ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 4, Special Issue 20, March 2017

Real Time Embedded Based Soil Analyzer & Normalize the Nutrients Level

[1]Pandiaraj P, [2]Krishna Kumar S, [3]Kannan G
Electronics and Communication Engineering
Kamaraj College of Engineering and Technology, Virudhunagar
[1]pandiaraj54@gmail.com, [2]s.kumar96882@gmail.com, [3]g.kannan369@gmail.com

Abstract— Preserve environment in farming is now becoming main concern since use of inputs like fertilizers and pesticides has been widely employed. Site specific application of chemicals, providing light and temperature is an effective way of resource saving and environment protection. Inappropriate nutrients, light and temperature has affect the growth of plants in the farm field. The farmers have to pay attention to control the above mentioned parameters in the farm field. The balanced nutrition level is provided by maintaining the pH level of the soil. Necessary lighting and temperature are maintained by using the light and heat sensors. According to the moisture content of the soil, pouring the water by using the moisture sensor. Controlling of light and temperature is done by incubator light and heat controlling fan via mobile app. automatic controlling of the solenoid valve is taken by using arduino through Virtuino mobile application.

Keywords—: pH, Nutrients, Automatic Controlling, Sensor.

I. INTRODUCTION

Soil analysis is a valuable tool for farmers, it determine the inputs required for efficient and economical production. A proper soil test will help to ensure the application of enough fertilizer to meet the requirements of the crop while taking advantage of the nutrient already present in the soil[5]. It will also allow you to determine lime requirements and can be used to diagnose problem areas. Sampling technique is correct as the results are only as good as the sample you take.

Soil testing is also a requirement for farms that must complete a nutrient management plan. Tests often check for plant nutrients in three categories (i) Major nutrients: Nitrogen (N), Phosphorus (P) and Potassium (K) (ii)Secondary nutrients: Sulphur (S), Calcium (C), Magnesium (Mg) (iii) Minor nutrients: Iron (Fe), Manganese (Mn), Copper(Cu), Zinc (Zn), Boron (B)[6].

A. pH Value

The soil pH is a measure of the acidity or basicity in soils. pH is defined as the negative logarithm (base 10) of the activity of hydronium ions (H+or, more precisely, H3O+aq)in a solution. It ranges from 0 to 14, with 7 being neutral. A pH below 7 is acidic and above 7 is basic .Soil pH is considered a master variable in soils as it controls many chemical processes that take place[1].

It specifically affects plant nutrient availability by controlling the chemical forms of the nutrient. The optimum pH range for most plants is between 5.5 and 7.0

B. Moisture Level

Soil moisture content may be determined via its effect on dielectric constant by measuring the capacitance between two electrodes implanted in the soil. Where soil moisture is predominantly in the form of free water (e.g., in sandy soils), the dielectric constant is directly proportional to the moisture content. The probe is normally given a frequency excitation to permit measurement of the dielectric constant. The readout from the probe is not linear with water content and is influenced by soil type and soil temperature. Therefore, careful calibration is required and long-term stability of the calibration is questionable.

C. Temperature Level

Temperature Level in the area shows the heat availability for the plants. Temperature level of the agriculture field is the good indication to find the necessary growth of the plants.

D. Light Intensity Level

Light Intensity Level in the area shows the light availability for the plants. This light sensor module uses the photo-resistor to detect the light intensity of the environment. The resistance of the sensor decreases when the light intensity of the environment increases.

II. METHODOLOGY

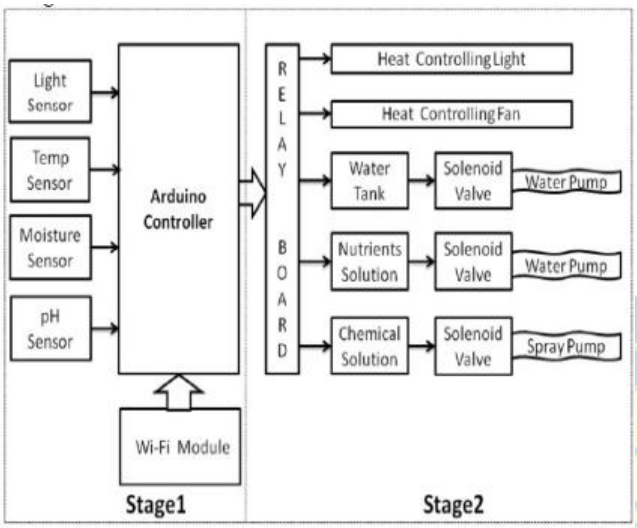
Real time embedded based soil analyser measures the pH value of soil and temperature, light in the agriculture field. Soil pH values start from the 0 to14.The range of pH value below 7 becomes acidity, above 7 becomes basicity and pH value 7 is the neutral value[1]. Soil pH value calculated with help of the pH sensor. Soil's most common pH value range is from 4 to 10. Soil Moisture level measured with the help of Moisture Sensor. It is immersed in the soil and gives the moisture content of the soil[7]. Temperature level is measured by using Temperature sensor. Sensor module is including resistive humidity sensing component and NTC temperature testing. This module is fast response, great anti-interference ability and durable. Light Intensity level can be measured by using Light sensor. Light-controlled variable resistor The resistance of a photo resistor decreases with increasing incident light intensity In the dark, a photo resistor can have a resistance as high as several mega ohms (MΩ)While in the light, a photo resistor can have a resistance as low as a few hundred ohms.

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 4, Special Issue 20, March 2017

III. SYSTEM ARCHITECTURE

The overall system architecture is shown in Fig.1 which includes Arduino Board, Sensors, Relay Board, and Controlling Unit.



. Fig.1: Overall System Architecture

A. *Measurement of Soil pH Value*

Soil pH is measured from soil solution using pH sensor. pH sensor has an output in mill-volts depending upon the pH value. pH sensor basically measures the hydrogen ion [H+] activity[3]. Measurement of pH with pH sensor is based on the principle that potential is developed when two solutions of different pH comes in contact through a thin glass membrane. Fig.2 shows the main parts of the pH sensor. At the tip of the sensor there is a thin membrane capable of ion exchange. For neutral solutions, i.e. at pH of 7 the output of pH electrodes is 0mV when ideally.

Fig. 2: pH Sensor

pH sensor interfaced with arduino. pH values are accepted by the arduino and displayed in the serial monitor and also Virtuino mobile application.

B. *Measurement of Moisture level*

The Soil Moisture Sensor is used to measure the volumetric water content of soil. Figure 3.3 shows the proper placement of the Soil Moisture Sensor[7]. The prongs should be oriented horizontally, but rotated onto their side – like a knife poised to cut food-so that water does not pool on the flat surface of the prongs.

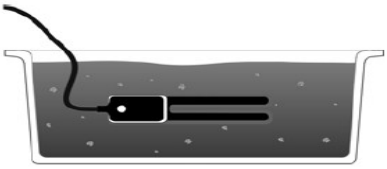


Fig.3: Proper placement of Moisture sensor

Moisture sensor is interfaced with arduino and It accept the values. Then displayed in the Virtuino mobile app through Wi-Fi module.

C. *Measurement of Temperature level*

The sensor module is including resistive humidity sensing component and NTC temperature testing. The compatible digital temperature humidity sensor module is component and connected with 8-byte MCU. This is useful module is fast response, great anti-interference ability and durable. Fig.4 shows the Temperature Sensor, which is interfaced with arduino and we can view the result in Virtuino mobile app.

Fig.4: Temperature sensor

D. *Measurement of Light Intensity*

Light sensor module uses the GL5528 photo-resistor to detect the light intensity of the environment. The resistance of the sensor decreases when the light intensity of the environment increases. The LM358 op-amp is configured as a "voltage follower" to increase the accuracy of this device. Fig.5 shows the Light sensor, which interfaced with arduino Readings are displayed in Virtuino app[2] through Wi-Fi module.

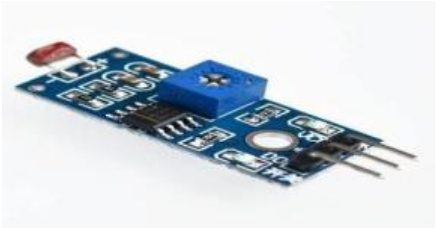


Fig.5: Light Sensor

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 4, Special Issue 20, March 2017

IV. HARDWARE IMPLEMENTATION

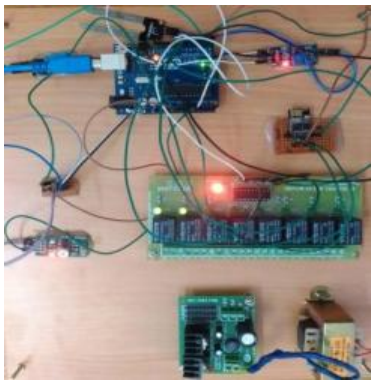


Fig.6: Hardware Setup

Fig.6 shows RTEBSA's Hardware setup. Sensors are interfaced with Arduino UNO. Outputs from sensors are analog in nature to process these analog signals to RTEBSA system A/D converters are used. Arduino is connected with Wi-Fi module. By using this Wi-Fi module we can connect our Android device. Through mobile app in this device we can visualize the sensor readings [2]. Controlling is done by according to the pH, moisture, temperature and light level in the agriculture field [4].

V. HARDWARE RESULT & DISCUSSION

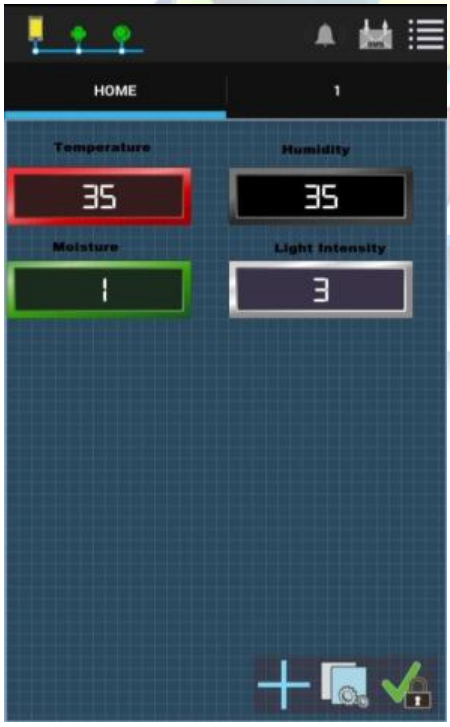


Fig.7: pH, Moisture, Temperature and Light intensity measurements by Virtuino mobile app.

Fig.7 shows the different sensor readings according to the condition in the agriculture field. In Fig.7, temperature is above the threshold value 20°. The fan will automatically rotate and reduce the temperature. Moisture level is below the threshold level 50.The motor will turn ON and pour the water in agriculture field. Similarly light intensity value is below the threshold which already programmed. Light will automatically glow in the field to maintain the intensity.

VI. CONCLUSION

Real time embedded based soil analyser is used to do analysis of various soil nutrients parameters with the help of the pH Sensor. Depends on the pH value, various nutrients level is calculated. Based on pH value, solutions are pouring to the field for maintaining the nutrients level. Similarly Soil moisture content is measured by moisture sensor and water pouring is applied effectively. Similarly light and temperature sensors measure the real time values in the field and auduino controls all the valve functions. IoT application also implemented.

REFERENCES

[1] SachinKumar ," Soil pH Sensing Techniques and Technologies-A Review" (International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering), May 2015
[2] http://iliaslamprou.mysch.gr/virtuino/virtuino.zip
[3] PG Scholar ," Real Time Embedded Based Soil Analyzer "(International Journal of Advanced Research in Computer and Communication Engineering), March 2014
[4] Dr. Ashwini kumar ,"Design of Control System for Measurement of pH and EC of Fertilizer Solution" (International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering), April 2015
[5] www.agric.gov.ab.ca/app21/rtw/index.jsp
[6] http://agritech.tnau.ac.in/agriculture/agri_nutrientmg_ nutrientavailibility.html
[7] http://en.wikipedia.org/wiki/Soil_test