Smart Agriculture for Sustainable Food Security Using the Internet of Things (IoT) in Uganda

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Background

The “smart farm” utilizes several elements and methods to control farm management/husbandry practices. When we develop the technology, we support innovation in the production process, but this technology must meet the requirements of farmers and the possibility to market the products. To increase production and reduce risks in agricultural production and optimize the utilization of labor, people are using Smart Farming.

Research objectives:

This study aims to identify the potential and challenges of using IoT in agriculture, in regard to economic aspects and impacts on-farm and the community. The main objective is to develop a mobile-based IoT technology (IoT mobile App) that will be used by smallholder farmers to make informed decisions on how to manage the limited water resources for irrigation using artificial intelligence and machine learning techniques.

Methods

Categorical types of data will be acquired as follows: **Soil data**: through the use of sensors, inter-and intra- farmer field soil status data including soil fertility, soil management practices as well as on historical land-use patterns will be collected. Representative soil samples will be collected and analyzed in certified laboratories for the following parameters: inorganic and organic nutrient content, soil moisture pH, and salinity among other soil physical-chemical characteristics. **Weather data**: weather data including precipitation, relative humidity, wind speeds, temperatures, and solar radiation will be acquired because they affect irrigation.

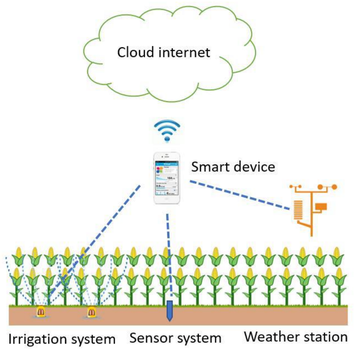
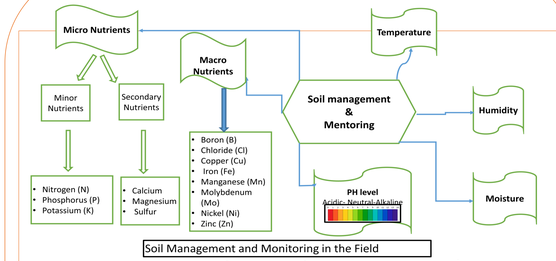


Figure 1. The architecture of an IoT System used in smart farming

Results

- We suggest developing a mobile-based IoT technology (IoT mobile App) to help smallholder farmers to make informed decisions.
- It helps in collecting, monitoring, and analyzing data related to crops even from remote areas. As a result, the smart farm will support farmers to economize the labor time on the farm as well as consume less energy (e..g. fuel), water, fertilizer, seed, pesticide, and other inputs.
- **Prototype designs**
- The main focus here will be to study the required calibrations and necessary components to attain relevant data. The research stage will also involve assembling sensing, and weather information by linking them to a smartphone as assembled in Figure 1.
- This technology is crucial because most farms are located in the countryside and this far farmland is tricky to supervise. We have to find an effective technique for monitoring farms from far away.



- We are planning to implement the proposed study for a small-scale farm in Uganda and we will compare it with the conditions in Finland as a future study.
- Our view is that the proposed system presents obvious benefits to agriculture and has the potential to reduce costs and increase yield by up to 50%, because Smart Farms will become a leading solution for increasing agricultural production in a cost-effective way, significantly enhancing economic growth, food security, and sustainability.

References

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