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Measurable Nutrients and Available Sensors to Design a Soil Tester with Crop recommendation

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Abstract: *Agriculture is the major source for the highly populated country like India to earn income and carry out their livelihood. The factors such as weather, rain, soil, pesticides and fertilizers are the main responsible aspects to raise the production of yields. The fundamental aspect of the agriculture is soil for the growth of the crop. Examination of soil plays vital role in agriculture productivity which has be done manually. In India still farmers are not making use of soil test to get better yields, they're following their ancestral methods to grow the same crop in same soil every year. The ancestral method leads to decrease soil fertility and crop yield every year because consumption of same nutrient by the same crop makes soil infertile. The purpose of this paper is to enlighten the measure of soil nutrients and environmental parameters using sensors.On acquiesced we can apply different data analytical algorithms to predict the suitability of the crop based on the nutrients present in the soil.*

Keywords*: Soil nutrients, Crops Prediction, Agriculture yield, Sensors.*

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I. Introduction

The Food and Agricultural Organization of the United Nation (FAO) predicts that the worldwide Population will contact 8 billion individuals by 2025 and 9.6 billion individuals by 2050. So as to keep pace, sustenance generation must increment by 70 percent by 2050 internationally. India is a large agricultural nation, and agrarian creation importantly affects national nourishment security too. Contrasted and created nations on the planet, the territory of farmland per capita is far lower than the normal dimension on the planet and the generation esteem per capita and arrive yield per unit are likewise on a lower level in the event of India. In this way, to confront difficulties of nourishment creation, we have to create strategies to deliver more yield with the restricted accessible characteristic assets. The remerging of worldwide retreat has caused swells crosswise over both the created and the creating economies[2]. Horticulture segment should be considerably more effective and versatile to guarantee worldwide nourishment security. Indian ranchers are at incredible inconvenience as far as size of homesteads, innovation, exchange, government arrangements, and so forth. Data and Communication Technology (ICT) can alleviate a portion of the issues of ranchers. After the World Wide Web (of the 1990s) and the versatile Internet (of the 2000s), we are currently going to the third and conceivably most "troublesome" period of the Internet upheaval—the "Web of Things" (IOT) which is otherwise called "Pervasive Computing[3]. IOT applications incorporate differing regions including agribusiness, medicinal services, retail, transport, condition, inventory network the board, framework observing etc.Applications in farming incorporate

soil and plant checking, nursery condition observing and control frameworks, observing of nourishment store network, checking of creatures, and so forth.

Fig 1: Manual Soil Testing Procedure

Accuracy cultivating gear with remote connects to information gathered from remote satellites and ground sensors can consider edit conditions and modify the manner in which every individual piece of a field is cultivated—for example, by spreading additional compost on zones that require more supplements (Chui et al., 2010)[4]. In soil manual testing, allude to at least one of wide assortment of soil investigation directed for one of a few conceivable reasons. Potentially the most generally led soil tests are those done to evaluate the plant-accessible groupings of plant supplements so as to decide manure suggestion in farming. For the most part a dirt example is sent to the lab, the outcomes will be allowed following multi week, to beat this we are wanting to build up a sensors based soil analyzer. In this paper we have talked about our total field work, for example, soil types, quantifiable supplements and supplements required for the plant development, distinctive information systematic methods[5]. The association of paper is as per the following, Section I gives brief review about the paper and job of this paper, Section II gives distinctive classes of soil present in India, Section III gives profound knowledge on the diverse kinds of supplements requires for the plant development. In Section IV we will examine about manual soil testing method and defeats related with it. Area V furnishes outline about of proposed work with best information explanatory methods. At last the paper end with end and few references.
N – Nitrogen: promotes the growth of leaves and vegetation.
P – Phosphorus: promotes root and shoot growth
K – Potassium: promotes flowering, fruiting and general hardiness Unlike the N number, and the numbers for P and K do not reflect the amount of elemental phosphorus and potassium in the fertilizer.

II. Different Classes Of Soils

All five is a mixture of just 3 varieties of weathered rock debris that make up the soil: sand, silt, and clay. How those 3 particles are combined defines your soil's kind—how it feels to the touch, the way it holds water, and the way it's controlled, among other things. Soil is a herbal resource that may be categorised into unique soil sorts, each with awesome traits that provide growing advantages and obstacles. figuring out the sort of soil you require for a project is paramount to help the healthy boom of plant life. There are wide form of soils thru out India, the sort of the soil changes from vicinity to place with associated nutrients[6]. For our experimental reason here we are considering different sorts o f soil to be had in Karnataka kingdom. essentially there are six varients of soil found in special regions of Karnataka as shown beneath

Table 1: Different Types of Soil

Soil name	Properties	Distribution
Black soil	This soil black in color. It is formed from lava rocks and is rich in clay. It is ideal for growing crops such as cotton, sugarcane	belgam,bijapur,Gulbarga and bidar
Laterite soil	Laterite soils lack fertility due to intensive leaching. Some latterites are suitable for growing plantation crops like tea,coffee,rubber.	Malnad and costal area of u.k, d.k and part of dharwad, chikmaglur, Hassan.
Red soil and loamy soil	But on the lower plains and valleys they are rich, dark colored fertile loam on which, under irrigation, they can produce excellent crops like cotton, wheat and fruits.	Shimoga,chikmaglur, Hassan, mysore
Coastal alluvia's	The surface soil is generally grey, yellow or light brown, the intensity of the color increases with depth. Other major crops are rice, sunflower and sugarcane.	DK,UK

Dark brown clayey soil	The application of manure and crop rotations that include grasses and cereals will help maintain soil organic matter.	DK.UK,mysore

III. Nutrients Required For Plant Growth

There are five major nutrients such as Nitrogen, Phosphorous, Pottassium, which plays a vital role in the growth of any plant/crop. If in case, there is any deficiency of any nutrient, we need to apply fertilizers related to it for compensating the deficiency. The different nutrient values required for regional crops such as Ragi,Sugar beets, Potatoes, and Ragi is shown in below table. [9]This link containst ph value of particular crops.and corresponding N P K values.

Table 2: Nutrient values for different crops.

Crops	Ph value	nitrogen	Phosphorus	potassium
Rice	5.8	70%	43%	70%
Sugar beets	6.3	83%	58%	100%
Potatoes	5.1	40%	37%	50%
Ragi	7.3	100%	100%	100%

IV. Manual Soil Testing

In agriculture, a soil test ordinarily alludes to the investigation of a soil example to decide supplement substance, sythesis, and different attributes, for example, the causticity or ph level. A soil test can decide ripeness , or the normal development capability of the soil which shows supplement inadequacies, potential toxicities from the nearness of trivial follow minerals. At that point each example is doled out an ID number, exchanged to a paper sack, and after that put in a metal plate. Each twelth example is a quality control test, either a check test of realized substance properties to guarantee exactness, or a copy test to assess lab accuracy[7]. Tests are dried quickly under constrained air, the temperature not surpassing 95F.Dried examples are squashed with a mechanical processor, and went through a treated steel 10-work 2.0 mm sifter to expel stones and undesirable flotsam and jetsam. The test is utilized to mirror the capacity of roots to acclimatize minerals. The normal rate of development is demonstrated the law of most extreme.

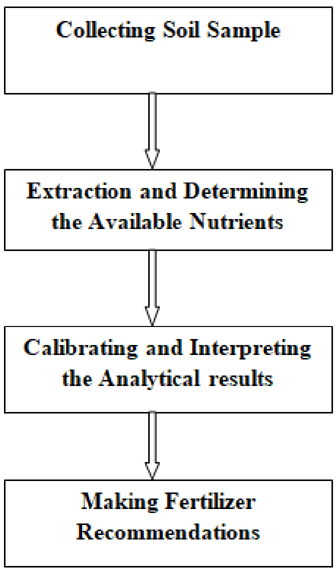

Fig 2: Different Phases of Manual Soil Testing

4.1 Downfalls of manual soil testing

Manual tests are error-prone. For any type of manual test, there's a greater chance of mistakes simply because of human error.Sometimes tester make errors because the test cases are tedious and repetitive.in another scenario, testers do not understand the details and dependencies of the software or the test may depend on installing third party apps and the tester is not aware of it.

Your 'time to market' will fall behind. We estimate that manual tests take five times longer to execute than automated tests. This inevitably leads to teams missing release date deadlines and experiencing time-to- market delays.
Manual testing too slow compare to sensors. One automation script can run across multiple platforms over and over, saving time and resources.
Testing capabilities are minimal. The fact is manual tests are very basic compared to automated tests. Now a days complex sensors are used to environments require sophisticated tests that manual testing alone cannot deliver

V. System Design and Flow

Hydrogen ion concentration of any solution can be measure by its pH value. The range of pH varies from 0 to 14, if any solution having pH value close to 0 it treated as a highly acidic, where as its value close to 14 is consider as a highly alkaline. A special selective hydrogen ion electrode (pH rods) is also immersed in the solution for electrically measurement of the pH value. This electrode gives an output voltage that changes its value according to the concentration ratio of Hydrogen ions inside the electrode as comparison to those which are outside the electrode. The output of the reference electrode does not depend on the concentration of ion ratio. After measuring the voltage between these 2 electrodes i.e. between reference and a special electrode, the pH of the solution can be determined. In order to measure pH and get accurate results, several challenges must be taken into account.

The soil testing framework is as shown in Figure 3. To quantify pH sensors are utilized. The sensors are associated and constrained by Arduino uno which is a microcontroller dependent on the ATmega328P. The deliberate data is sent to the farmer.

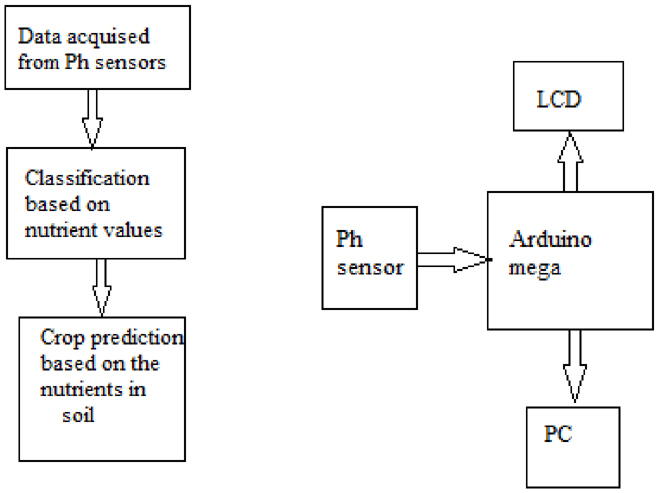

Fig 3: Architecture of sensor based soil testing and flow

We have developed an intelligent decision making system that recommends the suitable crop based on ph value. Among these various machine learning techniques that are being used in this field; this paper proposes a system that uses the decision support system to build an efficient and accurate model. The parameters of soil like NPK play a major role in the crop's nutrients For crop growth to their possible, the soil must provide acceptable environment for it. Soil is the anchor of the roots. The water holding capacity determines the crop's ability to absorb nutrients and other nutrients that are changed into ions, which is the form that the plant can use. Texture determines how porous the soil is and the comfort of air and water movement which is essential to prevent the plants from becoming waterlogged.

The proposed model works is testing of soil samples in the farm field of soil pH along with NPK calibration values using the Arduino Mega Microcontroller which is interfaced with ALCD and soil Ph sensor, thean feeding the gathered data of soil pH gathered through a Microcontroller and feed for the decision model to select the specific crop to be grown in that condition to get better productivity and manage resistance of crop.

In soil samples, based on the pH values the crops are selected. Then the displayed datasets are feed automatically to the decision software to get the specific suited crop to the site specific field. As shown in the fig 4.

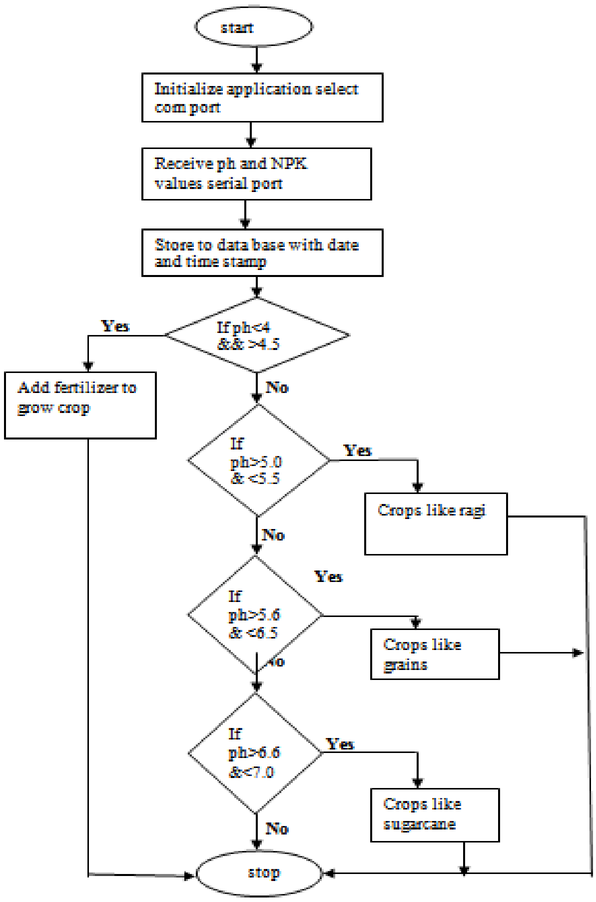

Fig 4: flow chart of decision making system crop recommendation

The level of acidity or alkalinity (Ph) is a master variable which affects the availability of soil nutrients. The activity of microorganisms present in the soil and also the level of exchangeable aluminium can be affected by PH. The water holding and drainage determine the infiltration of roots. Hence for the following reasons the above stated parameters are considered for choosing a crop.

VI. Experimental Setup And Result

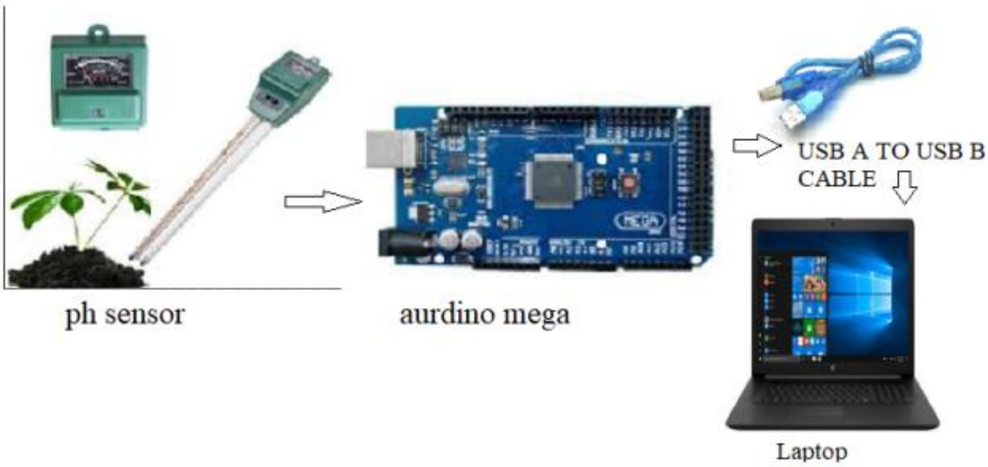

Fig 4 : Experimental setup for soil testing

The reading of the pH sensor is simple which is converted into computerized utilizing ADC (Analog to Digital Converter. The framework utilizes USB A to USB B fringe link to store the incentive in datasheets and for further reference with farmer. The framework sends any sudden changes in nature of soil to the agriculturist.

Initially we immerse the ph sensor to wet soil to get the soil ph value then we collaborate the ph sensor with microcontroller aurdino board using formulas we calculate the ph value, NPK value which is derived from sensors to know the soil feature in order to grow the suitable crop. The measured ph from sensor is digitized as using the equation 1 to 3

pHv = analog value * 5/1024/6 → 1

Ph=5.70*pHv+calibration → 2

Calibration= Nitrogen=(ph value*10)-15
Phosphorus=(ph value*10)-22
Potassium=(ph value*10)-12 → 3

Soil samples	Ph value	Nitrogen	Phosphours	potasssium	Recommended crop
Black soil	6.0	83%	48%	1000%	sugarcane
Laterite soil	4.5	30%	20%	35%	Tea
Red soil	5.5	70%	43%	70%	ragi
Dark brown clayey soil	7.1	100%	100%	100%	grasses

VII. Conclusion

Soil PH analyzed in relation to this work is one of the indices for measuring soil productivity in relation to crop production. From the soil pH analyses results, the PH portions of the land ranges from 4.5 – 8.0 and most of our tropical crops cannot grow well under this range of PH. The implication of this result is that appropriate management should be adopted to realize the optimum production capacity of the soil.NPK rating (or N-P-K) is used to label fertilizer based on the relative content of the chemical elements nitrogen (N), phosphorus (P), and potassium (K) that are commonly used in fertilizers. The three elements promote plant growth in three different ways. The crop recommendation system developed to help our farmers much advanced manner. And also with the help of this intelligent decision making technology we increase the farm productivity. So which in case good for the farmer and at last for the country. Many applications or systems have been developed to increase the crop growth.

References

[1]. A. Willig and H. Karl, Protocols and the Architectures for Wireless Sensor Networks, John Wiley and Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex, England, 2005.

[2]. B. BalajiBhanu, K. RaghavRao, J. V. N. Ramesh, Mohammed Ali Hussain, Agriculture Field Monitoring and Analysis using Wireless Sensor Networks for improving Crop Production", IEEE, 2014.

[3]. Jianfa Xia, Zhenzhou Tang, XiaoqiuShi, Lei Fan, HuaizhongLi ,"An environment monitoring for precise agriculture, based on wireless sensors network", IEEE,2011.

[4]. Shining Li, Jin Cui, ZhigangLi,"Wireless Sensors Network forPreciseAgricultureMonitoring", 2011, China.

[5]. DrishtiKanjilal, Divyata Singh, Rakhi Reddy, Prof Jimmy Mathew,"SmartFarm: Extending Automation to the Farm ", IJSTR, 2014.

[6]. S. R. Nandurkar, V. R. Thool, R. C. Thool, "Design and Development of Precision Agriculture System Using Wireless Sensor Network", IEEE, 2014.

[7]. Rekha P, LekshmiG.S and ManeeshaV.Ramesh, "Inegrated Wireless Sensor Network for Smart Sesame Farming in India", Elsevier, 2012.

[8]. AWATI J. S, PATIL V. S,"Automatic Irrigation Control by using wireless sensor networks",Journal of Exclusive Management Science, 2012.

[9]. https://www.cropnutrition.com/efu-soil-ph

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