USE OF IoT IN AGRICULTURE

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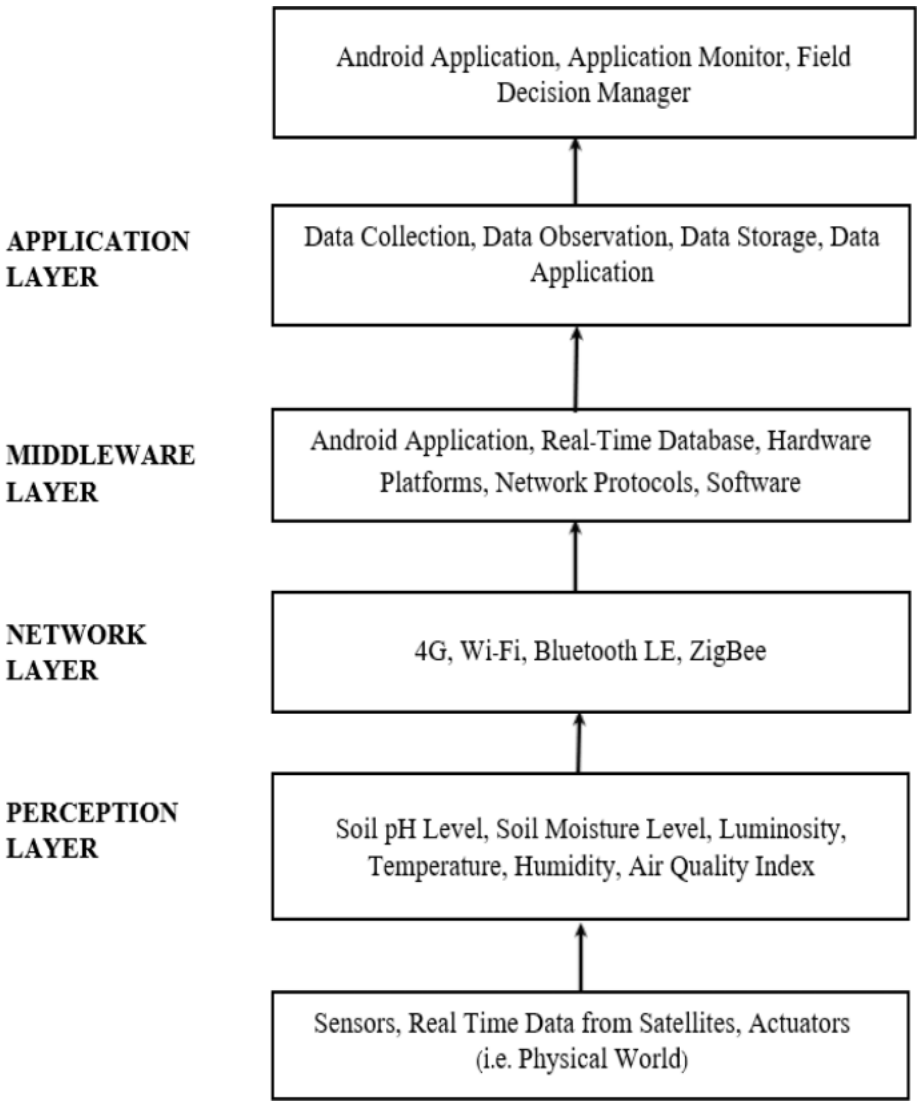
1 Introduction

IoT (Internet of Things) architecture is being increasingly used in agriculture to improve crop yields and reduce costs. IoT devices such as sensors, cameras, and drones are used to collect data on soil moisture, temperature, and other environmental factors. This data is then analyzed by machine learning algorithms to optimize irrigation, fertilization, and other key aspects of crop management. One key area where IoT is being used in agriculture is precision farming. Precision farming involves using precision agriculture tools such as GPS, sensors, and drones to collect data on crop health, soil conditions, and other factors that affect crop growth. This data is then analyzed to optimize planting, irrigation, fertilization, and other key aspects of crop management. IoT also plays a key role in Livestock monitoring, IoT enabled devices such as temperature sensors, cameras, and weight sensors can be placed on cows and other livestock. This data can be used to monitor the health of the animals, and ensure they are being raised in a safe and healthy environment. Another area where IoT is being used in agriculture is in the use of autonomous vehicles. IoT-enabled tractors, drones, and other vehicles are used to plant, harvest, and transport crops. This allows farmers to reduce labor costs and improve crop yields.

2 Architecture:

There are usually four layers present in an IoT system, which are as follows: 1.Perception Layer : Any IoT system's initial layer is made up of "things" or endpoint devices that act as a link between the real world and the digital one. The physical layer, which contains sensors and actuators capable of gathering, receiving, and processing data across a network, is referred to as perception. Wireless or wired connections can be used to link sensors and actuators. The components' range and locations are not constrained by the design. In the agriculture sector IoT sensor nodes collect information from the farming environment, such as soil moisture, air humidity, temperature, nutrient ingredients of soil, pest images, and water quality, then transmit collected data to IoT backhaul devices. Depending on the operation purpose and installation location, IoT sensor nodes can be installed as RFDs (reduced-function devices), which only communicate with FFDs (full-function devices). These nodes cannot communicate with the other RFDs, aiming to save energy and decrease investment costs.

2.Network Layer: An overview of the data flow across the programme is given by the network layers. Data Acquiring Systems (DAS) and Internet/Network gateways are present in this tier. Data aggregation and conversion tasks are carried out by a DAS (collecting and aggregating data from sensors, then converting analogue data to digital data, etc.). Data gathered by the sensor devices must be sent and processed. The network layer performs that function. It enables connections and communication between these gadgets and other servers, smart gadgets, and network



gadgets. Additionally, it manages each device's data transfer. The network layer in the agriculture sector works as following,the sensor devices are connected together via either long-range or short-range wireless networks, such as 4G, Wi-Fi, Bluetooth LE, ZigBee, and others. The system can be implemented using embedded systems, which are made up of tiny modules that provide a network and aid in delivering data more securely and accurately. The agricultural system would function more effectively in this way. The information about several distinct parameters, such as soil moisture, temperature, humidity, air quality, and ground water level regarding a given location, will be transmitted via a tiny embedded device in this smart agricultural system. As a result, the network layer is essential for data transmission from sensor devices to software or databases, where computations are carried out using the sent data.

3.Processing / Middleware Layer : The IoT ecosystem's processing layer functions as its brain. Before being transported to the data centre, data is often evaluated, pre-processed, and stored here. It is then retrieved by software programmes that handle the data and plan future actions.

This is where edge analytics or edge IT comes into play. In this sector, a remote database is used to store the substantial quantity of data that is received from the remote terminal unit in the perception layer. On a timely basis, a predictive analytic algorithm is applied to the data. These projected values are used to execute the required block of instructions. The instructions mention things like automatically watering the crops and automatically giving them shade. These instructions are in charge of altering the system's application gateway. Given that the weather in the globe is continuously changing and that the farm is hoping for the finest output possible, analytical operations play a significant role. The user may find it helpful to control crop production using these actions based on constantly changing real-time data.

4. Application Layer: The final layer in the system is the application layer, it comprises of communication protocols and hosting interface techniques for a communication network, including MQTT, AMQP, CoAP, etc. A website or an Android application, for example, receives data from the middleware layer that has been encrypted; these devices then employ internal software to decode the data and store it locally for later use. This information is used to demonstrate the current trend. The programme keeps track of data and makes wise recommendations to progressively boost the system's throughput.

3 Conclusion:

The idea of fusing agriculture with cutting-edge technology may be realised by incorporating technology into the traditional and archaic methods at the core of agriculture. The IoT-based strategy makes it simpler for technology to assess environmental factors like climate, soil quality, etc. while the software layer strengthens the conventional wisdom of the elderly. Technology must take lessons from existing methods and automate jobs to make life easier for people. Due to its flexibility to adapt to changing field circumstances, this technology has the potential to become worldwide. Therefore, IoT might assist achieve smart farming and save a drastically declining agricultural business by streamlining farming practices.