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Application of IoT in Agriculture

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***Abstract*— Agriculture is a backbone of the Indian economy, nowadays farmers are facing manpower problem, it may be due to migration of the manpower, and they need to manage the infinite resources in agriculture. Computer application for precise management is a novel weapon to increase the utilization of resources efficiently. Crop-dusting is a farmer's tedious, repetitive work, which drones will take over to save time, money with safety. Drones can hold fertilizer tanks and pesticides to spray on crops with much more accuracy than the manual one. In this paper, we have proposed one Internet of Things based architecture of smart agriculture techniques. The proposed architecture consists of various layers to per-forms smart agriculture work.**

Keywords*— *IoT, Agriculture, Automation, Crop-dusting, Drone.

I. INTRODUCTION

Related devices have penetrated every aspect of our lives with the approach of the IoT, from health and wellness, domestic robotics, logistics and automotive, to commercial IoT and clever cities [17]. Therefore, it is only fair that connected gadgets based on IoT and automation discover their apps in agriculture and as such improve several sides of the farmer. Over the past decades, agriculture has seen some technological shifts, becoming technology-driven and extra-industrialized. By using many clever agricultural gadgets, farmers have gained better control over the growing cattle and method of raising, making it more predictable and more competitive .Farm-mounted IoT devices should collect and process facts in a repeated cycle to optimize the farming process, and enabling farmers to react quickly to emerging problems and adjustments under ambient conditions. Sensors sense the condition of crops, animals, soil, or atmospheric observational data. Sensor data are fed to different software with pre-defined decision guidelines and fashions that decide the situation of the entity being investigated and any shortcomings or needs. The software determines after problems have been revealed whether the location-specific remedy is important, and if so, which one. The remedy wishes to be made using the correct machine operation.

The cycle repeats from the start, after evaluation. For mainly IoT-based approaches that make agriculture more regulated and precise, precision farming is an umbrella perception. Flowers and cattle get exactly the treatment they deserve, calculated with extraordinary accuracy, in clear terms.

II. APPLICATIONS OF IOT IN AGRICULTURE

Agriculture plays an important role in the economic growth of our country. Agriculture is that art of cultivating plants and science . Agriculture is completed not automatic for ages because the many countries are trending into implementations and new technologies ,it's a required objective to trend up with agriculture additionally. The necessary role is played by IoT in sensible agriculture. The sensors of IoT are capable of providing info regarding agriculture fields. we have planned associate degree IoT and sensible agriculture system victimization automation. This Internet of Things based mostly Agriculture observation system makes use of wireless detector networks that are used to collects knowledge from completely different many sensors at numerous nodes and transmit it is possible through the wireless protocol in smart agriculture in Fig 1.

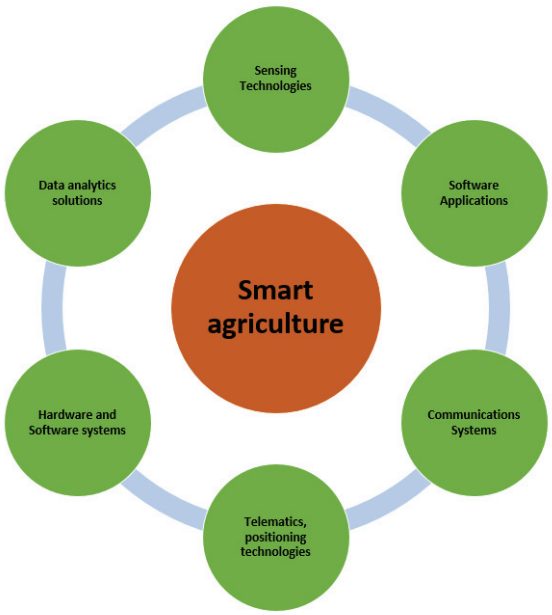

Fig 1: Smart Agriculture

The sensible agriculture victimization Internet of things system is battery based powered by Arduino, it contains a Temperature detector, wetness detector, water level detector, GPRS module and DC motor. Once the Internet of Things based mostly agriculture observation system starts it checks the wetness, water lev-el, and wetness level. This sysem sends an SMS alert on the cell phone regarding the amount. Sensors are used to sense the amount of water if it goes

down, it mechanically starts the water pump system. If the system temperature goes higher than the amount, the fan starts. This all is showed on the alphanumeric display module. This all is additionally seen in IoT wherever it shows info of wetness, wetness, and water level with time and date, supported per minute. Temperature is often assailing a specific level, it's supported the kind of crops cultivated. If we wish to shut the water with help of IoT there's a power switch given from wherever pumps are often forcefully stopped. The all activities are managed by end to end management system in Fig 2.

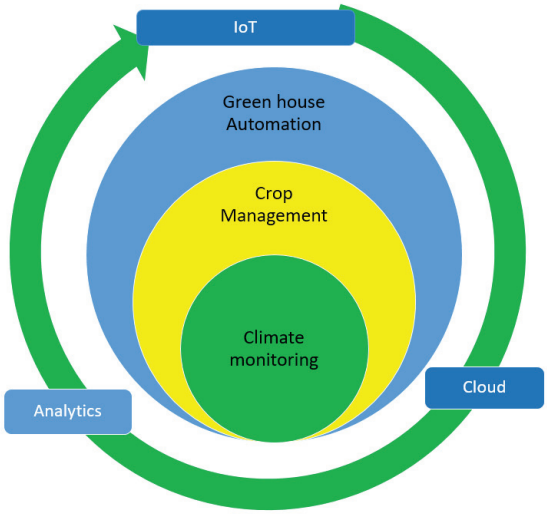

Fig 2:End to end form management System

III. Related Works

Researchers have been implemented various architecture of IoT for the agriculture sector. Nagaraja et al. [1] proposed a system to increase agriculture productivity that uses the blessings of cutting edge technology inclusive of Arduino, Internet of things, and Wire-less Sensor Network. Verdouwa et al. [2] developed and implemented an IoT-based system architecture framework within the agricultural and meal domain. A architecture framework includes a logical set of viewpoints architectural as well as guidelines for applying those viewpoints to version architectures of IoT-based character systems.

Jisha et al. [3] implemented an efficient system to control water for large farms and private sectors. It provides a primarily IoT-based technological water management solution, incorporating one of a kind sensors, cloud storage, etc. Boursianis et al. [4] re-viewed the latest IoT and UAV generation studies applied in agri-culture and define the basic IoT-era requirements, including wise sensors for data collection, IoT sensor forms, networks, agricultural protocols, as well as IoT programs and clever farming solutions.

Rajesh et al. [5] included the various functions, such as soil mois-ture sensor, temperature sensor, moisture sensor to facilitate proper irrigation. At exceptional locations on the farm, various sensor nodes are deployed to automate irrigation anywhere. Khan et al. [6] proposed an IoT based cell robotics network primarily for agricul-tural applications. The robots incorporate the Wi-Fi sensor network and connect for the reliable sharing of sensor information via the NRF protocol with help of Master and slave. Concept. The master robotic also passes these data onto the IoT server.

Ahamad et al. [7] combined two distinctive technologies, the In-ternet of Things (IoT) and the network of wireless sensors for smart far remote crop monitoring. Sensor nodes are installed in fields where information is collected on various parameters. On the transmission side, certain values are displayed after which the usage of a network of XBee sensors is transmitted to the bottom station.

Pratibha et al. [8] proposed a framework for temperature and hu-midity control in the agricultural sector through the use of CC3200 single-chip sensors. The camera is linked to CC3200 to capture im-ages and send them via MMS to mobile farmers using Wi-Fi. Ayaz et al. [9] highlighted the promise of Wi-Fi sensors and IoT in agriculture and difficulties that must be addressed as this technolo-gy combines with conventional agricultural procedure. IoT devices as well as verbal exchange techniques, connected to wireless sensors found in agricultural packages, are studied in depth.

Mishra et al. [10] presented a top-level view of IoT, large information, AI(Artificial Intelligence) and their intrusive role in shaping the future of agri-meals systems. Lizana et al. [11] suggested a low cost, tracking, and flooding system that could be used in family and group gardens.. Manideep et al. [12] specialized in the construction of such a Digi-cam module machine. The module enables us to capture the snap-shots that can be used to examine the form of leaf and whether any disease affects it.

Marcu et al. [13] described the potential response to the use of Libelium for Smart Agriculture as an extra-reliable IoT-based sys-tem to reveal parameters that have a immediate effect on crops. The monitoring system also target to manage irrigation-related agricul-tural problems, analyses the effect on agriculture of the calculated parameters, thus helping farmers grow safe crops.

Abhiram et al. [14] proposed an IoT-based superior solution to monitor soil situations and surroundings for a successful crop boom. Use NodeMCU, the built system can monitor humidity, tempera-ture, soil moisture level, humidity and several sensors that are connected to it. A agriculture related notification in the form of an SMS will also be sent to a farmer's phone about the use of Wi-Fi regarding the field's environmental situation.

Muangprathub et al. [15] suggested a system perfectly watering crops based on a wireless sensor network. These paintings aimed to layout and increase a control gadget the usage of sensor's node in-side the crop discipline including data control via cellphone and an in-ternet application, and used mainly three components hardware, web application, and cell application for that. Kumar et al. [16] proposed an IoT architecture to avoid the spreading of COVID-19.

IV. The Proposed Architecture of IoT Based Smart Agriculture

We aim to propose a formal concept to implement the idea of an age of IoT technology and robotics within the agricultural sector. The architecture is composed of core network layer, edge network layer, an end-user layer, device & storage layer, and management layer. The IoT device, edge device, the server and storage layer, and edge device do likewise.

The IoT sensors like drones, relays, whether sensors are connected to gateways through Node MCU or Arduino with Wi-Fi module. Data loaded on the cloud through gateways for monitoring and controlling of farming remotely using smart devices like smartphones and computers. The figure of the proposed architecture is shown in Fig 3.

In the IoT architecture all the sensors placed on the remote area of form and weather station is used to gather the information whatever received by the multiple sensors and information is transmitted to analytical tool for analysis. Sensors square measure devices are sensitive to anomalies. The monitor of crops will be done by farmer and with help of analytical dashboard, Farmers will take action.

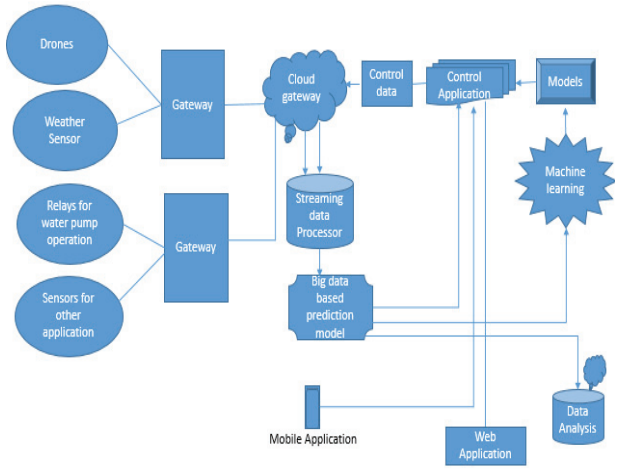

Fig 3: The proposed architecture of IoT based smart agriculture

A. *Crop observation*

The different types of sensors placed are used to monitor the crops for changes in temperature, humidity and size of crop in agriculture form in Fig 4. The sensors can analyze and detect any anomaly and farmer is notified. With help of crop observation farmer can reduce the expansion of crops.

B. *Weather conditions*

The farmer can determine the condition of weather and weather pattern in form and former can take appropriate action according to the condition of weather. The farmer will analyze the weather and will make planning for crop protection.

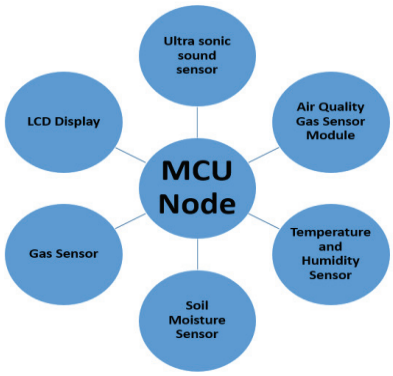

Fig 4: Sensors for Crop monitoring

C. *Soil quality*

The soil quality analysis helps to former for crop monitoring. The former will use fertilizer after analysis the soil condition. The soil voidance capability, that permits to regulate the number of water required for irrigation and therefore the choose most useful style of cultivation.

V. Conclusion

The proposed architecture presented an agriculture solution with the assist of IoT Technology as well as robotics technology. Agricultural robots automate slow, repetitive, and stupid obligations for farmers, allowing them to focus greater on enhancing overall manufacturing yields. Some of the most common robots in agriculture are used for harvesting and picking. The factory robots and Electric farm with interchangeable tools, including greedy technologies, low-tillage solutions, soft robotic, and sensors technology, will contribute to sustainable agricultural intensification, productivity in power generation, and underpin food security.

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