

Wireless Monitoring System for Smart Agriculture

According to the recent studies, countries around the world will soon be unable to provide sufficient crop yield and food for their entire population using traditional farming methods. To address this issue, innovation and improvements in farming practices are needed in order to increase production and preserve resources. Internet of Things (IoT) technology can be implemented as a smart farming solution to increase production efficiency, save water resources and lower overall costs.

There are many factors that can impact plant's growth, including light exposure, water, local carbon dioxide levels, temperature, moisture, soil salinity, pH, nutrients, pests, and disease. It is important to monitor and control crops' living environment to maximize plant growth. However, in practice there are a number of challenges in monitoring and controlling the environmental conditions of crops in the field:

1. Traditional time-based and volume-based farming strategies (e.g., watering on a fixed time schedule) cannot precisely and timely respond to subtle environmental changes and plants' needs.
2. Monitoring conditions over a large area farm with sensors would be preferable but is quite challenging. Although a wired monitoring system could be implemented, such a system has many drawbacks, most notably complicated wiring installation with miles and miles of wires.

The goal of this project is to design a wireless monitoring system that can monitor as many of the factors described above as is practical, and can report when at least one of the factors is outside of its acceptable range so that corrective action can be taken by the farmer. A few of the challenges that need to be addressed are as follows:

1. **Power:** Power management is a key challenge for practical implementation of any remote sensor system, particularly one with a large number of wireless sensors distributed over a large area. While some maintenance of power systems may be acceptable (e.g., swapping out batteries annually), if the maintenance becomes too cumbersome it will prevent adoption of the technology.

2. Communication: A wireless communication system is necessary to gather and report data. The communication system must be low power and capable of transmission over long distances. However, the data rate output by the sensors is typically quite low, so a low rate of data transmission is acceptable. A number of technologies are available, including WiFi, Bluetooth, cellular, LoRaWAN, Zigbee, and several others. The team will need to select and implement a wireless solution that is best suited for the task at hand.