Comparison with other approaches

There are many approaches on the subject soil quality sensors that are like the one exposed in this project, but also others that come with an improvement. Soil quality is essential nowadays, in a world that suffers from accelerating climate change and also for the regions that suffer from lack of food and resources.

For instance, an approach uses the same steps as the ones used in the project (and also a very similar electronic part with multiple wireless sensors, microprocessor, microcomputer, cloud platform and mobile app). It treats an IoT system used for monitoring moisture, temperature, and pH of the soil. First, data is transmitted from the sensor to the microprocessor, then WSN (Wireless Sensor Network) technique is applied, one node acting as a master and the others as slaves in order to have a better communication than transmitting directly to the microcomputer. So, the master transmits to the microcomputer (a Raspberry Pi Zero), and this transmits further to a cloud platform, same approach being also used in the project. Deep-learning mechanism is implemented at the level of the cloud platform and then data is transferred to the mobile app using a LoRa module.[1]

Another paper relevant to the subject exposes some technologies used to establish WSN communication (enables distributed sensing through efficient data communication between multiple sensors). The first example is ZigBee. It is based on many ground sensors that transmit to above routers that transmit then to coordinator unit above, driven by Wi-Fi. A hybrid version is used because of the limited transmittance distance at underground WSN (SoilNET). Another example is LoRa. It enables communication distance larger than at ZigBee, same low-power consumption and CSS modulation is used. The structure is composed from: LoRa nodes - end devices that communicate with the gateway (can be asleep otherwise), LoRa gateway - acts as relay and LoRa server. The last example exposed is NB-IoT (narrow band IoT), a cellular network, having significantly lower transmittance costs.[2] As there can be seen, this article treats also the approach of WSN communication like the first one and makes a comparison between different implementations of this technique, the NB-IoT being the most suitable one.

A third article shows the evaluation of soil moisture sensors using also IoT. Data is sent to a private cloud. Delphi method is used to screen the evaluation index system and also AHP (Analytic Hierarchical Process) is used to construct index weights. The conclusion of the paper is that capacitive moisture sensors are slightly worse than the resistive ones.[3] So, there can be seen that IoT can be also used to make a comparison between different types of sensors.

In-situ infrared soil spectroscopy is a different approach of determining the quality of the soil. AI-based spectral transfer functions are developed to map fields into spectra. Tests are done in

the lab also to validate machine learning models and a one-to-one comparison is made between the field measurements and the ones in the lab to correct the spectra in order to reduce the mean average error. This is used to develop a new data set to extract useful information about the soil's properties. The main advantage is the usage of low-cost sensors that capture few spectral bands, have narrow spectral ranges or low spectral resolution.[4]

A last article shows an analysis of retrieval methods to get the soil moisture and to make estimations. It makes an overview from statistical to machine learning approaches. Different sensors used and data is collected to get a good soil moisture estimation. There is still to improve regarding the moisture measurements in order to have higher spatial coverage or higher temporal resolution or accuracy.[5]

In conclusion, there can be seen that the soil quality parameters and their retrievement and processing are acquired in different ways. The most used ones though are the ones that approach IoT technology, wireless communication and cloud platforms, elements that are basically used in the project.

References

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