

# IOT BASED-SOIL NPK LEVEL, TEMPERATURE, MOISTURE AND PH DETECTION AND ANALYSIS SYSTEM USING SOLAR ENERGY.

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## **Keywords:**

NPK (Nitrogen, Phosphorous, Pottasium), IoT(Internet of Things), Sensors, Raspberry pi, Nutrients Analysis

## **Introduction:**

Soil testing is used to do chemical analysis of soil and to find status of fertility of soil. Soil testing also plays an important role in prediction of required nutrients of the crops. Soil testing further includes testing of soils for properties like pH, moisture and nutrients required for effective crop growth like Nitrogen, Potassium and Phosphorus. The measurement of Nitrogen, Phosphorus and Potassium, (i.e. N, P, K respectively) levels of soil is vital to make a decision what quantity additional contents of those nutrients are required to extend fertility of soil. The standard of soil is thus enhanced which subsequently provides a better yield quality of crop. Researchers in agriculture are looking for ways to optimize plant yield while minimizing the consumption of fertilizer. Since these macro-nutrients vary even on a small scale throughout a cultivated field, numerous researchers have attempted to develop the sensors to map these nutrient contents.

Solar energy can be used in agriculture in several ways and save huge amount of input cost. This important sector of economy uses energy directly as a fuel to run the tools, machinery and other appliances. Solar can be used for all these functions of agriculture. It can increase self-reliance, reduce pollution and cut down the fuel and electricity bills ultimately causing reduction in production costs. Thus, solar energy can be highly useful for agricultural practices.

## **Objectives:**

- Measuring the soil quality by considering various parameters will provide the early information regarding the potential effects and different primary land use activities that may be having long term effect on soil quality.
- It will help to identify whether the soil quality is degrading over time and the factors that may be contributing to the soil degradation.

- The purpose of soil quality monitoring is to track changes in the features and characteristics of agricultural soil, especially the changes in chemical properties of soil occurring at specific time intervals under the influence of agricultural and non- agricultural human activity.
- Soil monitoring and analysis reduces the cost of expenditure in agriculture practice too.
- The solar based renewable power supply recharges the system automatically and hence reduces the time taken in recharging the system. This system promotes eco-friendly practice of agriculture.

### **Methodology:**

#### **Mode of power supply:**

The IoT system network uses solar energy to produce the required electrical energy using solar panels and photovoltaic cells to store the power for further use.

#### **Collection of data from sensor:**

The sensors such as lm35(temperature sensor),npk sensor, Soil moisture sensor sensor are interfaced with raspberry and Arduino nano microcontrollers.

#### **IoT data processing, analysis of data:**

The data is transferred from sensor devices to a computing system which processes and stores data. The stored data is analysed by the system and then finally displayed by the system in the lcd monitor.

#### **Web and mobile application:**

The web and mobile application will be designed to monitor the different essential nutrients in the soil.

#### **Results and conclusion:**

- The project indicates farmers to provide required amount of fertilizers (npk) into the soil.
- As farmers use excess or a smaller number of fertilizers which leads less productivity of crops but by using this soil monitoring system farmer would be able to introduce sufficient amount of each essential nutrients.
- The farmer could also be able to monitor the moisture, temperature and ph level of soil which plays a vital role in the overall yield of crop which in return benefits the farmers in better production of crops and will be able to practice scientific approach of farming.
- Usage of solar energy in this system benefits in saving money, increasing self-reliance and reducing pollution.

**Future Scope:**

- The negative impact of covid-19 on the soil monitoring system market is expected to be there for a short period of time, and by early 2022 the market is anticipated to observe robust recovery rate along with the extensive demand for installation of IoT devices across the agricultural farms around the globe to enable optimal usage of resources with reduced requirements of the labour in the fields.