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Acquiring Food Security through Precision Farming Techniques

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Abstract*—Indian economy is majorly influenced by an agricultural produce. We know that about 1/3rd population of India is directly or indirectly dependent on agricultural related activities. But there are certain traditional ways which requires some basic changes to deliver improved farming techniques. Some smart solutions with IoT in farming activities can really help the farmer to produce effortlessly and improved crop yield. There are various technologies like Smart Irrigation System, Hydroponic Drip Irrigation, Crop Environment Database, Quality Prediction System, Disease Disaster Prediction, Remote Crop/Equipment Monitoring, Weather Monitoring, Livestock Monitoring, Greenhouse Monitoring, etc. which really helps us in planning and management. In this paper we deal with different aspects of precision farming & IoT in agriculture and their importance related to food security which attracts a lot more importance these days due to inflation.*

***Keywords*—** *Precision Farming, Internet of Things (IoT), Agriculture, Food Security, etc*.

I. INTRODUCTION

Indian being a nation where agriculture contributes around 13.7% of GDP, There is major workforce which totally depends upon agriculture produce. As we belongs to developing country, we don't have proper management of electricity, water supply, seed and fertilizers inspection, cost management, etc. like in the remote areas of vidarbha. It leads to problems like farmer's suicide, poverty, Hunger, food scarcity, etc. This motivates us to deal with new technological aspects that can surely benefits the farmer's at large extent and with the use of such technology the farmer will definitely improve the agricultural produce.

We have internet where we can connect to not only every single individual but also to smart devices which can remotely work and gives us pleasure of working. Internet of Things (IoT) is the same concept where we are connected to different types of devices remotely and can monitor and control according to our requirement. We now-a-days focusing to agriculture IoT where, agricultural activities can be controlled and monitored remotely with the internet access. According to weather forecast and report we can schedule the crop activities accordingly and can monitor them in real time. Also, through agricultural drones we can spray pesticides and monitor the plant activities by advanced sensors and digital image capabilities. Drone technology is very effective at collecting data to help farmers to improve crop health. Other technologies in green house management creates an ambient environment according to the crop needed. Also, there are precision farming techniques where a proper required quantity of water and pesticides should be provided to plant through controlled system. This all technological aspects leads us to food security and to become a wealthy independent country.

II. LITERATURE REVIEW

1. Ravi Kishore Kodali and Borade Samar Sarjerao proposed "A Low Cost Smart Irrigation System Using MQTT Protocol", A new system can be developed or designed which transform the old traditional farming into the smart farming. This paper tries to design a simple water pump controller by using a soil moisture sensor and Esp8266 NodeMCU-12E. A Message Queue Telemetry Transport protocol is used for transmitting and receiving sensor information. Depending on a status of soil moisture content NodeMCU-12E controls a water pump action and displays the soil moisture sensor data and water pump status on a web page or mobile application. In this way, a secure, flexible, trust-able and economical system is developed to solve agricultural irrigation problem.[4]
2. Nishant K. Verma and Adil Usman Proposed, "Internet of things (IoT): A Relief for Indian farmers", Indian farmers lacks sufficient knowledge about their soil structure which is changing day by day due to different weather conditions and other external factors. They even don't know about which crop will be optimally suited to be grown in such soil are some of the problem. This paper suggest a solution which will have a centralized data server to analyze the data and report to the farmer the precautionary step to be taken in advance of the safety of the crops. This will be ecofriendly energy management through the solar power plant and wind energy which will make the IoT device more portable and implementable in rural areas. [10]
3. Krittin Lekjaroen, et al., published paper- "IoT Planting: Watering System Using Mobile Application for the Elderly", It consist of IoT planting and gardening platform prototype with soil moisture, temperature, water sensor, grow light and android application for the elderly. An evaluation was performed by technology acceptance model (TAM).[6]
4. Victor H. Andaluz, et al., Proposed "Automatic Control of Drip Irrigation on Hydroponic Agriculture: Daniela Tomato Production", Work consist of the control drip which is applied to the hydroponic farming through a free software allowing the continuous monitoring of moisture, pH, temperature and electrical conductivity of soil. The controller performs the conditioning sensors, actuator

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control resource to irrigating water and nutrient solution and monitoring via web. Paper shows the results related with tomato fruit.[2]

5. Andreas Kamilaris, et al., proposed "Agri-IoT: A Semantic Framework for Internet of Things-enabled Smart Farming Applications", A proposed Agri-IoT supports reasoning over various heterogeneous sensor data streams in real time. Agri-IoT can integrate multiple cross domain data streams, providing a complete semantic processing pipeline, offering a common framework for smart farming application. Agri-IoT supports large scale data analytics and event detection, ensuring seamless interoperability among sensor, services, processes, operation, farmers and other relevant actors, including online information sources and liked open datasets and stream available on web.[3]

III. VARIOUS PARAMETERS

There are different parameters enlisted below which drives us to get the various aspect about farming techniques.

International human rights law established the right to food principle. But India lags far behind in nutrition standards as people in India gets quality of protein intake at only 20% which required being 100%. Its state responsibility to respect, protect and fulfill citizen's right to food security. There are four dimensions of food security- access, availability, utilization and stability. In India we have implemented National Food Security Act (NFSA) 2013. The overall food security majors can be fulfilled through the following parameters depicted in below figure 1.

Fig. 1. Food security.

Precision farming /Smart farming/ precision agriculture/ Agriculture 4.0 is the concept where various updated smart technologies used to improvise the agricultural yield more productively. With the advancement in this 21st century we evolve lots of concept which derives the basic agriculture in different modes. The technology like sensors and remote sensing, High precision positioning system, geo-mapping, automated steering system, variable rate technology, integrated electronic communication, agricultural drones, smart equipment's and sensors, etc. helps us a lot. Here human intervention in negligible and we can save time and energy at large extent. As machines are used precision and efficiency is at high level as there is negligible chance of mistake and thus been preferred.

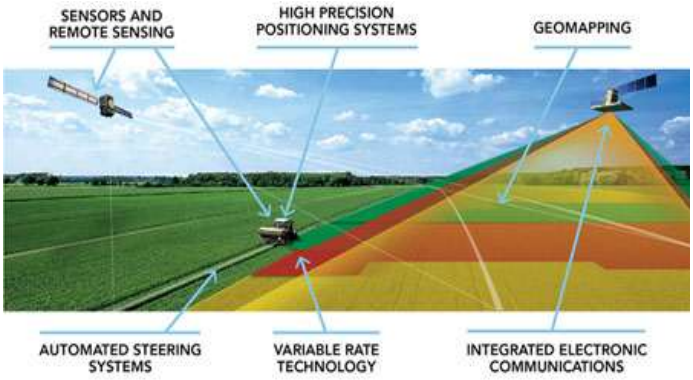

Fig. 2. Precision farming.

IV. SYSTEM DEVELOPED AS OF NOW

When we meant to acquire food security, we ensure adequate supply to people especially those who are deprived of basic nutrition. It's one of the major concerns in some countries like India. There are nearly 195 million undernourished people in India, according to UN agency. Food security index suggest India ranks 74 out of 113 countries. Right to food is the right of every single citizen according to UN charter. India have a lot of potential if it acquires some basic technological changes which now-a-days caters with IoT technology. Smart green house is one of the important application which can increase the crop production activity through artificial light, water, temperature control.

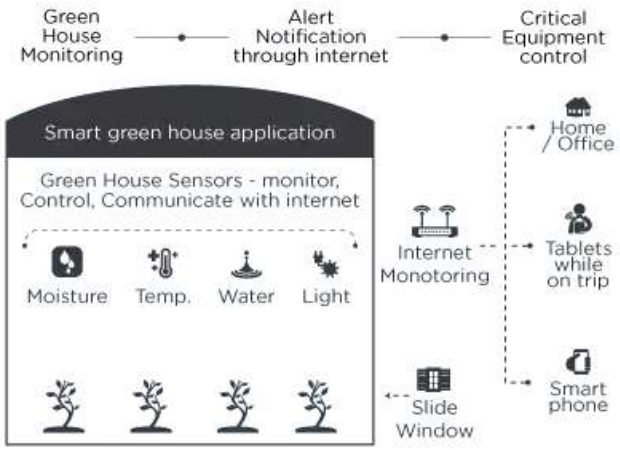

Fig. 3. Smart green house application.

Above figure suggest the smart greenhouse application where, green house as a separate entity can monitor, control, communicate with internet through greenhouse sensors. We have different sets of sensors like moisture, temperature, water, light, etc. As green house is integrated with internet we can even control this system from distance such as when we are at home/office, while on trip, from Smartphone etc. No need to visit farmland as we can save our time, energy and

most important parameter is security concern. As, lots of villagers visit farms at midnight to turn on/off motor pumps due to uneven electricity supply.

Precision agriculture is now-a-days evolved new farming management concept that uses agricultural drones to measure, observe, and respond to variability found in crops. Agricultural drones have been changing the face of farming and cultivation heavily. They are able to check the storm damage, monitor crop progress, are make sure that both crops and heard are healthy. This facility is really helpful for the farm that has very maximum yield or hilly terrain areas or having scarcity of labor. We got to get the best result as this technology provides geo tagged images of fields, real time feedback and logs, crop yield which ensures the farm's health. When weather conditions got more intense, hurricanes do damage, draught and pesticide intensifies then these drone technology has the potential to do plenty of things. This drone technology is also named as bird's-eye-view.

Fig. 4. AGRAS MG-1 by DJI.

Hydroponics is the modern technology in agriculture where a plant growth and productivity is controlled by water and its nutrients in the water. It's one of the practice where farming without soil and growing the crop on water. This technology is popular for green initiative where water is used precisely and also enriches the plant well with balanced nutrients which are essential for the plant growth and better yield. Use of aquarium water where fish rears or produce at a large scale can also be used for the agriculture purpose which provides essentials nutrients through fish waste known as aquaponics.

V. APPLICATION:

There are lots of applications in this segment. Some researches are already been exexcuted at international level like- Cropx's Soil Monitoring System, Temputech's Wireless Sensor Monitoring, Claas's Smart Equipment, Precisionhawk's Drone Data Platform, Precision Planting's Corn Maze, Teamdev's Libelium Network For Tobacco Crop Quality, Jmb North America's Connected Cows, etc.

There is lot of scope in this field to research as a wise man said- What's the logic of investing millions in agriculture if it will not pay off? So, to acquire food security and healhy lifestyle we must move towards technological advancement in agriculture.

VI. CONCLUSION

From the above study, we can conclude that the agriculture took completely new form of attire where technology plays a vital role. We must ensure to use precision farming techniques in our agricultural lands/farm to increase agricultural output and to get quality produce as per the international standards. Doing this we can achieve food security in minimum period of time and can be able to stand and survive in the list of developed countries soon.

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