

MRIDA - An AI Powered Soil Examiner

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India is a country that has a rich history and culture in agriculture. Agriculture is a vital part of India's economy and society, providing livelihoods for millions of people. In fact, according to recent data, around 58% of India's population is engaged in agriculture. With such a significant percentage of the population dependent on agriculture, it is essential to find ways to make the industry more efficient and productive.

One of the most significant challenges for farmers is understanding the health of their soil. Soil quality plays a vital role in crop health and yield. A farmer needs to know the soil's pH level, the presence of nutrients like nitrogen, phosphorus, and potassium, moisture content, and temperature to make informed decisions about crop rotation, fertilization, and irrigation.

And now, with the help of MRIDA (Multipurpose Real-time Integrated Digital Analyzer), an AI Powered device which can measure all these parameters accurately and efficiently, farmers can now be stress-free and will also follow sustainable agriculture.

The device has multiple sensors that can measure soil pH, moisture, and temperature. It also has sensors to detect the presence of nitrogen, phosphorus, and potassium, which are essential nutrients for plant growth. Also, this device is also connected with the internet through satellite which will help the farmer receive weather alerts and forecasts.

The device is also linked with an app which will provide the farmer with a nice interface and also has a built-in emergency service for contacting authorities and a speech-to-speech model for voice interactions and that too with indigenous language support.

This will also help the farmer to take intensive care of his crops with the knowledge of upcoming events and weather patterns.

Why should we build MRIDA?

With MRIDA, any farmer can now have adequate information about his soil and his local weather pattern which will help him decide when to sow/harvest his crops, when to irrigate the field and what nutrients or fertilizer he should add or not to keep the soil healthy and the soil environment rich with microorganism for better growth of his crops.

What does MRIDA do?

MRIDA is packed with features that makes it one of a kind and will be very useful and helpful for the farmers in the following way:-

- MRIDA contains a library of data for every crop's favorable condition to thrive in and also how to increase the yield of a crop based on what pH, moisture, nutrients content of a soil is and how much sunlight the crop needs based on the weather API used by MRIDA.
- To keep a check on the soil's NPK content and help the farmer decide whether or not to add more fertilizers based on the crop he's growing and also using the data of a crop's favorable environment and growth condition from the library of data.
- Also, to check the moisture content and temperature of the soil to ensure not to add excessive water and keep the temperature balanced too so that the soil is biologically rich with microorganisms.
- MRIDA will also use a weather API to keep the farmer informed for upcoming weather changes and also show the weather patterns of a week. This will help the farmer to make decisive actions for the crops if the weather changes.
- MRIDA will also check and analyze the conductivity of soil to check whether the soil is too saline for a crop or not.
- During any emergency, the farmer can call 112 or Kisan Call Centre.
- The app's language can be changed to any Indian indigenous language to suit the farmer.
- The built-in voice assistant can help the farmer get insights in just a voice command that too in his language. (Currently the app only supports Hindi and English).

How does MRIDA work?

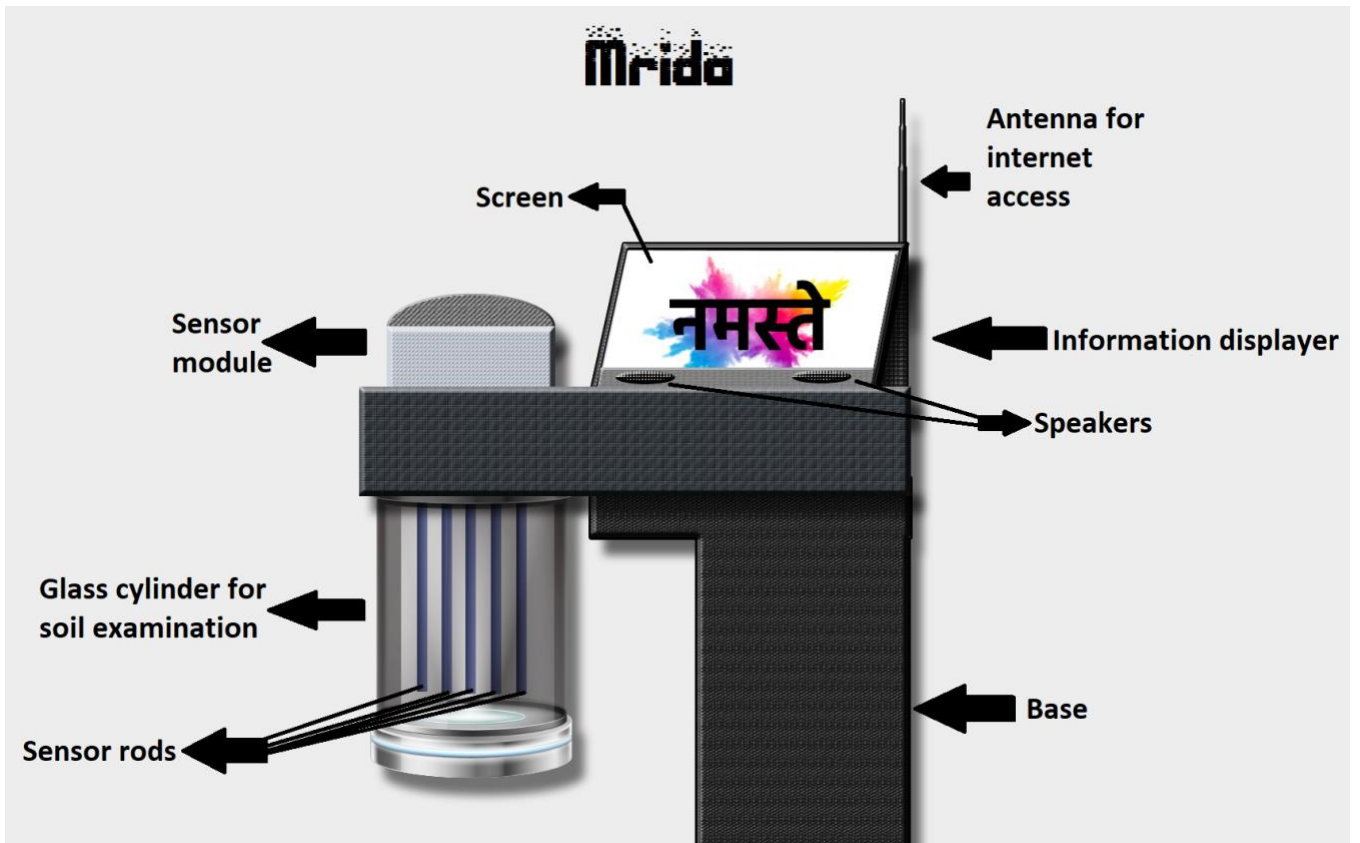
- **Data Collection:-** A compilation of data about each crop, plantation, trees and fruits will be extracted from various trusted sources. They include soil conditions, weather conditions, nutrient and water requirements, germination and growth period and then harvesting period of each crop in detail.
- **Data Preprocessing:-** Data collected of each crop will be compiled and tokenized in such a way that it avoids any possibility of confusion for the AI. Also, various ranges will be set for all sets of compiled data so that, the value of each crop is well defined and avoids the possibility of mixing up with the values of other crops.
- **Model Selection and Evaluation:-** First, data is clustered and the best suited machine learning model for this project will be random forest subset as we will deal with a lot of data and predictions based on a lot of factors like when to sow, when to add nutrients, when to harvest etc. For evaluation of the selected model, we will use Scikit-Learn which is a simple yet efficient predictive data analyzer based on python libraries. Also, as we want our AI to speak and interact with the farmer, speech recognition libraries with local language synthesizer and speech APIs will be used too.
- **Model Training:-** The model will be trained using cluster-data techniques and scikit-learn algorithm which will help the AI give fast and appropriate answers and prediction. The speech recognizer will also be trained with certain tokenized commands so to answer and understand what the farmer is saying in his language with real time translation and then, displaying the information on the screen while saying out loud what the farmer should do.
- **Model Testing:-** After testing the model, the outcomes will be checked for further corrections and tweaks, after correction, the data subsets and algorithms will be uploaded on the cloud and on the device.
- **Model Deployment and Monitoring:-** The model will be downloaded on the device with few preloaded subsets and crop data. After the device boots up, several questions will be asked in various commonly used and indigenous language and also to test APIs of speech, weather and crop data-prediction to further verify and understand the behavior of MRIDA during the runtime.

Advantages of MRIDA?



- Mrida will help the farmers understand about their crops in a much more elaborate way with each and every step the farmer should take to care for his crop.
 - This will increase the yield of the crop while keeping the soil healthy and nutrient rich so that the soil performs better and well in the long run.
 - MRIDA will also give alert of upcoming weather changes so that the farmer will be prepared of any upcoming rains, hailstorms or cyclones.
 - It will also help reduce excessive water usage and will also help in preventing the water logging of soil.
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- After each harvest, MRIDA will perform calculation based on the soil data received from the sensors about what to add in the soil and when to plough the soil for next harvest.
 - MRIDA will also contain an emergency protocol if the farmer's yield is destroyed by any natural calamities so that it can inform the nearest officers and government officials so that the farmer can receive the loss he suffered.
 - One of the greatest advantages of this initiative is that farmers will have the opportunity to learn new and advanced aspects of farming, crop care, and modern agricultural techniques in their own native language.
 - By receiving information in a language they are most comfortable with, they will be able to fully grasp critical concepts related to sustainable farming, soil health, pest management, irrigation techniques, and climate-resilient agriculture.
 - This will not only enhance their understanding but also empower them to apply these techniques effectively in their fields.
 - Additionally, this initiative will help bridge the technological gap by introducing farmers to digital tools and resources tailored for agricultural practices. As they engage with modern farming technologies, mobile-based advisory platforms, and real-time weather and market updates, they will gradually become more tech-savvy.

Diagram of the Hardware



Screenshots of the App

