

## Role of IoT in Smart Farming

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### **Abstract**

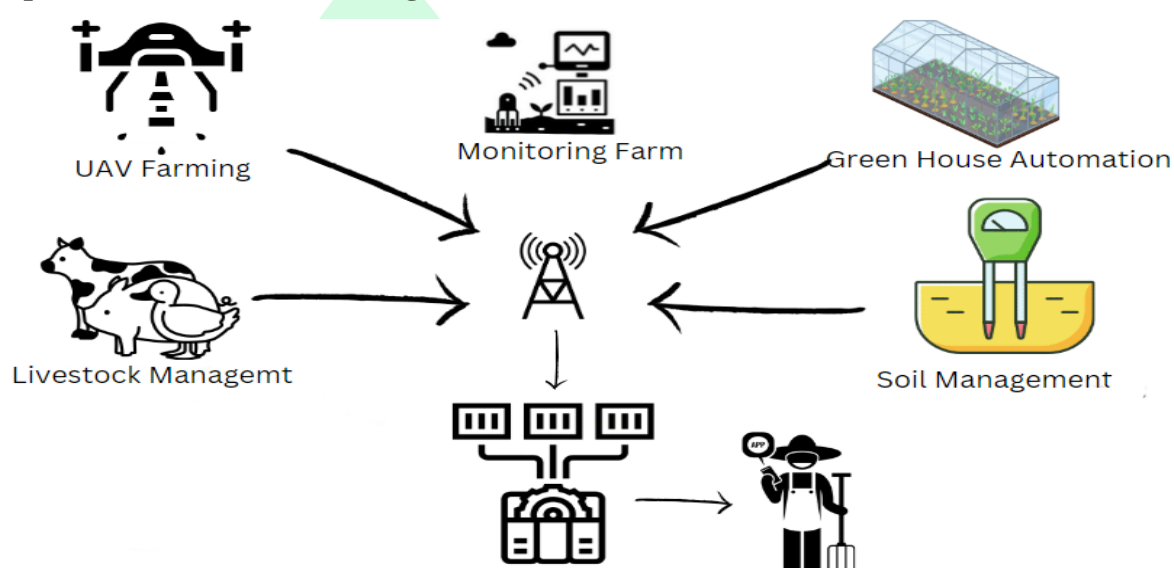
The increasing global population has raised the need for intensification of agriculture and this problem cannot be addressed with current agricultural technology. In the current agriculture scenario, the use of high input like fertilizers and other chemical input have led to adverse impact on the air and water quality, soil fertility and other parts of the ecosystem as well. But the Internet of Things is a promising technology that has the potential to handle the shortcomings of intensified agriculture. Internet of Things can not only reduce the adverse impact on our ecosystem but it can also reduce a substantial amount of crop inputs that can be used to produce extra output with the same level of input. Amidst various applications of Internet of Things in agriculture some are monitoring of soil, UAV farming, Greenhouse automation and Livestock management and this article outlines the advantages and constraints that lies in the path of harnessing the true potential of IoT for the agriculture sector.

### **Introduction**

Kevin Ashton gave the idea of the "Internet of Things" (IoT) in 1999. The IoT worldview is ready to change the rural area by laying out a mechanical domain in which unmistakable substances, like sensors, devices, and hardware, are expanded by computational power and systems administration capacities. These substances, generally alluded to as "Things," have the capacity to work either as free elements or as a strong, cooperative gathering of heterogeneous gadgets. With regards to the IoT worldview, the mix of these interconnected gadgets holds monstrous extraordinary potential for the agricultural sector. Through the usage of mechanical headways, farmers are engaged to improve their operational process, enhance production levels, and likely to make right choices grounded by real time data. By implanting sensors inside the soil, for example, moisture levels, temperature, and nutrient content can be consistently observed, accordingly offering significant bits of knowledge for efficient water and nutrient management. Besides, the execution of wearable gadgets on cattles, pigs and sheeps empowers ranchers to actually follow their wellbeing, location, and changes in their

behavior, thereby assisting the ranchers with keeping them healthy and preventing disease and, the application of Internet of Things into farmer's everyday devices holds promise for consistent communication and automation for example by the installing GPS and sensors in tractors enables them to navigate fields freely, thereby optimizing routes and minimizing fuel consumption. Moreover, drones equipped with imaging sensors can be used to screen crop health, irritations, and even guide the spraying with precision, resulting in reduction of pesticide use.

### Implementation of IoT in the agricultural sector



- ✚ **Monitoring the Field Soil:** In India, a large number of farmers face the problem of soil monitoring because in conventional methods it takes a lot of time to collect samples from each field and then labeling and sending them to nearest Krishi Vigyan Kendra (KVKs), State Agricultural Universities (SAUs) for testing. Subsequently a significant amount of time is taken by KVKs and SAUs to process and analyze these soil samples and compose the results of the tests. However, IoT has the potential to reduce the time required for monitoring of soil condition with the use of sensors which collect data from a wide range of parameter including soil moisture, soil temperature, soil electrical Conductivity (EC), PH, Exchangable Sodium Percentage (ESP) and other relevant parameters as well, which otherwise will take a significant amount of time by conventional methods. Then these data are transferred to cloud-data, where it is analyzed and visualized digitally. And, the resulting insights can be used by farmers to

make various decisions regarding irrigation and nutrient supply or carrying out any soil amendments.

- ✚ **Dairy Animal Observation:** As we all know, taking care of a large number of cattles requires an immense amount of effort and time and even if the Ranchers have enough time, no matter how hard they try, they'll always miss out on something. However, the efforts required and time consumed can be reduced drastically with the help of IoT, because Cattles can be equipped with sensors and different gadgets capable of observing information related with their health, rumination, and signs of heat and other state of cattles. These sensors are also equipped for monitoring Cattle feeding habits and their movement within the dairy farm. Besides, environmental parameters of Cattle Shed like temperature, humidity and air quality can also be monitored with the help of these sensors. And, the gathered information can be sent to the Data Centre for interpretation. So, the Ranchers can use this prompt data to recognize and treat sick cattles subsequently controlling the spread of disease and manage feeding and grazing schedules as well as the well-being of cattles.
- ✚ **Agricultural Drones:** Agricultural Drones are purposely designed for agriculture and are unmanned aerial vehicles (UAV) that are operated from outside of drone with the help of Remote control or programmed to fly autonomously using software, tha control the flight schedule and route installed in their systems, which operate simultaneously with GPS and sensors. Drones can be utilized for crop operations like Pesticide application and multispectral mapping of crop fields. And By analyzing the captured data by drones, valuable insights can be acquired consisting of crop performance, crop stress, irrigation requirement, pest and disease occurrence, plant density, yield prediction, and much more. Employing drones for agriculture operations like pesticide application doesn't only reduce the cost and time consumption but also increase the efficacy of pesticides. In addition, drones also make the multispectral mapping of crop fields accessible to farmers.
- ✚ **Greenhouse Automation:** Greenhouses are protected structures that provide favorable environmental conditions to crop plants by creating a micro-environment. Environmental factors like relative humidity, temperature, CO<sub>2</sub> concentration and light intensity can be managed by various systems fitted within the Greenhouse. The



utilization of IoT innovation in the monitoring of Greenhouse envelops the establishment of different sensors and IoT gadgets. These gadgets are utilized to assemble appropriate information in regards to the environmental conditions inside the nursery, including temperature, moisture, carbon dioxide levels, and light intensity. Therefore, this gathered information can be sent to a computer system for analysis. Besides the sensor can also be programmed to send alerts to the cloud-based system when the parameters such as humidity level, temperature, Co2 Level reaches a certain level and following these events the sprinkler, heating/cooling unit, venting system start acting until the parameters again reaches to a predetermined optimal level for crop plants. So, the nursery cultivators can proficiently direct and control the nursery climate.

### **Constraints in adoption of IoT in Agriculture**

There is no doubt that the benefits of implementation of IoT in Agriculture are numerous nonetheless, it hasn't achieved that success yet. This can be credited to various obstacles that require consideration, including little land possessions, low risk-bearing capacity, high initial fixed costs, absence of data, and lacking abilities expected to work IoT gadgets. It is also known that roughly 85% of farmers have land possessions of under 2 hectares, which fills in as the basic reason for all other limitations. The lack of information with respect to IoT innovations further hinders farmers' capacity to work and keep up with gadgets and softwire's successfully. Moreover, the establishment and support of IoT frameworks require huge amounts of capital, which numerous farmers don't have, further restricting their ability to take on this innovation. Thus, the practicality of carrying out IoT in agriculture remains a test, especially for limited scope farmers.

### **Conclusion**

Finally, after discussing IoT, its scope and uses in agriculture. It is crystal clear that there are numerous benefits of using IoT other than saving resources and time and increased fertilizer efficiency and pesticide efficacy, but it comes at a cost which draws our attention to the various problems faced by Farmers in implementing IoT in their own farms which not only include high initial cost but also the lack of technical knowledge. Which must be addressed prior to dissemination of technology in order to fully harness the true potential of IoT for agriculture.