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Soil Property Analysis Process by Multi Sensor Technique

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Abstract: ***Two significant issues in present day Agriculture are water shortage and high work costs. These issues can be settled utilizing agricultur task robotization, which empowers accuracy agribusiness. Thinking about plenitude of daylight in India, this paper examines the plan and advancement of an IoT Agribot that computerizes water system task and empowers remote ranch checking. The Agribot is created utilizing a PIC microcontroller. While executing the undertaking of water system, it moves along a pre-decided way of a given ranch, and faculties soil dampness substance and temperature at standard focuses. At each detecting point, information obtained from different sensors is prepared locally to choose the need of water system and in like manner homestead is watered. Further, Agribot goes about as an IoT gadget and transmits the information gathered from numerous sensors to a remote server utilizing GPS/GPRS. At the remote server, crude information is prepared utilizing sign handling tasks, for example, separating, pressure and expectation. As needs be, the broke down information measurements are shown utilizing an intuitive interface, according to client demand.***

Keywords: soil moisture, smart agriculture, smart farming, soil temperature sensing, soil humidity sensing

I. INTRODUCTION

As indicated by the ongoing insights, the land utilized for yield development in India is diminishing at a quickening rate. Obsolete water system procedures and accessibility of water assets are the essential purposes behind disjointed creation. Subsequently, innovative answers for agribusiness task robotization are the need of great importance. Specifically, improved water system components lessening water wastage are basic, which empower exactness agribusiness. Innovative answers for water system and agrarian undertaking mechanization are driven by electric power. Henceforth innovative answers for agribusiness task mechanization can yield better benefits for Indian ecological conditions.

II. LITERATURE REVIEW

Kalyan et al (2011): The requirement for frameworks that make agribusiness simpler and progressively reasonable includes expanded inside the previous couple of years.[1] Priyanka et al (2012): includes a few sensors, LCD show, and GSM and ARM processor.[2] Anjum Awasthi et al, (2013):

The proposed framework in this paper is planned by considering the necessity of a sugarcane crop for Indian climatic conditions.[3] Sanjukumar et. al. (2013): The Soil dampness substance based water system framework was created and effectively executed alongside stream sensor.[4] Swarup et al (2013) : Smart sensors based checking framework for agribusiness have been utilized to build the yield of plants by observing the ecological conditions (parameters) and in this manner giving the important data to the customers (ranchers).[5]

The proposed framework is primarily produced for the improvement of ranchers.[6] Saleemmaleekh et el (2013) : With the headway in innovation, our general surroundings in all aspects of our life getting computerized.[7] Fredlund and Xing (1994) recorded the different works did to infer conditions for the dirt water trademark bend.[8] Estimating water content in soils is a significant assignment and numerous creators have proposed and endeavored a few inventive, savvy and efficient methodologies. Sun et al (2008) built up a multi-sensor framework, which comprises of a phone with three sensors for estimating soil water content, mechanical quality and Electrical Conductivity (EC).[9]

Zhao et al (2009) built up a counterfeit neural system (ANN) model to foresee soil surface (sand, earth and residue substance) in view of soil qualities got from existing coarse goals soil maps joined with hydrographic parameters got from a computerized rise model (DEM) of the Black Brook Watershed (BBW) in northwestern New Brunswick, Canada.*[10]*

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III. SENSORS AND OTHER HARDWARE USED

A. Turbidity Sensor

TCS3200 Color Recognition Sensor is a little module planned with TCS3200 Color Sensor that can change over light power to recurrence. The TCS3200 can identify and quantify an almost boundless scope of noticeable hues. The TCS3200 has a variety of photograph identifiers, each with either a red, green, or blue channel or no channel. The channels of each shading are conveyed equally all through the cluster to dispense with area predisposition among the hues. Interior to the gadget is an oscillator which creates a square-wave yield whose recurrence is relative to the power of the picked shading.

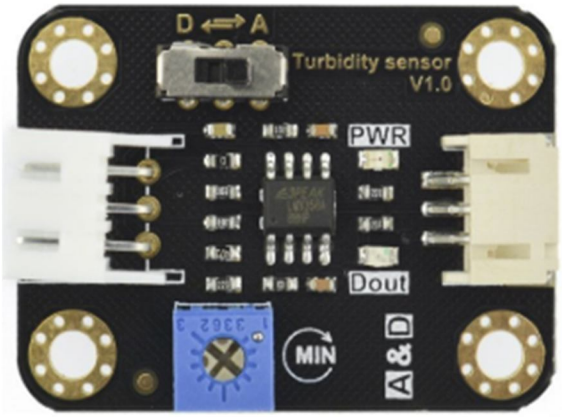


Fig.1 Turbidity Sensor

1) *Features:* Supply voltage: (2.7v-5.5v) DC, Programmable color and full-scale output frequency, Power down feature, Compact design
2) *Applications:* Test strip reading, Sorting by color, Color matching LED and LCD backlighting

B. Humidity Sensor

Humidity and mugginess is the nearness of water in air. The measure of water vapor in air can influence human solace just as many assembling forms in businesses. The nearness of water vapor likewise impacts different physical, synthetic, and organic procedures. Dampness estimation in ventures is basic since it might influence the business cost of the item and the wellbeing and security of the faculty. Consequently, stickiness detecting is significant, particularly in the control frameworks for mechanical procedures and human solace.

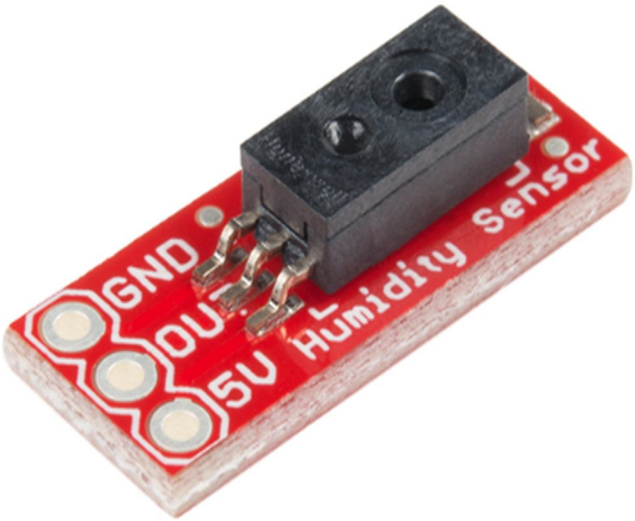


Fig.2 Humidity Sensor

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C. pH Sensor

Utilize the pH Sensor similarly as you would a customary pH meter with the extra points of interest of robotized information accumulation, diagramming, and information investigation. Average exercises utilizing our pH sensor incorporate; Acid-base titrations, Studies of family unit acids and bases, Monitoring pH change during synthetic responses or in an aquarium because of photosynthesis, Investigations of corrosive downpour and buffering, Analysis of water quality in streams and lakes.



Fig.3 pH Sensor

1) Features: Supply voltage: 5VDC, Soil Tester Moisture - Light – PH, Output: Analog.
2) Applications: Acid-base titrations, Analysis of water quality in streams and lakes.

D. Temperature Sensor

LM35 Precision Centigrade Temperature Sensors: The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 does not require any external calibration or trimming to provide typical accuracies of ±1⁄4°C at room temperature and ±3⁄4°C over a full −55 to +150°C temperature range. Low cost is assured by trimming and calibration at the wafer level. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. It can be used with single power supplies, or with plus and minus supplies.



Fig. 4 Temperature Sensor

1) Features: Calibrated directly in ° Celsius (Centigrade) , Linear + 10.0 mV/°C scale factor, 0.5°C accuracy guaranteeable (at +25°C), Rated for full −55° to +150°C range, Suitable for remote applications, Low cost due to wafer-level trimming, Operates from 4 to 30 volts, Less than 60 µA current drain, Low self-heating, 0.08°C in still air, Nonlinearity only ±1⁄4°C typical, Low impedance output, 0.1 W for 1 mA load.

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E. Soil Moisture Sensor

This sensor can be utilized to test the dampness of soil, when the dirt is having water deficiency, the module yield is at significant level, and else the yield is at low level. By utilizing this sensor one can consequently water the blossom plant, or some other plants requiring programmed watering strategy. Module double yield mode, advanced yield is basic, simple yield progressively precise. Soil dampness sensors measure the volumetric water content by implication by utilizing some other property of the dirt, for example, electrical opposition, dielectric consistent, or cooperation with neutrons, as an intermediary for the dampness content.

1) *Features:* Input voltage: 5v, Output voltage:0-5v, Output: Analog, Sensitivity: adjustable, Threshold level can be configured, Module triple output mode, digital, analog, serial outputs.
2) *Applications:* Agriculture, Landscape irrigation, Simple sensor for Gardeners, Research.

F. PIC16F877A

High-Performance RISC CPU

1) All single-cycle instructions except for program branches, which are two-cycle
2) Only 35 single-word instructions to learn
3) Pinot compatible to other 28-pin or 40/44-pin PIC16CXXX and PIC16FXXX microcontrollers
4) Operating speed: DC – 20 MHz clock input DC – 200 ns instruction cycle
5) Up to 8K x 14 words of Flash Program Memory, Up to 368 x 8 bytes of Data Memory (RAM), Up to 256 x 8 bytes of EEPROM Data Memory

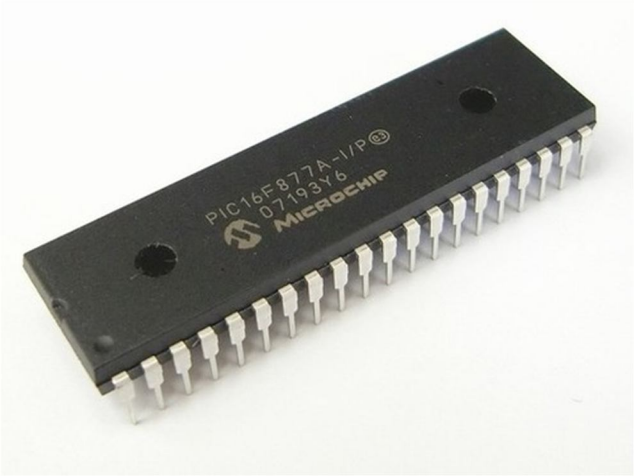


Fig.5 *PIC16F877A*

*G. LCD (2*160)*

The Liquid Crystal Display (LCD) was first created at RCA around 1971. LCDs are optically inactive showcases (they don't create light). Accordingly, LCDs require all most no capacity to work. Numerous LCD adding machines can work from the intensity of a sun based cell, others can work for quite a long time from little catch cell batteries. LCDs work from the capacity of fluid gems (LC) to turn energized light in respect to a couple of crossed polarizers covered to the outside of the showcase. There are two principle sorts of LCD presentations utilized for mini-computers today: Twisted nematic (TN) and supertwisted nematic (STN). TN showcases bend captivated light to 90 degrees and have a constrained review point. STN presentations were created to bend spellbound light between 180 to 260 degrees bringing about better differentiate and a more extensive review point.



Fig.6 LCD Character 2x16 Module

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H. Transformer

It is a universally useful case mounting mains transformer. Transformer has 240V essential windings and focus tapped optional winding. The transformer has flying hued protected associating drives (Approx. 100 mm long). The Transformer go about as venture down transformer diminishing AC - 240V to AC - 12V. Power supplies for a wide range of undertaking and circuit sheets. Venture down 230 V AC to 12V with a limit of 500mAmp current. In AC circuits, AC voltage, current and waveform can be changed with the assistance of Transformers. Transformer assumes a significant job in electronic gear. Air conditioning and DC voltage in Power supply gear are nearly accomplished by transformer's change and replacement.

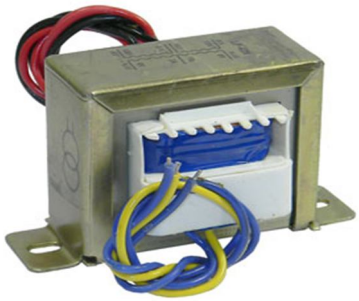


Fig. 7 Transformer

1) *Features:* Output current:500mA, Supply voltage: 220-230VAC, Output voltage: 12VAC , Soft Iron Core, 500mAmp Current Drain.

I. LM7805

This arrangement of fixed-voltage integratedcircuit voltage controllers is intended for a wide scope of uses. These applications incorporate on-card guideline for end of clamor and appropriation issues related with single-point guideline. Every one of these controllers can convey up to 1.5 An of yield current. The inward currentlimiting and warm shutdown highlights of these controllers basically make them resistant to over-burden. Notwithstanding use as fixed-voltage controllers, these gadgets can be utilized with outer segments to get movable yield voltages and flows, and furthermore can be utilized as the powerpass component in accuracy controllers.

1) *Features:* Output Current up to 1A , Output Voltages of 5v, Thermal Overload Protection , Short Circuit Protection, Output Transistor Safe Operating Area Protection.

IV. SOFTWARE USED

A. MPLAB

MPLAB is a restrictive freeware incorporated advancement condition for the improvement of installed applications on PIC and dsPIC microcontrollers, and is created by Microchip Technology. MPLAB and MPLAB X bolster venture the board, code altering, investigating and programming of Microchip 8-piece PIC and AVR (counting ATMEGA) microcontrollers, 16-piece PIC24 and dsPIC microcontrollers, just as 32-piece SAM (ARM) and PIC32 (MIPS) microcontrollers. MPLAB is intended to work with MPLAB-guaranteed gadgets, for example, the MPLAB ICD 3 and MPLAB REAL ICE, for programming and troubleshooting PIC microcontrollers utilizing a PC. PICK it software engineers are likewise upheld by MPLAB.

B. Embedded C

Inserted C is a lot of language expansions for the C programming language by the C Standards Committee to address shared trait gives that exist between C augmentations for various implanted frameworks. Verifiably, installed C programming requires nonstandard augmentations to the C language so as to help extraordinary highlights, for example, fixed-point number-crunching, various unmistakable memory banks, and essential I/O activities. In 2008, the C Standards Committee stretched out the C language to address these issues by giving a typical standard to all executions to hold fast to. It incorporates various highlights not accessible in ordinary C, for example, fixed-point math, named address spaces and fundamental I/O equipment tending to. Inserted C utilizes the greater part of the language structure and semantics of standard C, e.g., principle () work, variable definition, information type revelation, restrictive articulations (if, switch case), circles (while, for), capacities, exhibits and strings, structures and association, bit activities, macros, and so forth.

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V. CIRCUIT DESCRIPTION AND POWER SUPPLY

A power supply (once in a while known as a power supply unit or PSU) is a gadget or framework that provisions electrical or different sorts of vitality to a yield burden or gathering of burdens. The term is most regularly applied to electrical vitality supplies, less frequently to mechanical ones, and once in a while to other people.

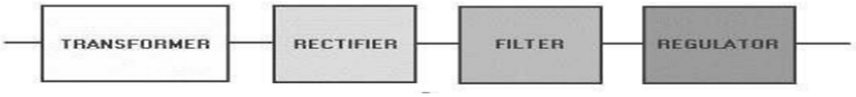


Fig. 8 basic block diagram of power supply

Circuit Description: This circuit is a little +5V power supply, which is helpful when exploring different avenues regarding advanced hardware. Little reasonable divider transformers with variable yield voltage are accessible from any gadgets shop and grocery store. Those transformers are effectively accessible, however for the most part their voltage guideline is exceptionally poor, which makes then not truly usable for computerized circuit experimenter except if a superior guideline can be accomplished here and there. The accompanying circuit is the response to the issue. This circuit can give +5V yield at around 150 mA current, yet it very well may be expanded to 1 A when decent cooling is added to 7805 controller chip. The circuit has over-burden and therminal assurance. The capacitors must have enough high voltage rating to safely handle the input voltage feed to circuit. The components used are 7805 regulator IC 100 uF electrolytic capacitor, at least 25V voltage rating 10 uF electrolytic capacitor, at least 6V voltage rating 100 nF ceramic or polyester capacitor.

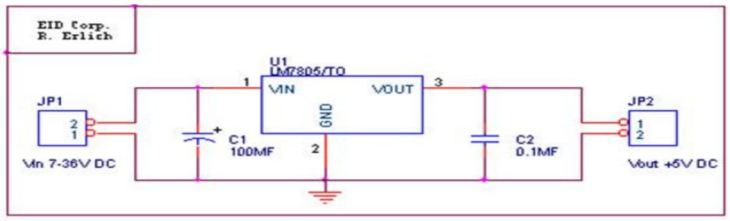


Fig. 9 power supply circuit diagram

VI. RESULT

Following is a table and the graphical representation of the data we received.

S.N	DATE	SOIL MOISTURE	pH	TEMPERATURE	TURBIDITY	HUMIDITY
1	2019/05/16 3:41:22 AM	100	100	100	100	100
2	2019/05/16 3:43:12 AM	100	100	100	100	100
3	2019/05/16 3:44:12 AM	0000	0000	0064	0024	0015
4	2019/05/16:48:15 AM	0000	0000	0064	0011	0012
5	2019/05/16 3:51:27 AM	0000	0000	0064	0000	0015
6	2019/05/16 3:54:37 AM	0407	0000	0065	0011	0013
7	2019/05/16 3:57:44 AM	0000	0000	0065	0028	0014
8	2019/05/16 2:10:09 PM	0000	0000	0067	0448	0396
9	2019/05/16 2:13:29 PM	0000	0000	0067	0446	0391
10	2019/05/16 14:15:12 PM	0000	0000	0067	0412	0373
11	2019/05/16 14:17:45 PM	0000	0000	0067	0462	0402
12	2019/05/16 14:20:33 PM	0000	0000	0066	0419	0387
13	2019/05/16 14:22:24 PM	0000	0000	0066	0417	0387
14	2019/05/16 14:25:27 PM	0166	0000	0067	0373	0354
15	2019/05/16 14:27:45 PM	0000	0000	0067	0405	0379

Fig. 10 Table Showing the Data Report of Moisture,pH, Temperature, Humidity and Turbidity

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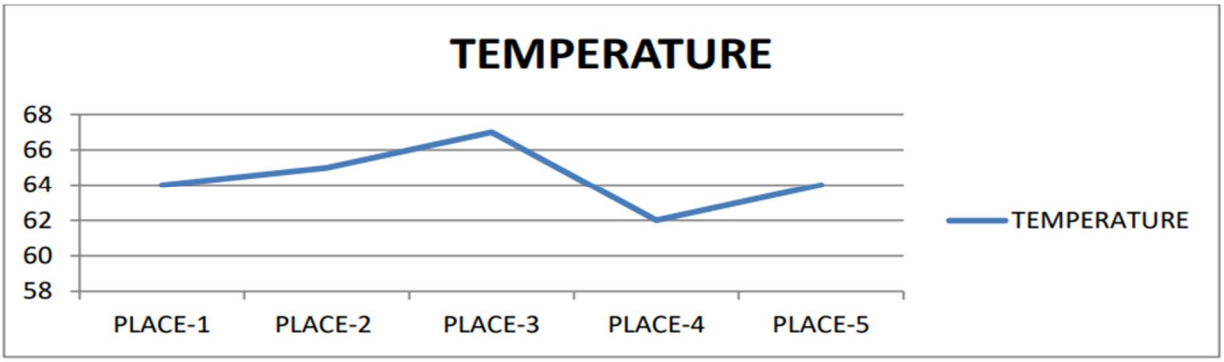


Fig. 11 graph showing the value of temperature at different time

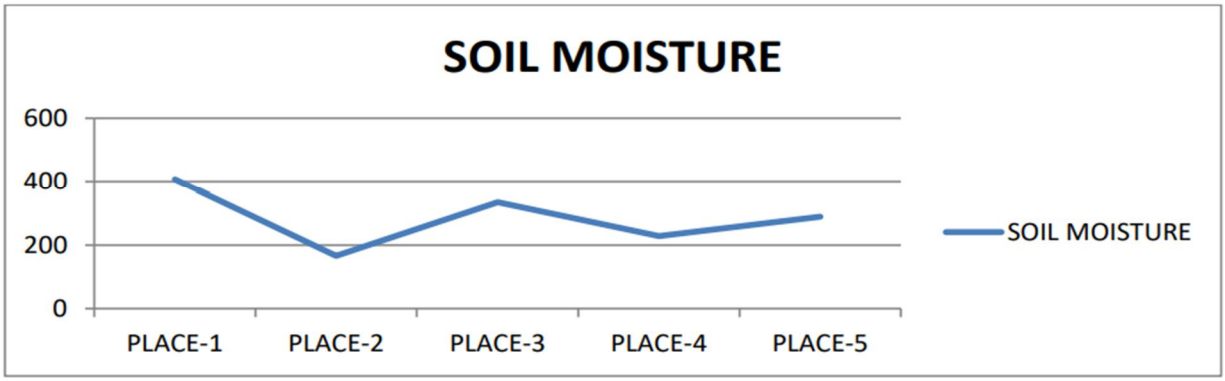


Fig.12 graph showing different value of soil moisture at different time

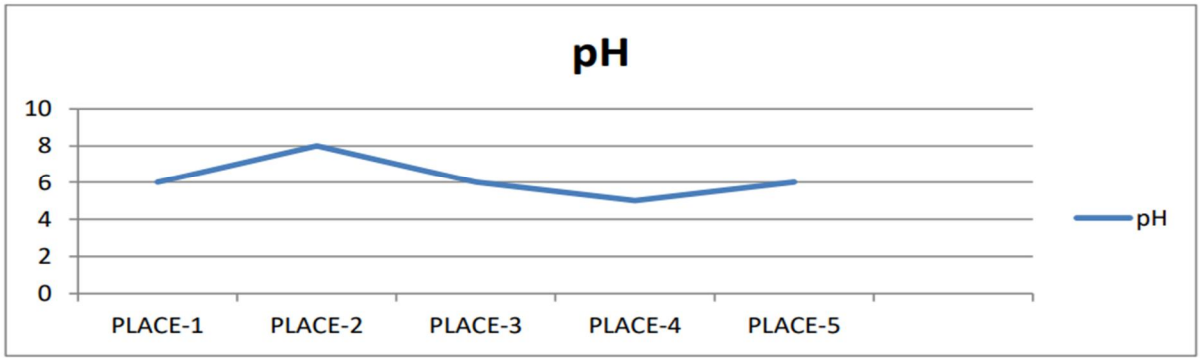


Fig.13 Graph showing different pH values at different time

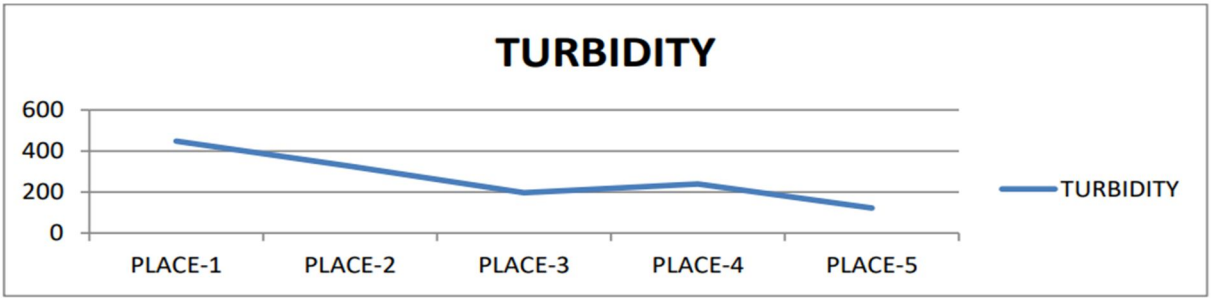


Fig.14 Graph showing different value of turbidity at different time

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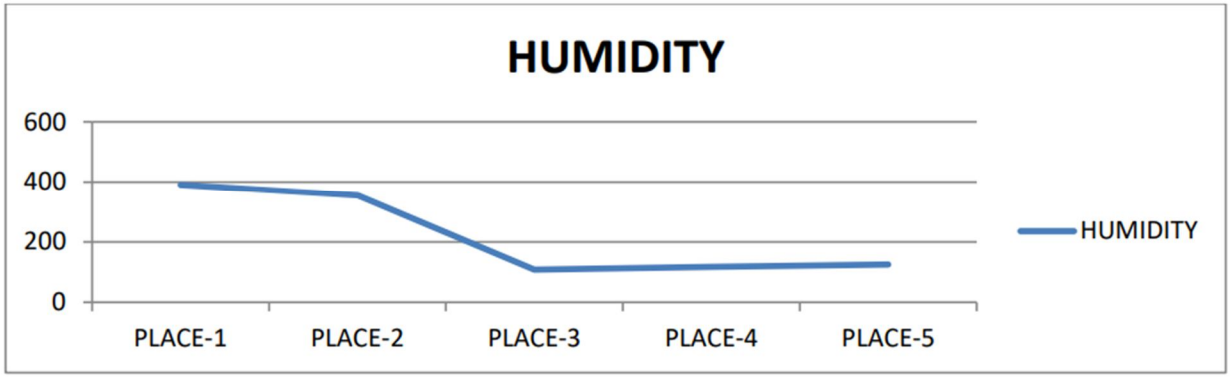


Fig. 15 Graph showing different values of humidity at different time

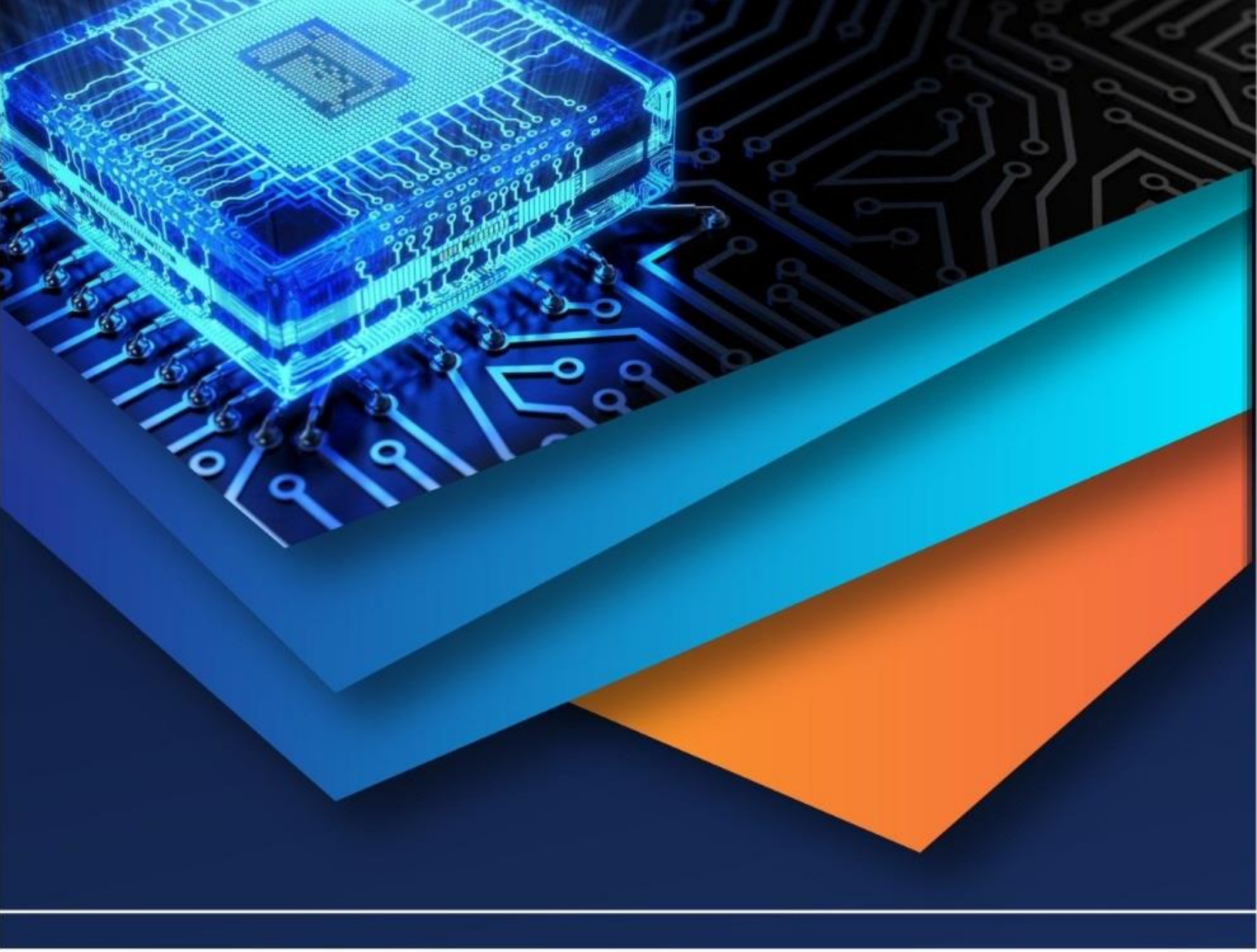
VII. CONCLUSION

All the five soil properties i.e Temperature, pH, Turbidity, Humidity, and Soil Moisture has been analyzed at five different places through IOT and readings are presented in line graph along with date and time and it has been uploaded to the website precisely. Hence, these different properties of soil can be analyzed by this technique.

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