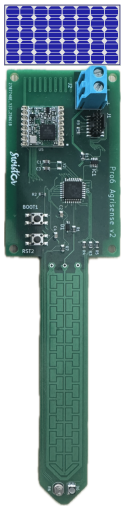
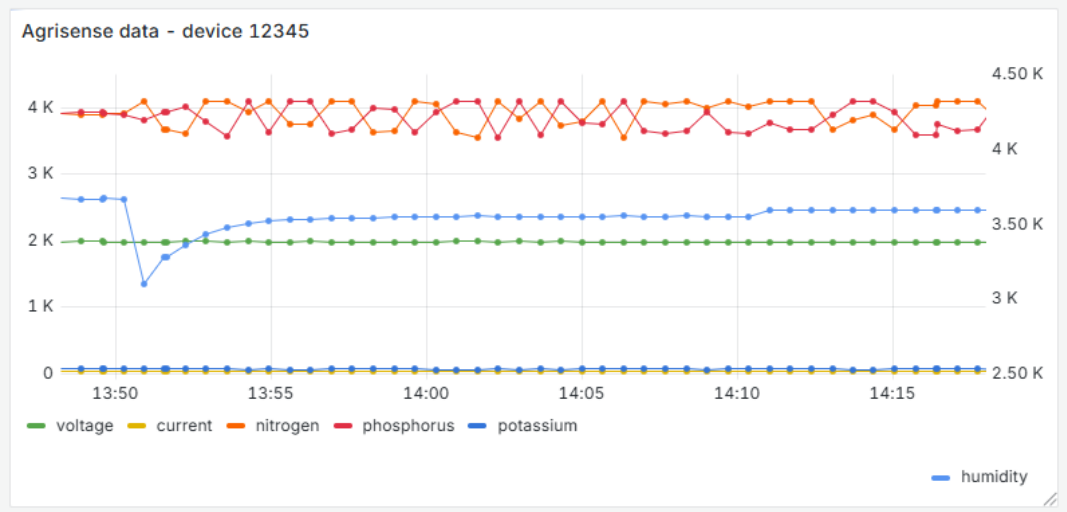
IoT Sensor for Sustainable Agriculture

Population growth and urbanization are increasing the pressure on agriculture to improve both yield and sustainability. The project aims to contribute to Agriculture 4.0 by developing an IoT sensor that monitors soil properties, assisting farmers in making data-driven decisions.



Sensor node



Dashboard

Agricultural Sensor Node

The agricultural sensor node measures the moisture and nutrient content of the soil, specifically nitrogen, phosphorus, and potassium. In addition, the device also measures its voltage and current to track its power consumption. With its LoRa communication capability, it can be deployed over a large area, transmitting data over long distances ranging from hundreds of meters to a couple of kilometers. Its simple design and wireless capability make it an affordable, scalable soil-monitoring solution. Additionally, it has a solar cell to harness solar energy, and its low-power design allows it to conserve energy efficiently.

Gateway and Dashboard

A gateway has been developed and deployed to receive data from sensor nodes. Multiple sensor nodes can communicate with a single gateway, allowing the whole system to cover a large area with sensor nodes. The collected data is stored in a MySQL database, and Grafana dashboards is used to visualize the stored data. The dashboards, which can be accessed through a web interface, offer customizable features for visualizing the information.

Prospect

Upon evaluation, it was found that the current sensor is not functioning and needs to be redesigned. The NPK sensor requires additional time and experimentation for proper validation. Overall, most functionalities of the sensor node have shown promising results during validation. Next steps would involve incorporating the Data Link Layer in the LoRa wireless communication to ensure reliable and error-free data transmission between the sensor nodes and the gateway.

Supercapacitor

The sensor node utilizes a supercapacitor that offers high energy density in a compact form factor. One significant advantage of using a supercapacitor over a battery is its rapid charging capability, which is particularly beneficial in ideal sunlight conditions for quickly harvesting and storing energy. The supercapacitor from Swistor features nanostructured, carbon-based electrodes and is made without any lithium or cobalt, making it environmentally friendly.

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