# A Sensor Device For Analysing The Various Parameters of Soil For Effective Growth Of The Plant

**Sridevi K[1], Aarthikadevi K[2],Dhivya D[3],Elamathi S P[4],Karthiga S[5]**
[1]Dept of Electronics & Communication Engineering
[2, 3, 4, 5]Dept of Electronics & Communication Engineering
[1, 2, 3, 4, 5] Sri Eshwar College of Engineering.

***Abstract-*** *For sustainable growth of agriculture field continuous soil testing has to be made for better production.Farmers are finding difficult to take the soil to the testing centre to check for quality of the soil. Farmers usually face productivity loss due to improper planting according to monsoon condition. In our project, we are analysing the pH, moisture content, turbidity and macro nutrients level in the soil and suggesting the best suitable crops to be cultivated in their farm and also to increase the yield. The device also suggests the nutrients that should be incorporated in the soil for better result.*

***Keywords***- Arduino microcontroller, Nutrient sensor, Temperature sensor (LM35), Turbidity sensor, Moisture sensor,16*4 LCD,Toggle switch.

## I. INTRODUCTION

As we all know Agriculture is the backbone of Indian economy still we are unable to utilize our land resources. Due to industrialization, the agriculture lands are occupied by the corporate companies. So the demand for production increases. But farmers were unable to satisfy the needs because of various factors such as infertile soil, lack of rainfall, or due to some climatic disasters. It is reported by the Agriculture University Survey that the infertility of soil is increasing day by day because of stimulants. The precision agriculture involves the effective control of farming inputs to raise profitability of crop production, improve crop quality and protect the surroundings. Information regarding variability of different soil parameters in a field is necessary to the decision-making process. The chemical and physical properties of soil can be easily mapped by various soil sensors developed so far. Conventional method of soil testing involves processing of soil samples by chemical reagent and by photo spectrometry (i.e.) color change in the sample for the measurement of macronutrient in the soil. Usually soil testing laboratory collects 60 to 70 samples to starts the process. This metho dis expensive and also time consuming process. Also, this limits the number of samples analyzed in the field which further makes it difficult to describe esoil nutrient levels in the agricultural field.

## II. EXISTING SYSTEM

The present system deals with the detection of NPK values available in the soil using fiber optic sensor. The principle behind the optical fiber is based on the interaction of incident light. The reflected light may vary due to the soil physical and chemical properties. The sensor works on the principle of calorimeter which determines the color intensity. The sensor probe consists of seven fibers arranged in concentric configuration central fiber act as receiving fiber and surrounding 6 fiber acts as transmitting fiber. The driving circuit of LED consists of voltage to current converter, a subtractor and a buffer. The colored light passed through the fiber to an aqueous solution of soil sample. Depending upon NPK values of the soil light particular wave length and strength get absorbed by the solution and remaining gets reflected back. Reflected light is collected by the receiver probe and then converted to electrical signal using phototransistor. The output is calibrated in terms of deficient component values as per the standard color chart. The results are inaccurate and it requires more time.

## III. PROPOSED SYSTEM

In this paper, we demonstrated an automatic sensor and monitoring system for continuous nutrient requirement for the soil. We determined pH, soil quality, water quality and the surrounding temperature required for proper growth of the soil. The pH of the soil is determined by the amount of $H^+$ and $OH^-$ ions dissolved in the water. The quality of the water is analysed by the turbidity sensor. The principle behind turbidity sensor is Nephelometry. The light of known intensity is passed through sample some amount of light get scattered. This determines the turbidity of the water. Moisture sensor is used to measure the water content present in the soil. When the water content level is low the output voltage value will be high, else the value will be low. Temperature sensor senses the surrounding temperature in Kelvin, then it is calibrated to give the output in Celsius for easy analysis. Nutrient sensor is to test the NPK value present in the soil. All these modules are combined and given to the microcontroller and this system tells about the best suitable crop for the given soil samples and thereby indicating the amount of insufficient nutrient in their soil. As this system is easy to handle farmers can test their soil periodically to increase the production in order to face the demand.

**A. Hardware Design**

**3.1 MICROCONTROLLER (Arduino UNO)**

The microcontroller forms the heart of the device. The microcontroller takes care of the control, sequencing, monitoring and display functions. The controller consists of internal ADC to convert analog input into digital. It receives the input data and displays it on the LCD. The operating voltage of arduino is 5V. It has 6 analog pins and 14 digital pins. The memory is classified into three types SRAM, EEPROM, Flash memory. The flash memory is used to store the data. The EEPROM provides a memory space for long term storage of program.Flash Memory and EEPROM are non-volatile.SRAM is volatile and it will be lost when the power is cycled.

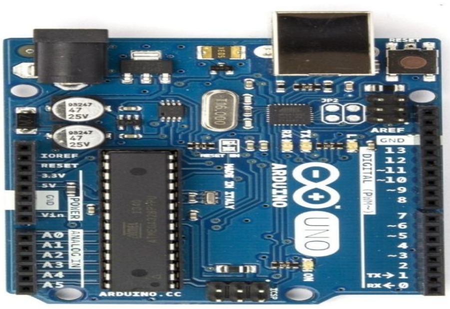



**Fig3.1 Arduino Uno**

**3.2 TEMPERATURE SENSOR**

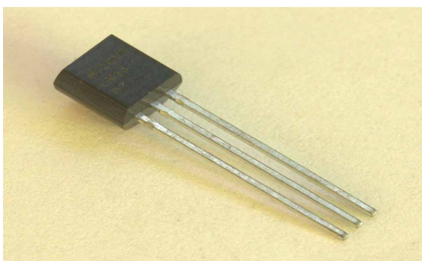


**Fig3.2 Temperature sensor LM35**

A temperature sensor is a thermocouple or Resistant Thermometer (RTD) that provides temperature measurement through an electrical signal. A thermocouple (T/C) is made from two dissimilar metals that generate electrical voltage in direct proportion to changes in temperature. The temperature sensor gives the value in Kelvin but it is not comfortable for the practical use. So there is a need of conversion from Kelvin to centigrade is required. The Analog to Digital Converter (ADC) converts analog values into a digital approximation based on the formula ADC Value = sample * 1024 / reference voltage (+5v).

**The following are the steps to be followed to interface temperature sensor with arduino UNO:**

- The left side pin of LM 35 is connected to VCC (i.e.) 5V of the microcontroller
- The middle pin is connected to the data pin (A3) of the microcontroller
- The right side pin of LM35 is connected to the ground.

**3.3 MOISTURE SENSOR**

Most of the soil moisture sensors are designed to estimate soil volumetric water content based on the dielectric constant.The Soil moisture sensor comprises of two modules.A two legged lead which is inserted into the soil and an amplifier module which posses four pins. The amplifier module has a potentiometer.Potentiometer is a small electronic component whose resistance can be adjusted manually.The amount of current flowing in a circuit can be controlled by either increasing or decreasing the resistance value.The electricity transmit capability is possessed by dielectric constant. The predictable estimation of water content is measured by dielectric constant.

**The following are the steps to be followed to interface moisture sensor with arduino UNO**

- The first pin is connected to VCC (i.e.) 5 V of arduino
- The second pin is connected to Ground of arduino
- The third pin is digital pin since we get analog input it is not used
- The four pin is analog that is connected to the data pin (A4) in the arduino

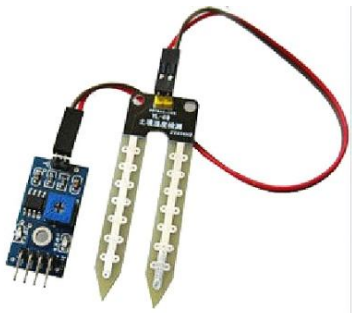


**Fig3.3 Moisture sensor**

### 3.4 TURBIDITY SENSOR


**Fig3.4 Turbidity sensor**

Water quality can be measured by the level of turbidity. The term turbidity refers to suspended particle in the water can be determined by light admittance and scattering rate which changes with the amount of total suspended solids in water. As the total suspended solids increases turbidity level also increases.

**The following are the steps to be followed to interface arduino with turbidity sensor**

- The left side pin is given to the analog pin
- The middle pin is connected to ground
- The right side pin is connected to VCC

### 3.5 NUTRIENT SENSOR

In this module, we have analysed macro nutrient content and pH in the soil. The major macro nutrient present in the soil which support plant growth are nitrogen, potassium and phosphorous. The soil samples are fed into the nutrient sensor where the NPK level are analysed and it display the results as inadequate, adequate for the given soil sample then it is given to the microcontroller. The microcontroller gives a guideline to the farmer regarding the NPK value present in their soil.

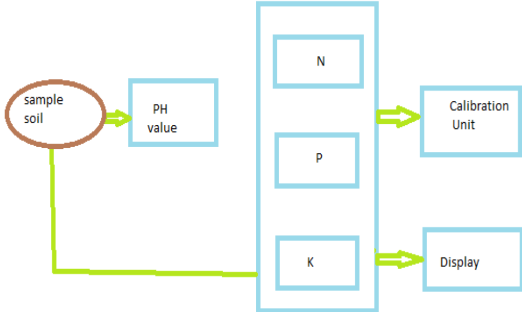



**Fig3.5 Nutrient sensor module**

### 3.5.1 pH SENSOR

This sensor is used to identify the amount of salt content in the soil. The pH value ranges from 1 to 14. The pH value ranges from 1 to 6is said to be acidic, value of 7 denotes neutral soil and 8 to 14 is alkaline soil.

It shows the copper quantity of the soil in the salt. The pH meter is an instrument to measures the hydrogen-ion concentration in a solution which indicates its alkalinity or acidity. The pH meter processes the alteration in electrical prospective among pH and reference electrode.

### 3.5.2 ION SELECTIVE FIELD EFFECT TRANSISTOR

An ISFET is a field effect transistor used for measuring iron concentration in solution.The ion selective membrane is placed on the top of the insulation layer FET structure so the threshold value of ISFET can be modulated chemically and the voltage measured is related to concentration of targeted ion. The major advantage over ISE,is that low outputimpendence, high signal to noise ratio. This not only detects NPK but also other nutrient such as ammonium, manganese, cobalt, sulphur, iron, calcium etc.

## IV. PROCEDURAL BLOCK DIAGRAM

The analog value from the nutrient sensor, moisture sensor, temperature sensor and turbidity sensor are given to the microcontroller with different data pins.The microcontroller has the in-built analog to digital converter. Finally, the digital values are displayed in the LCD.

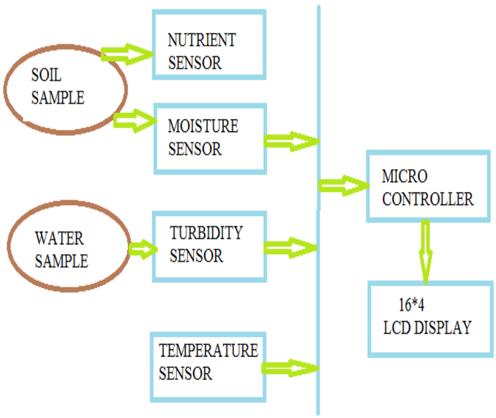
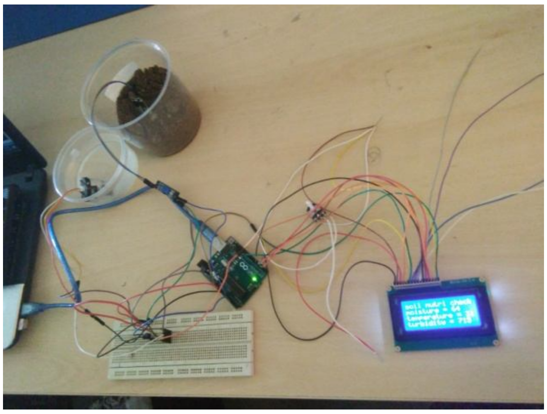



**Fig 4.1 Block diagram**

## V. RESULT

In this paper, we have proposed a hand-held testing device which suggest the farmers about the best suitable crop for their soil and also suggest the insufficient nutrient content in the soil for the crop considered.This helps to achieve better production in the agriculture field.



## VI. CONCLUSION

### A. FUTURE SCOPE

Design and implementation of nutrient analysis are presented in this paper mainly focused on measurement of nutrient content of the soil.Designed system is very helpful for reducing the system cost and manpower. The system is useful in measuring the nutrient content and suitable for small space, low cost, low power able to recycle the nutrient content which is already used by the plant. However there is need to make this system more advanced more accurate and cost effective so that farmers can use this system in large scale which is challenge that must be addressed in future, and hence system become fully automatic by controlling the other parameters such as pH, temperature ,nutrient content, turbidity and moisture etc. The deigned prototype ensures high rate of production. This system effectively makes the rural and urban household self sustained in vegetable consumption.

## REFERENCES

[1] P. Kumar, L. K. Sharma, P. C. Pandey, S. Sinha, and M.S. Nathawat,"Geospatial strategy for forest biomass estimationof tropical forest of sariska wildlife reserve (India)," IEEE J.Sel. Topics Appl. Earth Observat. Remote Sens., vol. 6, no. 2,pp. 917–923, Apr. 2013.

[2] Tanuja R.Patil, Shamshuddin K, Rajashekhar Patil,Sadanand P," a decision support system for farmers to gethigh crop yield".

[3] J. Huang, X. Wang, X. Li, H. Tian, and Z. Pan, "Remotelysensed rice yield prediction using multi-temporal NDVI dataderived from NOAA's- AVHRR," PLoS ONE, vol. 8, no. 8, p.e70816, Aug. 2013.

[4] Prachi Sharma,Dr. D.V. Padole," Design And Implementation Soil Analyser UsingIoT".

[5] M.P.Sharma,M.Yadav,K.Yadav, R.Prawasi,P.Kumar,and R.S.Hooda,"Cropping system analysis usingremote sensing and GIS: A block level study of kurukshetradistrict," J. Agricult. Biol. Sci., vol. 6,no. 10, pp. 45–61, Oct.2011.

[6] P. Bisht, P. Kumar, M. Yadav, J. S. Ravat, M. P. Sharma,and R. S. Hooda, "Spatial dynamics for relative contribution
of cropping pattern analysis on environment by integratingremote sensing and GIS," Int. J. Plant Prod., vol. 8, no. 1, pp.1–17, 2014.

[7] Vaibhav Ingale, Rashmi Vaidya, Amol Phad, Pratibha Shingare,"A Sensor Device for Measuring SoilMacronutrient Proportion using FPGA"