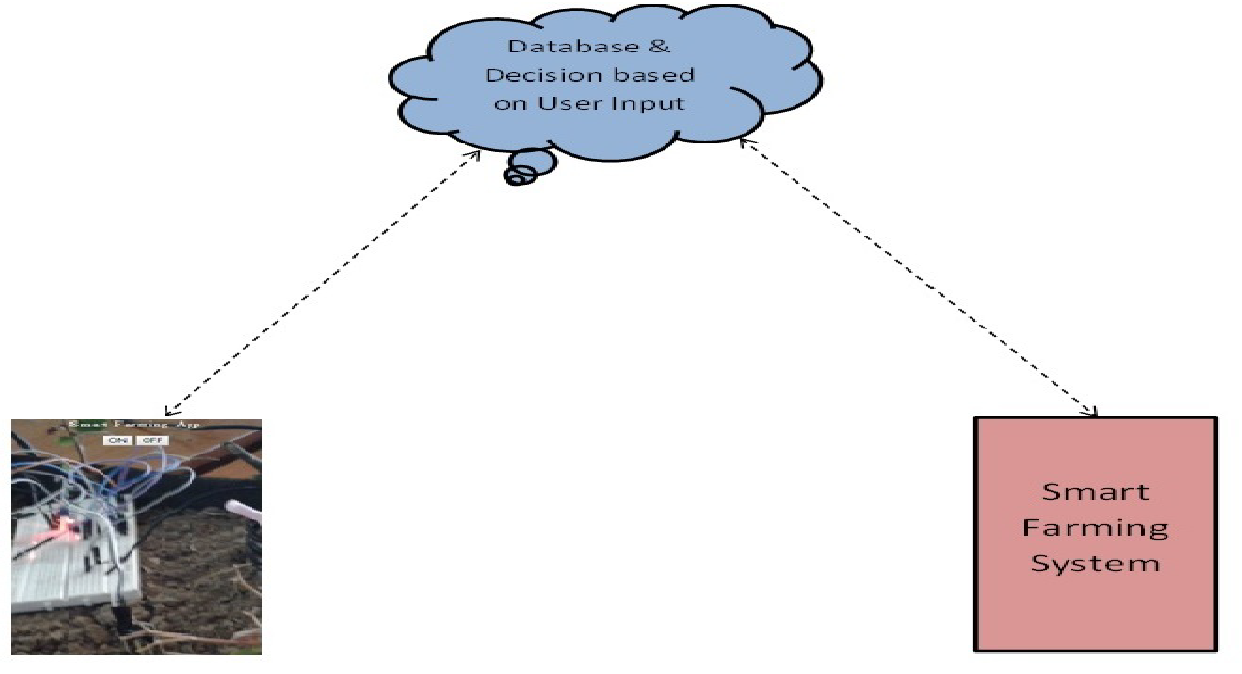

Figure 2

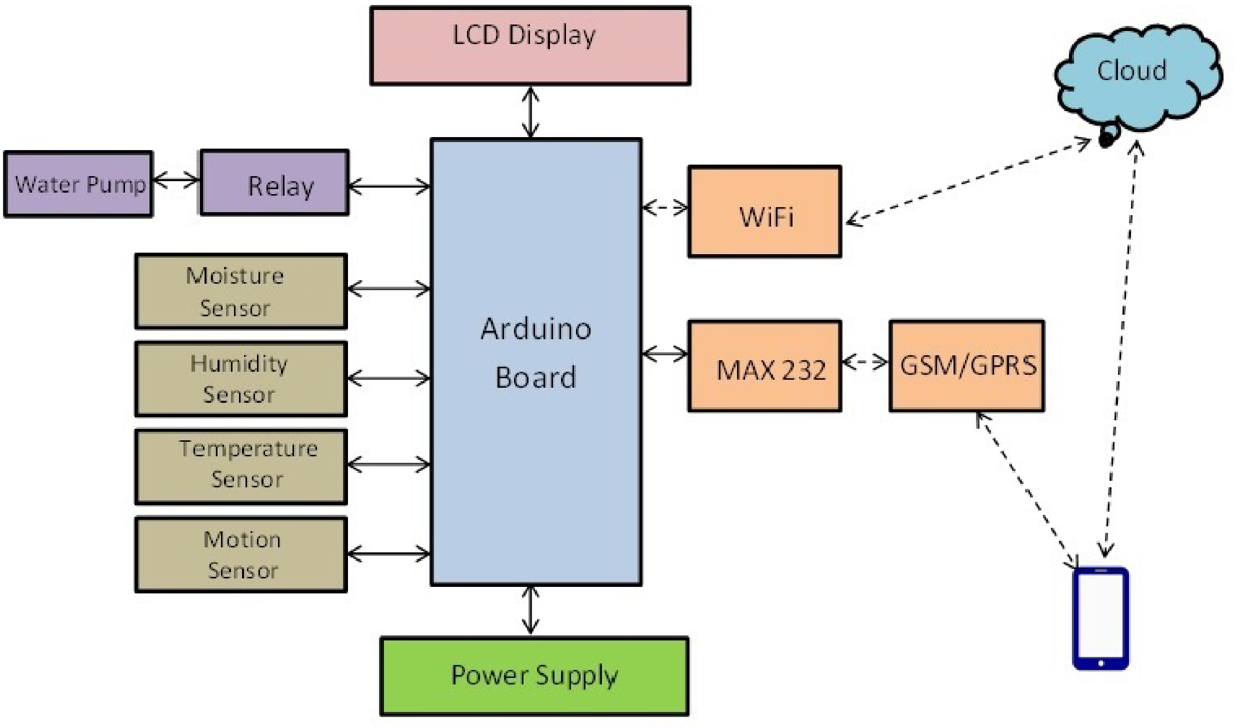
LCD Display
Cloud
Water Pump
Relay
WiFi
Moisture Sensor
Arduino Board
Humidity Sensor
MAX 232
GSM/GPRS
Temperature Sensor
Motion Sensor
Power Supply

Figure 3

Implementation

The reason for the ARM7 processor is that it interfaces every one of the parts

related with the Development pack. Number of pins in this processor is

64. Each stick is relegated with specific segment of the unit for performing specific

capacity. The edge estimation of the sensors is set in this LPC 2148 processor

which is in charge of the programmed ON and OFF of the engine which is

combined with the pump for directing water to the horticultural land. The

temperature limit esteem will be refreshed to server or framework, through IoT for

each 1 minute from the incorporated advancement pack. LM35 temperature

sensors utilize speaker at the accurate supporters outright temperature (estimated in

Kelvin) into also Fahrenheit or Celsius rely leading it arrangements. The two

resistors are adjusted in the production line to create an exceedingly exact

temperature sensor. The coordinated START Read the information Deployment of

Sensor Is Temperature/the Humidity esteems in go Is the water esteems in run

Motor on STOP NO YES Data server (IoT passage) circuit has various transistors

in it - two in the centre, a few in each intensifier, a few in the dependable flow source, and several in the bend give circuit. The edge esteem is achieved (1 RH%-

3 RH%) this breaking points can be set in the microcontroller if its goes above past

10 RH% conditions will be unusual generally dampness level will be in ordinary

Condition.

IOT based smart agriculture system is used to generate decisions regarding

irrigation using real time data. First of all, farmer logs in to the system using his

credentials such as username and password from an Android application. He

is then allowed to select the crop for that season. System is implemented in three

phases.

_ Sensing

_ Processing

_ Information distribution.

The sensing phase involves the sensing of the physical parameters which includes

temperature, moisture, humidity and motion. All these sensors are attached to the

Arduino Uno R3 microcontroller board. This board acts as the IOT gateway in the developed system as it has the capacity to transmit the data to the cloud. This

transmission is done using Wi-Fi ESP8266 module. The processing phase takes

place in the cloud. The cloud consists of a Web Server, a database where the

sensed data is maintained and a decision logic which takes decisions based

on the sensed data. In the information distribution phase, the output of the decision

logic will be sent to the android application and then to the IOT gateway. The end-

to-end algorithm of the smart farming system is given below

Start

_ Continuously acquire sensor data

_ A/D conversion of the sensed data on the Arduino Board

_ Send the data to the cloud through the IOT Gateway

_ If the data is above the threshold

_ Send a notification to the Smart Farming Application

_ If user selects Turn ON

_ Send a control signal to the server i.e. cloud

_ Control signal is then sent to the IOT gateway

_ The IOT gateway triggers the relay and the water pump is turned ON

_ Else if user selects turn OFF

_ Send a control signal to the server i.e. cloud

_ Control signal is then sent to the IOT gateway

_ The IOT gateway triggers the relay and the water pump is turned OFF

_ Endif

_ Else

_ Continue checking for the threshold condition

_ Endif

End

The Smart Farming Application is developed on Android.

The features that are provided in this application are as follows

1. Selection to turn ON/OFF the water pump

2. Selection of an irrigation profile i.e. the farmer can choose a time on a particular day to start the irrigation and a time to stop the irrigation. This facilitates the farmer to invest his time in some other productive work. The application
profile also allows the farmer to select the same schedule for a week or a month

3. Suggestion to the farmer to use a particular pesticide for their crop

4. Notify the farmer on the invasion of the field by animals.

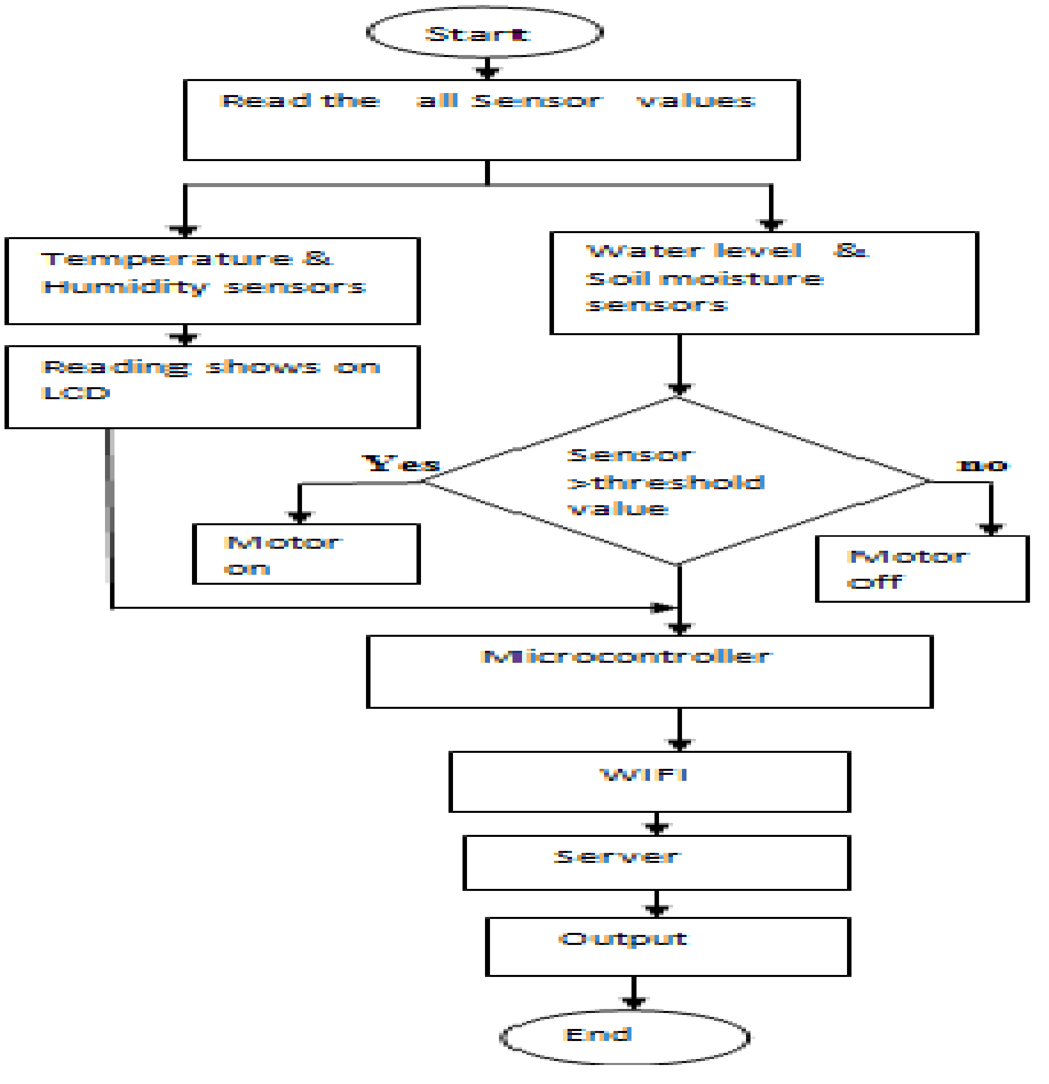

Figure 4

CODE

```
#include <Arduino.h>
```

```
#include <stdlib.h>
#include <String.h>

//Ubidots account data
String token = "  ";      //your token to post value
String temp_id="  ";                              //ID of your temperature variable
String hum_id="  ";                               //ID of your humidity variable
String soil_id="  ";                              //ID of your soil variable
String light_id="  ";                             //ID of your light variable

//sensor output connections
const int light_out = A0;
const int soil_out = A1;
const int temp_out = A2;
const int hum_out = A3;

float temp=0,hum=0;
int soil,light;

void ShowSerialData()
{
  while(Serial2.available()!=0)
  Serial.write(Serial2.read());
}

//this function is to send the sensor data to Ubidots, you should see the
new value in Ubidots after executing this function
void save_value(String payload)
{
   String le;                                // length of the payload in characters
   le = String(payload.length());      //this is to calcule the length of payload

  for(int i = 0;i<7;i++)
  {
    Serial2.println("AT+CGATT?");                                 //this is made
repeatedly because it is unstable
    delay(2000);
    ShowSerialData();
  }

  Serial2.println("AT+CSTT=\"http://internet.tatadocomo.com\"");
//replace with your providers' APN
  delay(1000);
  ShowSerialData();
  Serial2.println("AT+CIICR");                                    //bring up
wireless connection
  delay(3000);
  ShowSerialData();
```

```
 Serial2.println("AT+CIFSR");                                    //get local IP
adress
 delay(2000);
 ShowSerialData();
 Serial2.println("AT+CIPSPRT=0");
 delay(3000);
 ShowSerialData();
 Serial2.println("AT+CIPSTART=\"tcp\",\"things.ubidots.com\",\"80\"");
//start up the connection
 delay(3000);
 ShowSerialData();
 Serial2.println("AT+CIPSEND");                                  //begin send
data to remote server
 delay(3000);
 ShowSerialData();
 Serial2.print(F("POST /api/v1.6/collections/values/?token="));
 delay(100);
 ShowSerialData();
 Serial2.print(token);
 delay(100);
 ShowSerialData();
 Serial2.println(F(" HTTP/1.1"));
 delay(100);
 ShowSerialData();
 Serial2.println(F("Content-Type: application/json"));
 delay(100);
 ShowSerialData();
 Serial2.print(F("Content-Length: "));
 Serial2.println(le);
 delay(100);
 ShowSerialData();
 Serial2.print(F("Host: "));
 Serial2.println(F("things.ubidots.com"));
 Serial2.println();
 delay(100);
 ShowSerialData();
 Serial2.println(payload);
 Serial2.println();
 delay(100);
 ShowSerialData();
 Serial2.println((char)26);
 delay(7000);
 Serial2.println();
 ShowSerialData();
 Serial2.println("AT+CIPCLOSE");                                 //close the
communication
 delay(1000);
 ShowSerialData();
```

```
}


void setup()
{
 Serial2.begin(9600);                                   //sim 900
coonected to serial2 of GR-Kaede at 9600 baud rate
 Serial.begin(9600);                                    //serial
communication baud rate

 delay(2000);
}

void loop()
{
 int cnt=0;
 String payload;                      //Variable to collect all sensor
data for data upload on Webserver

 if (Serial2.available())
 {
 Serial.write(Serial2.read());
 }

  temp = analogRead(temp_out);
  temp = map(temp, 0 , 1023, 0, 100);
  Serial.print("temp = ");
  Serial.println(temp);

  hum = analogRead(hum_out);
  hum = map(hum, 0 , 1023, 0, 100);
  Serial.print("hum = ");
  Serial.println(hum);

  soil = analogRead(soil_out);
  soil = map(soil, 0 , 1023, 0, 100);
  Serial.print("soil = ");
  Serial.println(soil);

  light = analogRead(light_out);
  light = map(light, 0 , 1023, 0, 100);
  Serial.print("light = ");
  Serial.println(light);

 while(cnt<5)
 {
 Serial.println();
 Serial.println("Uploading Sensors Data to Ubidots Cloud Service");
```

```
  payload = "[{\"variable\":\"" + temp_id + "\",\"value\":"+
String(temp)+"},{\"variable\":\""+ hum_id+ "\",\"value\":" + String(hum) +
"},{\"variable\":\"" +soil_id+ "\",\"value\":" + String(soil) + "},{\"variable\":\"" +
light_id + "\",\"value\":" + String(light) + "}]";
  save_value(payload);                                    //call the save_value
function
  cnt++;
  delay(20000);

   temp = analogRead(temp_out);
   temp = map(temp, 0 , 1023, 0, 100);

   hum = analogRead(hum_out);
   hum = map(hum, 0 , 1023, 0, 100);

   soil = analogRead(soil_out);
   soil = map(soil, 0 , 1023, 0, 100);

   light = analogRead(light_out);
   light = map(light, 0 , 1023, 0, 100);
  }

  //Delay for 90 seconds
  delay(45000);
  delay(45000);
}
```

Conclusion

IOT based smart agriculture system can prove to be very helpful for farmers since

over as well as less irrigation is not good for agriculture. Threshold values for

climatic conditions like humidity, temperature, moisture can be fixed based on

the environmental conditions of that particular region. The system also senses the

invasion of animals which is a primary reason for reduction in crops. This system

generates irrigation schedule based on the sensed real time data from field and

data from the weather repository. This system can recommend farmer whether or

not, is there a need for irrigation. Continuous internet connectivity is required. This

can be overcome by extending the system to send suggestion via SMS to the

farmer directly on his mobile using GSM module instead of mobile app.

Therefore, the paper proposes a thought of consolidating the most recent

innovation into the agrarian field to turn the customary techniques for water

system to current strategies in this way making simple profitable and temperate

trimming. Some degree of mechanization is presented empowering the idea of

observing the field and the product conditions inside some long-separate extents

utilizing cloud administrations. The points of interest like water sparing and work

sparing are started utilizing sensors that work consequently as they are modified.

This idea of modernization of farming is straightforward, reasonable and operable.

As relying upon these parameter esteems rancher can without much of a stretch

choose which fungicides and pesticides are utilized for enhancing cropcreation.

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