A STUDY ON INTERNET OF THINGS (IOT) AND ITS APPLICATIONS IN AGRICULTURE

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Abstract- India is the land of agriculture. Over 58% of the population in India, depend on agriculture for their livelihood. Due to rise in human population at alarming rates, there is a huge demand for agricultural produce in order to cater the rising human needs. Smart agriculture can be made through the help of the Internet of things(IoT) architecture which is possible because of the extensive use of sensor devices, internet protocols, and RFID. This paper focuses on the implementation of various IOT technologies in the field of agriculture.

Smart farming can be a capital-intensive and hi-tech system of growing food cleanly and sustainable for the masses. It's the appliance of recent ICT (Information and Communication Technologies) into agriculture.

In IoT-based smart farming, a system is made for monitoring the crop field with the assistance of sensors (light, humidity, temperature, soil moisture, etc.) and automating the irrigation system. The farmers can monitor the sector conditions from anywhere. IoT-based smart farming is very efficient in comparison with the traditional approach.

Few of the technologies involved are the ANFIS and PLSR.

Introduction- Agriculture is the heart of Indian economy. Coping with the needs of the agriculture produce is great challenge faced by the farmer community. Since majority of Indian agriculture depends upon the monsoon rains, recent climatic changes have drastically impacted the agriculture which is the heart of the Indian economy. The IoT is a technology which is very promising in finding a solution to this problem. This is done by using sensors which are connected to the internet. The use of the IoT technology in the field of agriculture takes it to a whole new level by making it easy and also increasing the productivity and cutting down physical strain to the farmers.

Smart farming through the utilization of IoT technologies will help farmers to scale back generated wastes and enhance productivity which will come from the amount of fertilizer that has been utilized to the quantity of journeys the farm vehicles have made. So, smart farming could also be a capital-intensive and hi-tech system of growing food cleanly and sustainable for the masses. It's the induction also because the application of recent ICT (Information and Communication Technologies) into agriculture.

Agricultural drones are a really exemplar of IoT applications in Agriculture. Agriculture industries today, became one among the main industries where drones can incorporate. Two sorts of drones, that is, ground-based and aerial-based drones are being incorporated in agriculture in some ways like, for crop health assessment, irrigation, planting, and soil & field analysis.

The benefits that the usage of drones brings to the table include, simple use, time-saving, crop health imaging, integrated GIS mapping, and therefore the ability to extend yields. The drone technology will provides a high-tech makeover to the agriculture industry by making use of strategy and planning supported real-time data collection and processing.
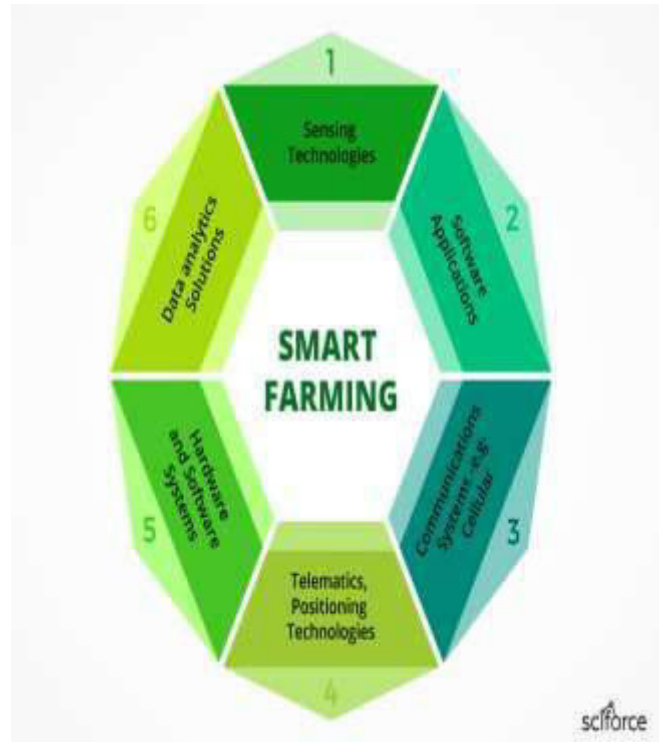

Figure 1

System Architecture

In order to support the agricultural needs, IoT plays a vital role. It is possible because of the increase in the use of sensor devices and internet protocols.

The key equipment which makes it possible to integrate the concept of IoT in the field of agriculture are the devices such as sensors, drones, satellite images, and the cloud servers which is connected to all other devices, thereby establishing a total control of those devices.

These devices are designated to carry some of the important tasks which are vital for agricultural success. Some of the tasks carried out by these devices are validation of the soil moisture, humidity, temperature, nitrogen content, pH level, oxygen requirement etc. This leads to the automation of agriculture by establishing a control over important factors of agriculture.

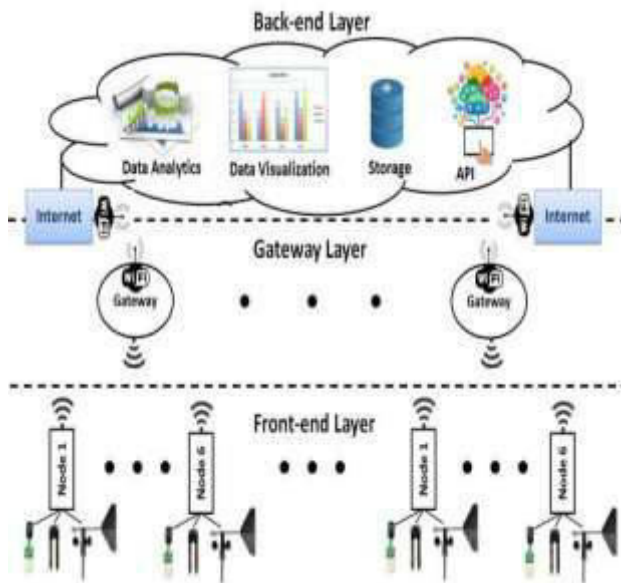## Cloud based IoT architecture for agricultural applications

Figure 2

Role of IoT in Irrigation:

Since the Indian agriculture mainly depends on the monsoon rains for the water source, it is a problem to find the water source throughout the year. Hence irrigation poses as a serious problem. Therefore the integration of IoT in this aspect of irrigation hugely creates an impact. In smart irrigation system, an arduino micro-teller is used to control and perform tasks like sensing and measuring the moisture in the soil. Basically it is a resistor which changes values when it contacts moisture. The value of resistor decreases when the moisture is more, and vice-verse. Based on the values of the resistors, a code is developed.

Basically these values are put in the if condition, and these decides whether the water pump will be turned on or off.

Code to illustrate the working:

```
int m=0;

void setup() {

pinMode(A0, INPUT_PULLUP);

pinMode(8,OUTPUT);

Serial.begin(9600); }


void loop() {

int m= analogRead(A0);

Serial.println(m);

delay(200);

if (m>=980)

{

  digitalWrite(8, LOW);


}


else if(m<=970)

{


  digitalWrite(8, HIGH);

}


else

{

  digitalWrite(8, HIGH);

 }

}
```

Various sensors are employed to implement the SIDSS. One of this is often a Soil sensor which detects the various crops and conditions and therefore the device is modelled with GSM/GPRS modem to collect information from various locations. The environment variables like Rainfall, humidity, depth of water level needed etc. are given as input to the system.

The amount of water needed to irrigate the sector is accurately predicted by ANFIS inference system which generates the fuzzy rules. the opposite technique which is employed for predication is PLSR. It's a statistical procedure which is employed to get the values of predictor variables ANFIS shows the higher performance than PLSR to work out the water required for Irrigation.

Using the VWC(Volumetric water content) sensors, we can get to know the amount of water required by the crop precisely.

The advantages of using the VWC's are they are:

- Inexpensive
- Ready to use
- Increased data interpretability

The data collected through these VWC's are the input variables, and then analysis is made based on the data collected.

Role of IoT in determining nitrate level in soil.

Nitrates are common components of fertilizers. These are harmful substances which causes health hazards to plants as well as humans who consume it.

But increase of nitrate level in the soil, helps the growth of food crops which invariably increase the productivity of agriculture.

In order to overcome the ill effects of nitrate, a smart nitrate sensor is used to measure the amount of nitrate which is present on the surface.

Various equipment s contribute to the functioning of the implementation of IoT in the detection of nitrate level on the surface of the soil.

These include: Electra-chemical impedance spectroscopy which detects the level of nitrate in the soil.

The deployment of wireless sensor network(WSN) in the agriculture field offer various benefits such as soil management, harvesting management, resource and land utilization, and also the labour involved.

Role of IoT in Livestock Management:

The IoT provides solution to farmers even when it comes to livestock management. The IoT systems provide technologies to monitor the health of the livestock. Some sensors are attached to the livestock, these sensors accumulate information about the livestock like the body temperature, blood pressure, digestion, and various other parameters, and these accumulated data is sent to the cloud via an inexpensive technology. If any of the parameters are not normal, or any sign of illness it will be immediately alerted to the farmer.

These are the parameters based on which the health of a cattle is measured:

Parameters	Normal	More	Less
Body Temperature	38-42°C	Anthrax, Influenza	Indigestion
Heartbeat	48-84	High BP	Low BP
Humidity	1-72%	Stress	-NA-

In cattle farming, one of the major challenges is to make sure that there is enough production of milk throughout the year. For these, the farmer has to make sure that the reproductive cycles of the cattle owned by him do not occur at the same time, to ensure the production of milk throughout the year.

It becomes very important to know the different reproductive cycles. Like it is important to know when a cow is in heat and when it gives birth.

These challenges can be tackled using the IoT. The IoT device can detect when a cow is in heat, and notify the farmer. This becomes a means for efficient management of the livestock without having to maintain a record for each of the cow present in the farm. It can also detect the calving time so that the process can be carried out safely if know well in advance.

Conclusion-

IoT technologies, when implemented in a proper direction can take the field of agriculture to a whole new level. The use of equipments such as drones in order to spray fertilizers, and to irrigate, it substantially increases the productivity and sharply decrease the time involved. The usage of sensors and other IOT tools can be a promising means to change the way of agricultural methods. Farming will play vital role in next few years in country. Thus there's need of smart farming. Internet of Things will help to strengthen smart farming. IoT works in several domains of farming to reinforce time efficiency, water management, crop monitoring, soil management, control of insecticides and pesticides etc. It also minimizes human efforts, simplifies techniques of farming and helps to understand smart farming. in conjunction with these features smart farming can help to grow the marketplace for farmer with single touch and minimum efforts.

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An IoT Based System for Remote Monitoring of Soil Characteristics Abdullah Na1, William Isaac2, Shashank Varshney3, Ekram Khan4 Department of Electronics, Aligarh Muslim University Aligarh, UP, India

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Figure1: https://www.iotforall.com/

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