Precision and Smart Farming

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Abstract:

Precision and Smart farming can be considered as the backbone of farming because a large percentage of world's population is dependent on farmers and farming.In India also approximately 75% of population is dependent on farming .Smart farming can be hi-tech system and capital-intensive for clean food grown in mass. Recent studies have hypothesized that the IoT has ability to change major industries for the betterment of the country, including its effect on agriculture. Extreme weather and increasing global climate change are obstacles that must be addressed in order to meet the demand for food. Farmers using SQ farming and Internet of Things technology can reduce waste and improve efficiency in a variety of ways, from the number of trips taken to the amount of fertiliser used. Smart farming is a high-tech, capital-intensive way of processing clean food in mass. It's the introduction of ICT into agriculture.In the below research study we will be talking about that, how to use IoT ideas to make necessary work that proportionately deals with major cultivating system. Observations will be made after studying the results given by Arduino as a result everything will be monitored by internet and computer systems while sitting long away from the fields where the farming is done.

Keywords: IoT, sensory Technology, precision and smart farming, agriculture,Arduino.

1.   Introduction

IoT concept came into news at time of 1999-2000 by market publicants and market investigators. It is basically a differentiation of many devices which altogether sense and work with the technology embeded in the IoT methods[1]. It very fastly became a trend in the upcoming years technology which resulted in the spectrum of many business and gave maximum benefits every passing year. IoT has better solutions to the day today problems faced by the farmers such as security,health,traffic, congestion, control, smart agriculture, better retail [3].

There has been a lot work done In the area of Iot in agroculture to develop system for the ease of farmers[4].

Nowadays the technology advancement has been so much that it has taken agriculture and IoT technology to another level in lieu of finding problem's solution faced by agriculturists and hardworking farmers in their day to day livelihood i.e., water shortage,management of cost and issues about the productivity[6],[7].

A lot of the efforts are inputted by wire-less sensory network which collects the data from devicesand then transferingto the local server[8]. Now the collected data through these devices will now be studies and analysts will make a report the the conditions and it will be monitored correctly wholly.

Only monitoring is not considered as the sole purpose, it will also be helping the enviromentalists and the agriculturist to know how much waste is produced or is there an animal (wild) attack on the crops which can harshly effect the production and quality of the soil and crops cultivated in the areaetc[9],[10].

Now,Fig1. Is a diagram that shows easy effective cost provided by trends of agriculture for security purposes, monitoring the field, Greenhouse, livestock farming.
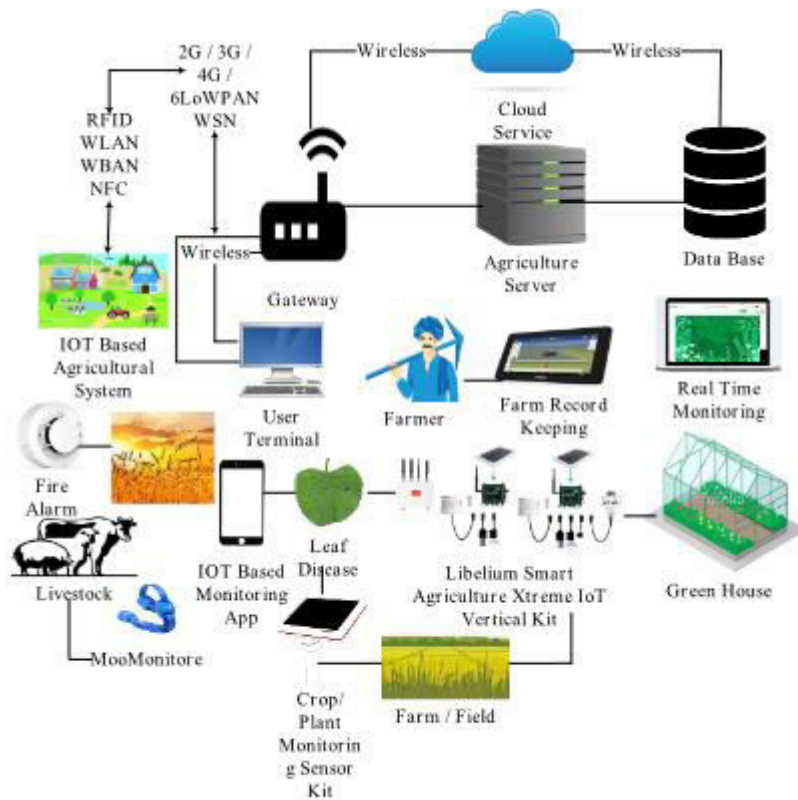
FIGURE 1. Agricultural trends.

As a total field of agriculture there are numerous applications and prototypes and protocols. Though in a lot of countries in the world there a different set of rules, policies and guidelines that are to be followed in the field of agriculture for IoT [28]-[30]. So, to transform from innovation to technology this whole paper analysis concludes the numerous issues in precision and smart farming trends.

2.   MAJOR COMPONENTS IN IOT

Now after analysing the below figure 2 we can say that precision and smart farming based on IoT technology has 4 major components.

They are termed as :
- Physical Structure
- Data Acquisition
- Data Processing
- Data Analytics

From terms above all the Physical structure is considered to be the major one because of the fact that all the devices or sensory devices are dependent and controlled by it.

Data Acquisition has 2 more components named as : IoT data acquisition , standard data acquisition.

The data acquisition also has 7 components: MQTT, web-socket , AMQP, node COAP ,DDS, HTTP.

Data analytics has 2 major components namely monitoring and controlling. Monitoring has 3 major application live-stock monitoring, field monitoring green-house monitoring[11]. There are many applications that are to be monitored in field of applications of monitoring that are soil , water pressure , humidity, air pressure, gas, temperature disease monitoring on crops[12],[13]. The intervention caused manually are eliminated somehow by the greenhouse smart designand it measures different parameters by plant requirements accordance of IoT device[14]-[16].
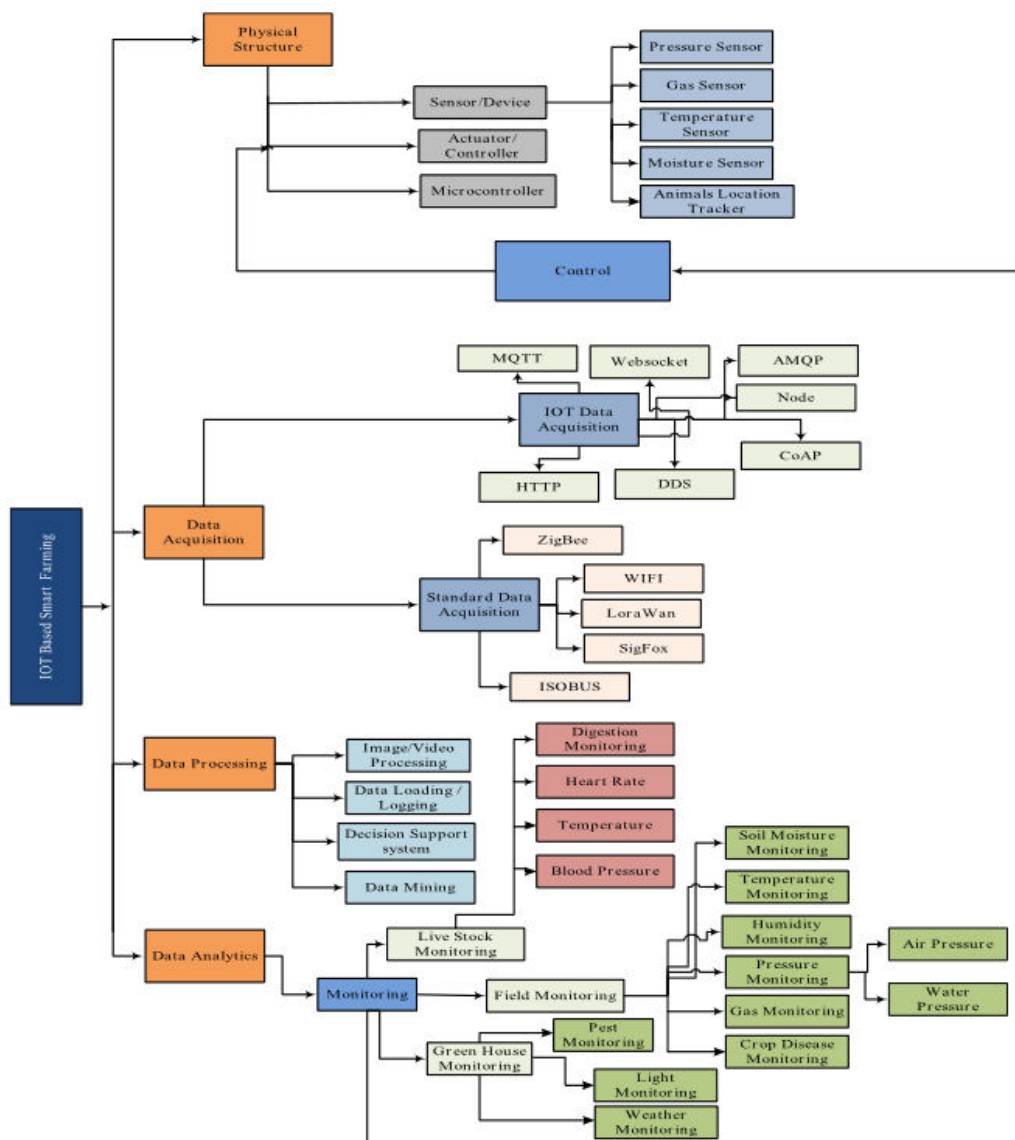

FIGURE 2. Major components of IoT based smart farming.

2.1 Cloud Computing

IoT and Cloud Computing altogether collaborates in agriculture in order to provide a persuasive access to all the resources that are being shared over the course of time. To meet all the requirements upon a network a vital role is being played by the Cloud computing system[17]. Its software has been architecture in order to process and transfer the tasks and the agricultural info in anymore but good condition[18],[19].

The edge computing technology is a general solution that somehow facilitates data generation at the source of data processing which included all the embeded devices and it is also considered as the major backbone of cloud computing. And moreoverfollowing technology is also deployed for requirements of precision and smart farming[20].

2.2 MACHINE LEARNING AND BIG DATA ANALYTIC

Big data has a major amount of essential parts that are generated and used by the agricultural netwoks and sensors. It also helps in analysing and providing different and qualitative crops monitoring hacks at every other stage[21]. A better system review has been posted by the analysis in big data about agriculture[22]. Neural Networks provides dat training and module of detection which helps in retrieving optimal solutions at a good speed[23].

2.3 PROTOCOLS& METWORKS OF COMMUNICATIONS

IoT network has many kind of networks for all ranges of communication possible. Many of these IoT technological networks help us to monitor a specific crop through sensors and specific devices[25]. Protocols of communication are also named as the backbone of the network system of the IoT agriculture and its applications verything is exchanged over the network[26].

2.4 ROBOTICS

Many bots for agriculture are in the last phase of development for a sole purpose and that is precision and smart farming which actually deduces the amount of work done by the farmers but increases the speed of work by machines with the correspondence and help of advancing technologies used.all these bots are used for the increment production of crops and for utilization of efficient resources[27].

3. AGRICULTURAL NETWORKS IN IoT

Iot in agriculture networks is considered for being a major elemtsin field of agriculture done by IoT. It also helps in monitoring data collected in agriculture and also helps in facilitating transfer and receiving the data used in agriculture.As seen in Fig3 it has architecture of agricultural network done by IoT used in platform such as toplogy and protocol.
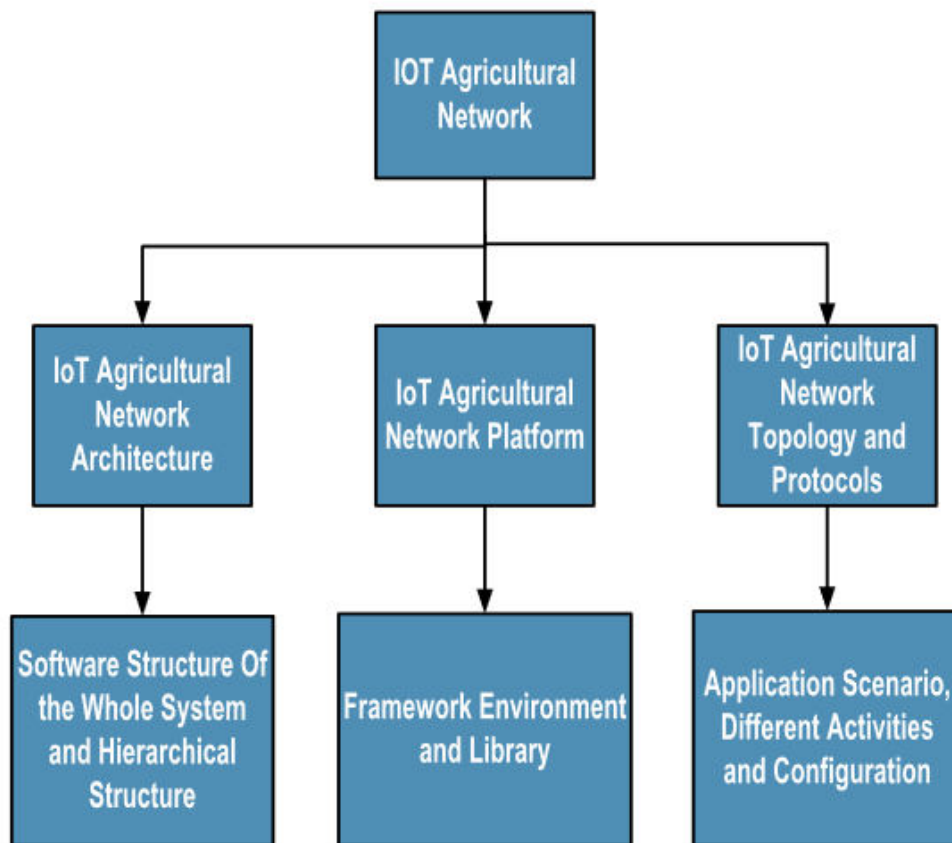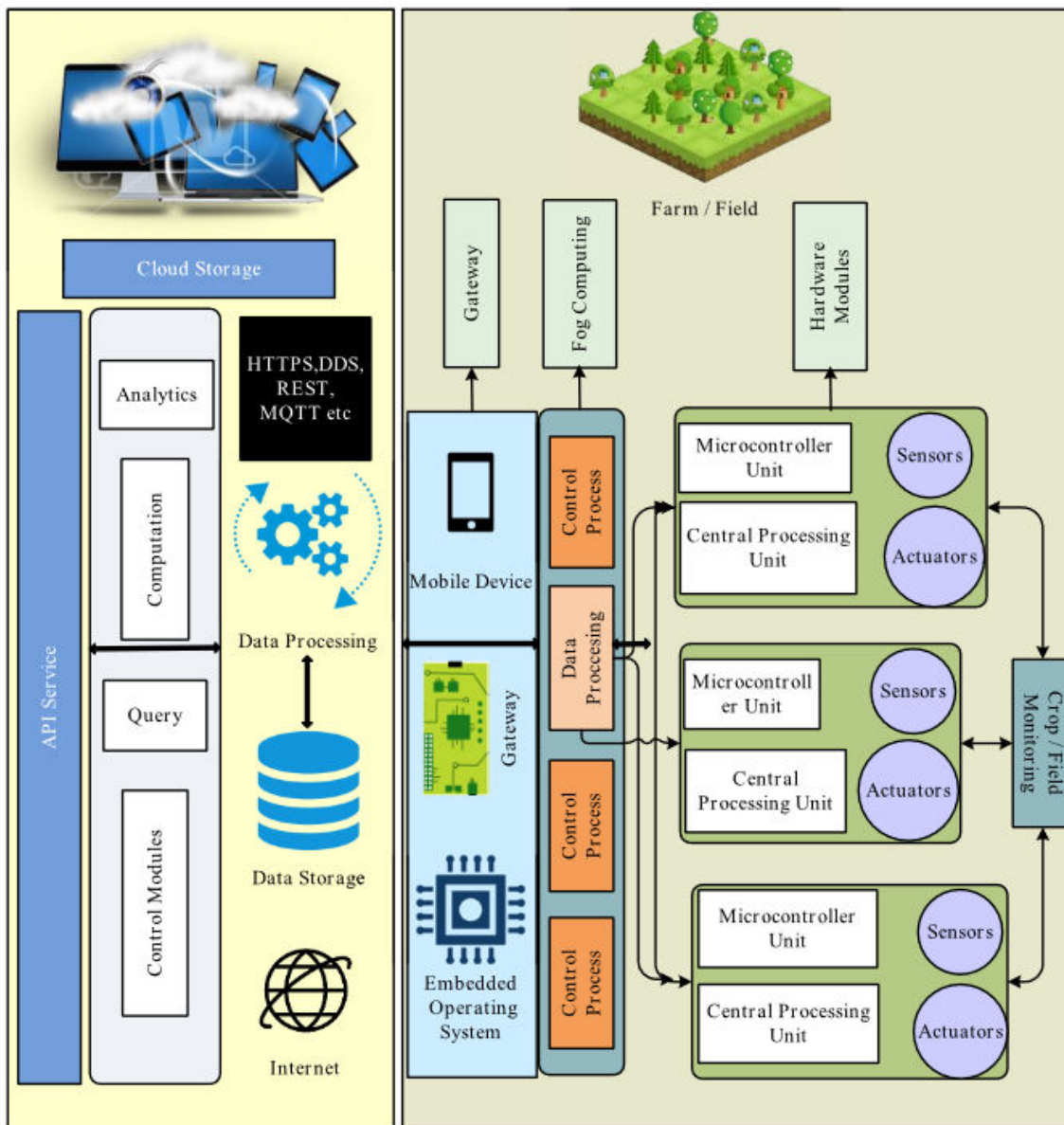
FIGURE 3. **IoT agricultural network.**

3.1   CLOUD INFRASTRUCTURE

It give certainly a very big amount of capacity to store through servers that are virtualized largely and are connected wholly to take actins that are necessary[29]. This platform has 4 layers which are supposed as Cloud Storage, Gateway ,Fog Computing , hardware modules.

Mostly devices are not designed for data sharing purpose through internet connection. The solution is to bridge all the devices for liability and security control. The hardware models are redistributed as a source of integration by fog computing and cloud services. It consists sensors, controller processing units, acutators. In this figure shown below there is a design recommendation for network used in IoT network.

Figure 4   **IoT agricultural network platform based on cloud.**

4.   IoT APPLICATIONS

This system of IoT agricultural is defined as the most major variety of research field filled with greenhouse monitoring, precision farming, livestock farming.

4.1   Precision Farming

It helps in improving ,automation and optimizing all the possible ways to enhance the production of agriculture and system of cropping to be smart. [30] Different types of IoT sensors are used to determine moisture level weather condition and quality of the soil and planning of effective techniques used in harvesting with optimization technology.[28]. In a remote remotely monitoring agricultural platform that's been presented on basis of the data that is to be monitored. An architectural concept which is almost based

on the systems of the cyber security and defined as the software networks present for the precision farming[31].

4.2   GREEN HOUSE MONITORING

In this plants grow under a certain environment that is being controlled. In this technology certain environmental conditions are provided which truly helps in monitoring the growth of plants anytime.
Some of the recent researches have found that IoT may be implement on the greenhouse to socially and invertedly minimize the resources provided by humans and can distribute a link t greenhouse form anywhere to the responsible customer[14]-[16]. Data is mainly obtained from the detectors or by the sensors that correspondingly available to be transferred to another server for multiple procession to be done. And in the mean-while while the implementation is going on the main components can transfer data from networks and sensors respectively.
All the better decision are made by the agriculturists with the help of analysis that is done by obtaining achieving and receiving optimal data.
There are various application that are IoT based used In greenhouse
They are climate and plant monitoring, water management etc.

4.3   LIVESTOCK FARMING

A major negative impression is being liued by the environmental and weather circumstances that absorbs vast amount of climatic condition and it is also considered as a serious issue by researchers[32]. Every year a big amount of profit is lost by the ranchers cause of the illness in the animal husbandries.
 For monitoring the weather conditions different IoT devices are deployed by the virtue of weather stations and are sensed for other activities on the field for other data sources that implement the farms. Now people who use this can interact from remote locations by using their devices such as mobile or tablet.

5   CHALLENGES FACED

According to researchers point in literature there are a number of challenges that need to be solved successfully[30]. A lot of challenges are linked by deployment of smart farming technology and its IoT applications. Our Research paper has pointed out all the challenges that explored at the field of IoT agriculture.

5.1   HARDWARE AND NETWORKING CHALLENGES

The setup of the IoT agriculture invites most challenges. Some of these are harsh to the existing perception layer of the environmental experience and it directly exposes the extreme humidity and temperature conditions which can possibly put a threat on all the electronic devices present on the field. These devices are ,made to work for a very long period of time so sometimes some issues with their battery life and quality occurs with passing of time, they also lose power potential which is backbone of the whole system that is working ion the field. There is also an issue about the high cost that cannot be afforded by any farmer in day to fay life as the networking comes high internet services and a lot of programming and coding skills[22]. There is also a challenge of storing the data as transferring it from one place to another and also the danger of loss of data which can completely change the game for farmers and the fact that all

of these things are certainly dependable on the machine work which has high efficiency but may go wrong anytime and can make huge losses once we are totally dependent on it.

5.2   AGRICULTURAL PLATFORMS

A very complicated architecture is being held by IoT in comparison to another architectural platform because of some much complexity there is a need of real time monitoring and a very much dependable structure of components plugins and APIs, large frameworks to be done and use of resourceful documents to maintained by the developers time to time. The use of unlicensed spectrum can also put our whole system to a threat such as Sogfox, LoRa, Zigbee, Wi-Fi. We cannot be reliable on such kind of technologies.

6   CONCLUSION

With the research done over the world by exploration in technical solution for enhancing the production of agriculture by the service provided by the technology with help of IoT. In the above studypaper we have discussed about the tests on IoT in precision and smart farming. Till this end we elaborate that the IoT based smart farming is the backbone of the farming which will boost and has the power to enhance and completely change the future of farming in India and in the whole world. The introduction of new equipment and networks and sensory ,security device make the work a lot easier and can be done by sitting far away and with no extra physical which is unlike the conditions that is faced by the farmers now in their day to day lives. Now hopefully the governments are also taking an interest and working and investing this field as there is a lot of scope of work to be done and development to be done as well. It is also relaxing to knowing that the major industrial organization are keen to invest in this system and to develop it to make life of the farmers and the techniques of farming better. Finally its is expected that this survey will result in a useful piece of info for all the researchers policy makers , agriculturist and in the field of technology to whoever is participating.

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