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LIST OF PAPERS

High Tech Farming using Big Data and IoT for Smart Agriculture

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***Abstract*---**The agricultural industry will become possibly more significant while comparing few decades back. According to the UN Food and Agriculture Organization to feed the population the world will be need of producing 70% more food. In 2050 than it produced before. To convene these needs, farmers and agricultural industries are revolving to the Internet of Things for data analytics and to increase production capabilities.

I. INTRODUCTION

THE technological innovation in farming has been fast forward in 1990s. The IoT has made the future of farming to the next level. Smart agriculture is becoming more familiar among farmers, and high tech farming has become more important to agricultural drones and sensors. IoT technology has been used in many areas of agriculture to enhance their growth and production.

IoT for the most part is resourceful, well-organized and significant method used in the incremental process for finding various solutions to the hectic situations that happening in real world. It consists of various components which includes devices for sensing, actuation and monitoring, controllers for controlling the actions among devices and corresponding applications in the device. It can transfer data among networks using network connections. The data can be collected locally or from cloud database based on the level of IoT implementation.

The IoT technology is more efficient due to following reasons:

1. Connection of devices globally
2. Reduced human intervention
3. High Velocity
4. Less time consumption
5. Efficient Communication

II. SMART FARMING NEEDS FOUR THINGS FOR DEVELOPMENT

There are many smart devices that help to enrich the performance of various farms. However, an IoT application for agricultural development is a critical task. The following are the components needed for smart farming.

A. Hardware

To incorporate an IoT for agriculture, it is necessary to select the sensors that are to be attached to the device for actuation and monitoring. Sensors can be chosen based on the data that is too needed for agriculture. The sensor selected must work properly on the need and should produce actual data.

B. The Brain

Data analytics plays a vital role in high tech agriculture. So data collection should be done vitally either locally or from cloud database. Data collected should make sense and can used for any predictions by applying data mining algorithms.

C. Maintenance

Hardware maintenance is a challenging part of IoT products in agriculture and sensors may get damaged since it is placed on fields. So it is necessary to make sure that hardware is compactable easy to maintain.

D. Mobility

In order to access the data remotely by owners or users of IoT applications, it is important to have smart phones for accessing the information for their monitoring. Also it must be to connect through wireless network with proper broadband capacity for easy access and sharing of data among themselves.

E. Infrastructure

Internal infrastructure should be efficient and proper in order to perform high tech farming agriculture. Security of those systems should be maintained effectively. Without proper the data may be stolen or physical device can also be broken.

The following are methods of IOT technologies used in farming.

1. High Tech Farming: Precision Farming & Smart Agriculture

Farmers have already started in on employing some high tech farming techniques and technologies in order to improve the efficiency of their daily work. Sensors are placed in farming fields allow farmers to find the details of the area such the resources available and also to know the topological terrain attributes as well as temperature of the soil. It also helps to predict the climate of forthcoming days or weeks.

Farmers can also use their smartphones to monitor their equipment remotely, and check the crops and to obtain status of stocks which may help for further feeding and producing. They can even use this technology for statistical predictions [1].

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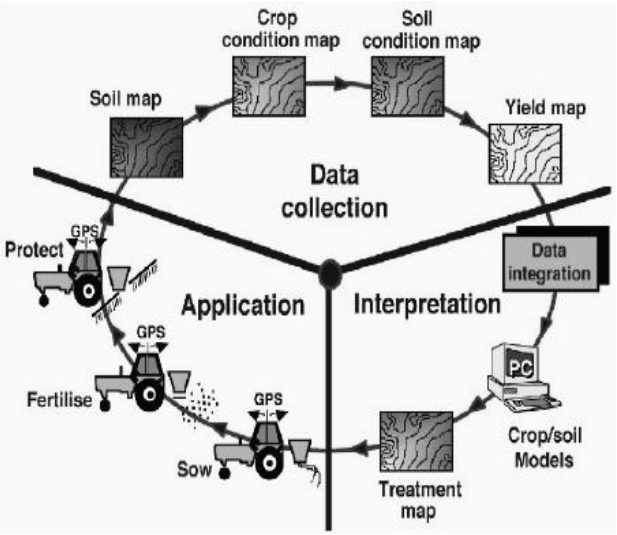

Fig 1: Precision Agriculture Cycle

2. Agricultural Drones

In recent days, farming started to inculcate the drones for their major use. Farming Drones are used for the enhancement in agricultural field for various ground based and aerial based crop health assessment, irrigation, crop monitoring, crop spraying, planting, and soil and field analysis. Mainly this is done based on mapping the patterns. So the usages of Drones help to save time and also increase yielding.

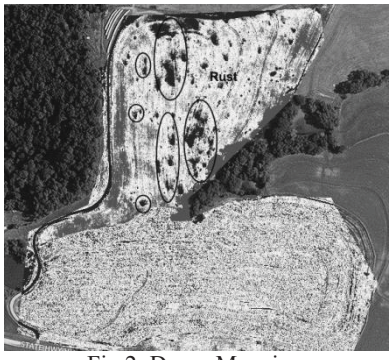

Fig 2: Drone Mapping

3. Livestock Monitoring

The farmers can use livestock monitoring to keep track of cattle fields and also for productivity of the cows. I also capture the data of each cow and help to collect data about heat, nutrition and health which are needed by them. The device can be fixed on collar or ear for the monitoring.

Fig 3: Livestock Monitoring

4. Smart Greenhouses

Greenhouse farming is a technique which helps to improve the growth of vegetables, fruits, crops etc. Environmental parameters can be controlled through manual intervention. So this may result in loss of production, energy as well as labor cost, which make this method less effective. A smart greenhouse can be designed with the help of IoT which monitors efficiently by controlling the climate without human intervention.

In smart greenhouse, different sensors are used to measure the environmental parameter which helps to identify the requirements of the plants.

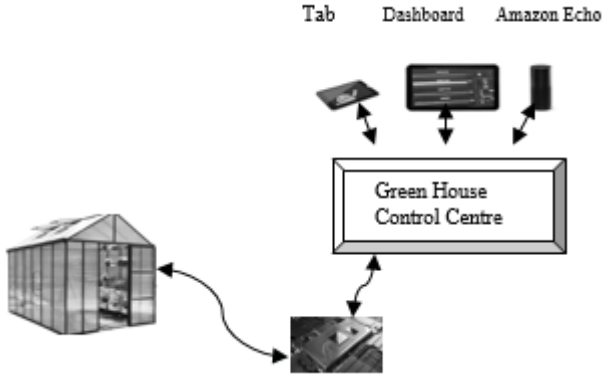

Fig 4: Smart Green Houses

5. End-to-End Farm Management Systems

A more multifarious approach towards the IoT technology in agriculture is farm productivity management systems. This includes a number of IoT agricultural devices and sensors, installed in dashboards which are capable for analysis and built-in reporting features. This proffers farm monitoring capabilities remotely and allows you to streamline most of the business operations.

6. Cattle Monitoring and Management

Just like crop monitoring, there are IoT agriculture sensors that can be attached to the neck or ear of animals in the farm to monitor their health and log performance. This works similarly to IoT devices for pet care.

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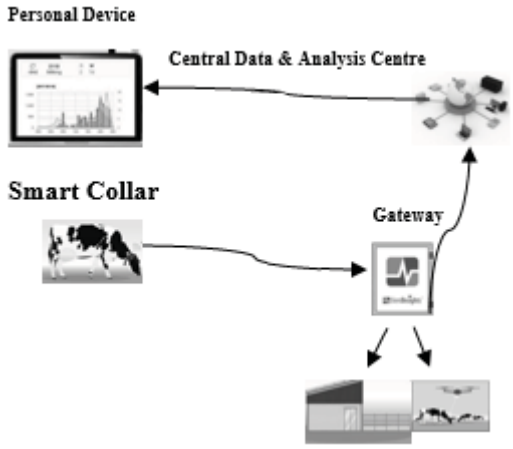

Fig 5: Cattle Monitoring and Management

The Benefits of smart farming

Technologies and IoT have turned the agriculture in many phases. Namely, there are,

- **Data are collected by smart agriculture sensors,** e.g. weather conditions, soil quality, crop's growth progress or cattle's health.
- **Better control over the internal processes and lower production risks**. The output of the production can be foreseen and plan can be made for better future product distribution.
- **Cost management and waste reduction.** If any anomalies in the crop growth or livestock health, the risks can be reduced.
- **Increased business efficiency through process automation**. Usage of smart devices, automates multiple processes across production cycle, e.g. irrigation, fertilizing, or pest control.
- **Enhanced product quality and volumes**. Achieve better control over the production process and maintain higher standards of crop quality and growth capacity through automation.

III. CONCLUSION

Thus the IoT applications on agricultural farming help the farmers to collect meaningful data. Farmers under all categories should understand the prospective of IoT market for agriculture by using high tech farming to increase competitiveness and sustainability in their productions. With the swift growth in population, the requirements can be successfully meet if the farmers implement agricultural IoT solutions in an effective manner.

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