Vol. 3 Issue-4, December 2022 (e-ISSN: 2582-8223)

Application of IoT in Smart Agriculture

Nimbalkar D. V[1]., GatkalN. R[2]., Pawase P. P[2]. and Khurdal J. K[2].
[1]Business Manager, ICAR-CIRCOT, Bombay.
[2]Ph. D. Student, Department of Farm Machinery and Power Engineering, Dr. Annasaheb Shinde College of Agricultural Engineering and Technology, MPKV, Rahuri- 413722, Ahmednagar, Maharashtra, India.

ARTICLE ID: 58

Introduction:

The population of the globe will expand by 25% to 9.8 billion people in 2050, according to a United Nations study. By 2050, almost 70% of the world's population is expected to live in urban regions, and this trend of urbanization is predicted to continue growing quickly. Consequently, by 2050, food supply will need to double.

The Internet of Things (IoT) is a innovative technology that offers an accurate and effective automated solution for modernizing agriculture with the least amount of human intervention. Precision agriculture is encouraged by advances in sensor technology, wireless communication technology, and remote sensing technology (PA). Wireless transmission of data to information processing facilities is required to improve agricultural output and quality (Haseeb et al., 2020). This concept is based on the technological developments that have given rise to the idea of smartness, such as the Internet of Things, Big Data, and Cloud Computing, among others. IoT for farming is a network of screens, cameras, and computers that can work together to improve how well a farmer can do his job. They could communicate with one another without a need for human intervention because this computer would be self-sufficient. In other words, the devices already know what to do at any given time and why they should communicate with other tools in the system.

The reasons why IoT technology is more effective are as follows:

i. Every laptop has access to the internet.
ii. The least amount of physical effort possible
iii. Better Access
iv. Time management and strong communication skills.

IoT in Smart Agriculture:

The most significant pillar supporting India's economic prosperity is agriculture. The biggest challenge that traditional farming faces is climate change. Among the many effects are massive flooding, the strongest hurricanes, heated winds that cause lower rainfall, and other climate changes. The effects of these factors have a negative impact on performance. Natural consequences of climate change frequently include cyclical changes in plant lifecycles as shown in Figure 1.

The farming industry needs innovative thinking and Internet of Things tactics to boost productivity and lower barriers. The Internet of Things (IoT) is now focusing on the agriculture industry, empowering farmers to overcome the significant challenges they face. Farmers may have access to a lot of information and data about upcoming trends and innovation thanks to IoT. Establishing agricultural interdepartmental collaboration at the same time that global agriculture becomes increasingly industrialized is essential. Global agriculture has improved as a result of agricultural intercolumniation.

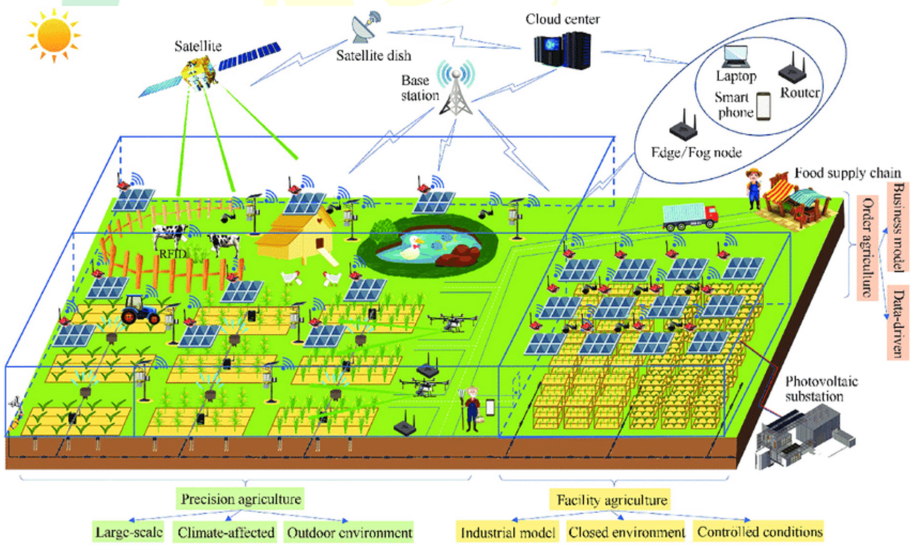

Fig. 1: Smart agriculture.

A wide term used to describe agricultural and food production methods that use IoT, big data, and sophisticated analytics is "smart agriculture." The integration of analytics, automation, and sensing technology into current agricultural processes is referred to as the "Internet of Things." The following are the IoT applications in smart agriculture that are most popular:

i. Smart agricultural vehicles like drones, autonomous robots, and actuators.

ii. Connected agricultural settings like smart greenhouses and hydroponics.

iii. Sensor-based systems for monitoring crops, soil, fields, animals, storage facilities, and just about everything else that affects productivity.

iv. Data analytics, management systems, and visualization.

Application of IoT in smart agriculture:

i. Monitoring: In the agricultural sector, variables impacting the farming and production process, such as soil moisture, air humidity, temperature, pH level, etc., can be tracked and gathered. These elements depend on the agriculture industry under consideration. The monitoring techniques are being used in some clever agricultural sectors in crop farming, aquaponics, forestry, livestock farming.

ii. Tracking and Tracing: Future farms must demonstrate that the products they sell are safe and easy to track and trace in order to meet consumer demand and increase profit value. This will raise consumer confidence in product safety and health-related issues. A number of tracking- and tracing-based issues for the smart agricultural sector have been put up in order to address this issue. SISTABENE, a tracking and tracing information system for agricultural goods and foods including dairy and vegetables, was created by the authors in. With the use of this technology, suppliers can keep tabs on the manufacturing process and supply chain faults, and end users may identify the source of their food (Tradigo et al., 2019).

iii. Smart Precision Farming: The development of the global positioning system (GPS) has led to significant advances in a wide range of science and technology disciplines. The most crucial factors for identifying a device, such as position and time, are provided by the GPS. Numerous industries, including automobiles, IoT ecosystems, and Smartphone's, have effectively implemented GPS technology. However, GPS is only effective as a support for sky-based and outdoor systems. In the meantime, there is an increasing need for finding and navigation systems in homes and on the streets of smart cities. An upgraded global navigation satellite system (GNSS) is being set up to address this issue (Alatise and Hancke, 2020).

iv. Greenhouse Production: Walls and a roof, which are typically constructed of translucent materials like plastic or glass, make up a greenhouse. Plants are raised in a greenhouse where environmental factors such as moisture, soil nutrients, light, temperature, etc. are all carefully regulated. Because greenhouse technology creates the right environmental conditions, it allows anyone to grow any plant, at any time (Tripathy et al., 2021).

Sensor used in smart agriculture:

i. **Temperature sensor:** The thermometer, which measures the temperature of solids, liquids, and gases, is the most popular type of temperature sensor. Because it is not very accurate, it is also a typical form of temperature sensor that is mostly utilized for non-scientific applications. Temperature sensors are used in numerous applications, including food processing units, HVAC and HV systems, and environmental controls as shown in Figure 2.

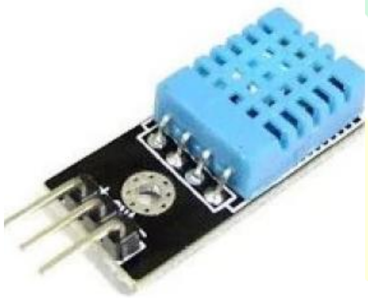

Fig. 2:Temperature sensor

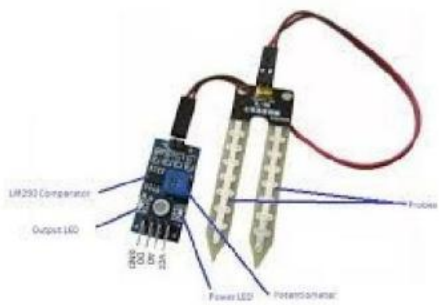

Fig. 3:Soil moisture sensor

Fig. 4: PIR sensor

Fig. 5: Light sensor

ii. **Soil moisture sensor:** A soil moisture sensor measures the amount of moisture in the soil. The sensor can produce both analogue and digital outputs. The analogue output threshold can be changed, but the digital output is fixed. It works on the principle of open and short circuits. The LED indicates if the output is high or low. Dry soil will not allow current to flow through it, acting as an open circuit as shown in Figure 3.

JUST AGRICULTURE multidisciplinary e-Newsletter

iii. **PIR sensor:** Any object with a temperature greater than absolute zero radiates heat energy. It emits infrared wavelengths, making it invisible to the human eye. PIR sensors detect the infrared radiation that is released or reflected from an object rather than heat. It is employed to find moving individuals, animals, or other items. The temperature will increase from ambient temperature as a person walks by in the field. The detection is triggered when the sensor transforms the ensuing change into a change in output voltage as shown in Figure 4.

iv. **Light sensor:**A resistor whose resistance is affected by light intensity is referred to as a "light dependent resistor," also known as a photoresistor, photoconductor, or photocell. light-sensitive devices, or LDRs. This "light energy," whether visible or in the infrared portions of the spectrum, is converted into an electrical signal emitted by the light sensor, a passive device. Due to their ability to convert light energy (photons) into electricity, light sensors are more generally referred to as "photoelectric devices" or "photo sensors" (electrons). The two primary types of photoelectric devices are those that produce electricity when lit, like photovoltaics or photo missives, and those that modify their electrical properties, like photoresistors or photoconductors. These results in the device classification listed below as shown in Figure 5.

Conclusion:

The obstacles we need to get beyond in order to accelerate the adoption of IoT in smart agriculture. For most farmers, especially small- and medium-scale farm owners, IoT solutions need to be inexpensive, but there are still several issues that need to be solved. Though we believe that the use of IoT solutions for smart agriculture is inevitable and will increase productivity, provide clean and green foods, support food traceability, decrease the need for human labour, and boost production efficiency, security technologies still need to be continually improved.A successful link between the sensors and microcontroller allows for wireless communication between various nodes. Future development will also concentrate on enhancing the stick's sensors to collect more data, particularly in relation to pest control, and incorporating GPS modules to transform the agriculture IoT technology into a fully functional, agriculture precision-ready product.

References:

Alatise, M.B. and Hancke, G.P. 2020. A Review on Challenges of Autonomous Mobile Robot and Sensor Fusion Methods. IEEE Access. 8: 39846.

Haseeb, K.,Ud Din, I.,Almogren, A. and Islam, N. 2020.An energy efficient and secure IoT-based WSN framework: An application to smart agriculture. Sensors. 20: 2081.

Tradigo, G.,Vizza, P.,Veltri, P.,Lambardi, P., Caligiuri, F.M., Caligiuri, G. andGuzzi, P.H. 2019. SISTABENE: An information system for the traceability of agricultural food production. In Proceedings of the 2019 IEEE International Conference on Bioinformatics and Biomedicine (BIBM), San Diego, CA, USA, 18–21 November. 2304–2309.

Tripathy, P.K., Tripathy, A.K., Agarwal, A. and Mohanty, S.P. 2021.MyGreen: An IoT-Enabled Smart Greenhouse for Sustainable Agriculture. IEEE Consum. Electron. Mag. 10: 57–62.

World Population Projected to Reach 9.8 Billion in 2050 and 11.2 Billion in 2100. April 2021. Available online: https://www.un.org/development/desa/en/news/population/world-population-prospects-2017.html (accessed on 5 April 2021).