Khet Mitra: A Smart Aid for Desert Farmers

Final Project Report

Problem Statement and Background Research[1]

Desert farming, specifically farming on sandy soil, has many differences from farming in water-rich regions. Particularly, crops grown in deserts require a smaller volume of water, but they require it more frequently. Furthermore, desert soil is able to sustain crop growth at a higher temperature. However, desert farmers lack access to equipment and systems that are specifically designed for farming in arid regions. Basic diagnostic systems that can provide crucial data about soil health and plant growth are often unavailable, leaving farmers with little information to guide their decision-making. This can make it difficult for farmers to identify and address problems with their crops and soil. As a result, many desert farmers have to rely on intuition and experience to make decisions about their farming practices.

Current Solution

Desert-based soils have unique characteristics that make them different from water-abundant soils. For example, they tend to have low organic matter content, high salinity levels, and low water-holding capacity. These factors can significantly affect the growth of crops, making it essential for farmers to have accurate information about the soil conditions. However, the equipment and systems available for soil testing and management were developed primarily for water-abundant soils, and therefore, they may not provide accurate results when used in desert-based soils. This can lead to unreliable recommendations, which can result in poor crop performance.

As a result, desert farmers may have to resort to alternative methods such as lab testing their soil samples to obtain more accurate information. However, this process can be time-consuming and expensive, making it inaccessible to many non-commercial farmers. Additionally, lab testing may not always be feasible for farmers who live in remote areas or lack access to the necessary equipment and resources. This can make it difficult for farmers to make informed decisions about their crops and manage their soil effectively.

Solution – Your Project

Our solution to this problem is a Raspberry Pi-based device that helps desert farmers diagnose the quality of their soil. Our device takes inputs from three different sensors - temperature sensor, moisture sensor, and pH sensor - and passes them through a machine learning algorithm. Our machine learning algorithm has been trained on soil data from twelve

[1] The background research was conducted in the form of an interview with spokespersons of Gravis, an NGO that operates in Rajasthan, India and Uttarakhand, India. The NGO aims to improve the wellbeing of people living in rural, remote, and arid regions.

regions that were published online by the agriculture ministry of Rajasthan. Our machine-learning model exhibits an accuracy rate of 94 percent.

Our device also offers a prescription to farmers if their soil does not meet the criteria for crop cultivation. In addition, we trained a separate machine-learning model that was trained on climate data that was published by the Indian Meteorological Data. Through our second model, we were able to determine soil health up to two months into the future and offer precautionary precautions to users if necessary. Our second machine-learning model exhibits an accuracy rate of 89 percent.

Impact

We have built 12 models of Khet Mitra and distributed them to farmers across four different municipalities. Currently, we have 50 farmers using our device and our device provides analysis for soil spanning over 150 acres. We have gotten a positive response from farmers who appreciate the intuitive operation of the device. Many farmers have also benefited from the prescriptions offered by the device, specifically, the prescriptions offered to prepare them for future weather conditions. Even in the short period that our device has been implemented on-ground, we have seen a significant increase in crop production and soil fertility levels. Furthermore, Khet Mitra has also been implemented in our school community garden. We have noted an 8% month-on-month increase in microgreens production in our school garden.

Future Scope

In the near future, we hope to conduct an in-depth study on the efficacy of our device. Currently, our device has been implemented on-ground for one and a half months. While we are already seeing positive results, we hope to monitor the progress of our device for a period of six months to determine the efficacy of our device. Through our study, we want to determine the empirical accuracy of our device for soil-quality diagnosis, prescription generation, and future soil-quality prediction.

Furthermore, we want to increase our area of impact. Currently, our devices have been installed in farms and gardens in and around Jaipur. We hope to distribute the device to farmers in other arid regions of Rajasthan, such as Barmer, Jaisalmer, and Chittorgarh.

Finally, since our device is powered by machine-learning algorithms, we want to improve the accuracy of our algorithms. We plan to achieve this goal by two means. First, we will increase the dataset that we consult. As a result of our on-ground testing, we can acquire more data. Second, we will improve our algorithm training techniques, such as incorporating robust training.

Sustainable Development Goals

SDG 8, Decent Work and Economic Growth

Our project promotes economic growth by providing desert farmers with a device that helps them diagnose the quality of their soil and make informed decisions about their crops. By doing so, we are helping to improve the livelihoods of farmers and promote economic growth in arid regions.

SDG 10, Reduced Inequalities

Our project also helps reduce inequalities by providing small and non-commercial farmers in arid regions with access to diagnostic tools and information that are typically only available to larger, commercial farmers. By doing so, we are promoting greater equality and access to resources in agricultural communities.

SDG 12, Responsible Consumption and Production

Our project promotes responsible consumption and production by helping farmers make more informed decisions about their crops and soil health. By providing them with accurate diagnostic tools and information, we are helping them optimize their resource use and reduce waste, which ultimately promotes more sustainable agricultural practices.

Team Details

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