

# SOIL NUTRIENT IDENTIFICATION USING ARDUINO AND ELECTROCHEMICAL SENSOR

Salve Akshay B<sup>1</sup>, Sagar Sonali S<sup>2</sup>, Patne Mahesh L<sup>3</sup>, Jangam Omkar R<sup>4</sup>.

<sup>1,2,3,4</sup>Student B.E. Computer Engg., SVPM COE, Malegaon, Baramati, Pune

\*\*\*

**Abstract** - In India, where the economy is basically base on farming and the climatic conditions. The primary reason is the need of downpours and scarifies of arrive store water and abused of fertilizers so we require to control these parameters. This framework made remote sensor organize for checking rural situations for different components such as NPK, temperature and stickiness along with other variables can be of centrality. By which we can apply fertilizer to the put where it needs, too we can maintain a strategic distance from over fertilization of the crops. A key in soil testing for defined fertilization is to decide the amount of soil supplements, taken after by proposal of supplement needs and site-specific fertilization. This consider planning to grant a brief review of potential electrochemical sensors and a rundown of their challenges and openings in soil supplement detection.

**Key Words:** NPK, Real time detection, Soil fertility.

## 1. INTRODUCTION

In India, where the economy is basically base on horticulture and the climatic conditions are isotropic and are not able to make full utilize of agrarian assets. Generation of edit depends on the interaction between soil and plant properties. Maximization of generation of crops is reflected by organic, physical, chemical condition of the soil. Sensor Systems give wide assortment of applications and mindfulness has expanded with respects to executing innovation into a rural environment. Manual collection of information for chosen variables can be intermittent and deliver varieties from inaccurate estimation taking; this can cause complications in controlling any vital factors.

Root retains required sum of supplements and water from the soil where biochemical responses takes put. Plant rate of supplement retention depends on the minerals accessible in the soil. Generation of crops debases with the inadequately rate of supply of any fundamental supplements.

Amount of NPK is subordinate on trim sort and on plant development status. How much amount of fertilizer to be utilized is advance subordinate on display substance of NPK supplements in the soil. Since the macronutrients change indeed on little scale all through the developed field, various analysts have endeavored to create the sensor to outline these supplement substances. To get the adjust sum of supplements to be given and to select the right trim for numerous editing in the same arrive, we require to degree the genuine sum of supplements show in the soil. For accomplishing the feasible farming keeping up and for

minimizing any country's financial misfortunes and natural impacts, legitimate administration of fundamental soil supplements plays a crucial part. Innovation plays a convenient part for advancement of environment and for accomplishing the financial objectives.

## 1.1 Description of Proposed System

In this framework we illustrate a programmed electrochemical sensor framework for nonstop supplement assurance. The flow-through electrochemical sensor framework with two terminal framework works based on stream infusion investigation (FIA) method for recognizing the supplements. The essential point of this framework to create a touchy and solid electrochemical sensor framework for observing the supplements in soil test for long-term applications.

## 1.2 Block Diagram Description

The soil supplement distinguishing proof framework comprises of electrochemical sensor, arduino microcontroller, serial harbour, cable connector, directed control supply, soil test, LCD show and PC.

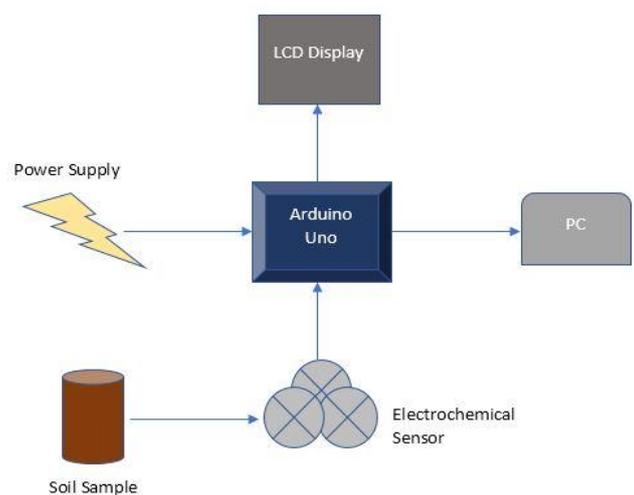
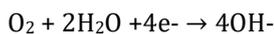


Fig -1: Block diagram of proposed system

## 2. Electrochemical Sensor

The electrochemical sensor comprises of two cathodes which reacts to focused on particle and changes the responses to distinguishable electrical signals. Particle Specific Cathode (ISE) and Particle Particular Field Impact

Transistor (ISFET) are the two sorts of commonly utilized potentiometric electrochemical sensor for soil supplement discovery. Here ISEs is not reasonable for real-time detecting applications since of their time delay (a few minutes). An electrochemical sensor comprises of a dissemination obstruction, a detecting anode and a counter anode. In an environment free of chemically responsive gasses, oxygen diffuses into the cell and adsorbs on both cathode. The result is a steady potential between the two in which the small current streams. The cell chemical prepares at this point,



Oxygen enters through the sensor through the capillary where it comes in contact with the cathode and it promptly diminished to hydroxyl particles. This sort of electrochemical sensor is based on ISFET innovation. The electrochemical sensor has the potential to be created in bunches to exceptionally little estimate by utilizing MEMS-based miniaturized scale manufacture innovation at moo costs. Other than, little measured sensors require little volume of reagent and tests, which can too diminish the fetched in soil testing.

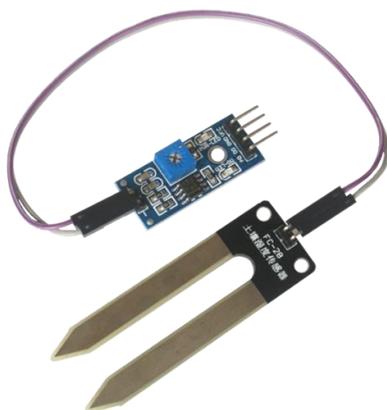


Fig -2: Electrochemical Sensor

### 2.1 Ion Selective Electrode

The reaction component of ISE strategy can briefly have portrayed by the Nernst condition as a alter of an ISE's potential, compared with a reference electrode, is direct to the alter of the ionic movement (in logarithmic units) of the target ion. ISEs were detailed to identify soil nitrate (Dahnke, 1971; Hansen, 1977), ammonium (Banwart, 1972; Simeonov, 1976) and potassium (Mei, 1982; Wang, 1992). To date, no promising ISE for phosphorus location was reported, but a few literary works displayed that the PVC-based membrane ISEs could be utilized to degree phosphate substance in natural samples (Glazier, 1988; Carey, 1994; Liu, 1997, Fibbioli, 2000; Wroblewski, 2001). ISEs were utilized for soil supplement location in two bearings: (1) Stream Infusion Investigation (FIA) frameworks (Ruzicka, 1977; Hongbo, 1985; Ferreira, 1996), and (2) vehicle-based

soil detecting frameworks (Adsett, 1991; V. I. Adamchuck, 2004). Be that as it may, ISEs might not have been prepared for real-time sensing applications since of their reaction delay.

### 2.2 Ion Selective Field Effect Transistor

ISFET is the integration of an ISE and a field impact transistor (FET). The ion specific layer is put on the best of the separators layer of the FET structure, so the limit voltage of the ISFET can be chemically modulated and the measured voltage is related with the concentrations of a target particle. ISFETs have a few focal points over ISEs, such as small dimensions, moo yield impedance, tall signal-to-noise proportion, quick response and the capacity to coordinated mult-ISFETs on one chip. ISFETs were detailed to distinguish soil ammonium (Oesch, 1981), nitrate (Van, 1994; J. Artigas, 2001) and potassium (Greenery, 1975; 1978; Van, 1994; J. Artigas, 2001). Moreover, ISFETs were utilized in FIA frameworks and vehicle-based real-time soil detecting frameworks by analysts (A. U. Ramsing, 1980; Loreto, 1996). A fruitful robotized framework for soil pH mapping was detailed to be tried beneath field conditions by Adamchuck et al. (2002). However, ISFET's tall taken a toll and conflicting repeatability constrained their wide extension use in down to earth systems.

### 3. Arduino UNO Microcontroller

Arduino is an open source computer equipment that plans and fabricates microcontroller based units for building advanced gadgets and intuitively objects that can sense and control objects in physical world.

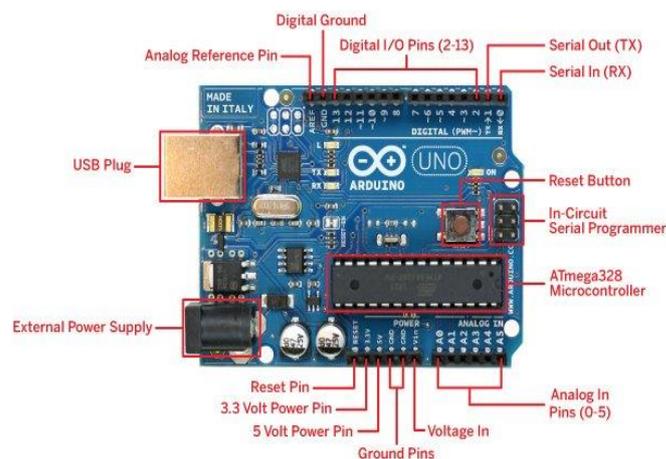


Fig -3: Arduino Uno R3

These framework gives sets of computerized analog I/O pins, serial communication interfacing, USB harbour for stacking programs from the individual computer.

For programming the microcontrollers, it gives an coordinates advancement environment (IDE) based on preparing extend which back for C, C++, Java programming

dialects. The primary highlights incorporates Atmega 328, 32 KB of streak memory of which 0.5 KB utilized by bootloader, 2KB of SRAM, 1KB of EEPROM, 16MHz clock speed, ICSP header, control jack, 6 analog I/O pins, 14 advanced I/O pins, 6 beat width tweak yield pins, input voltage is 7-12v and its working voltage is 5v.

#### 4. CONCLUSIONS

The points of interest of potentiometric electrochemical sensors are stimulating the intrigued of their applications in soil supplement discovery. They have potentials for robotized multi-target fast discovery of soil supplements. As such, they are too confronted with the challenge from their unwavering quality. Advanced engineering innovations have opened our intellect and given new approaches for soil testing to take after the KISS (Keep It Basic and Stupid) principle to treat the complex soil testing methods with simpler methodology at a lower cost.

#### REFERENCES

- [1] Jianhan Lin, Maohua Wang, Miao Zhang, Yane Zhang, Li Chen, "ELECTROCHEMICAL SENSORS FOR SOIL NUTRIENT DETECTION: OPPORTUNITY AND CHALLENGE"
- [2] C.Ananthi, Azha.Periasamy, N.Manikandan, "Agriculture Land Maintains By Arduino," in Proc. 18th IJSRD , 2014, 2321-0613
- [3] G. Dharesh Vadalia, Minal Vaity, Krutika Tawate , Dynaneshwar Kapse, "Real Time soil fertility analyzer and crop prediction," in Proc. IRJET, 2017, 2395-0072.
- [4] Mr. Gaikwad S.V, Prof.Galande S. G., "Measurement of NPK, Temperature, Moisture, Humidity using WSN," in Proc. IJERA., 2015, pp. 84-89.
- [5] Deepa V. Ramane , Supriya S. Patil, A. D. Shaligram, "Detection of NPK nutrients of soil using Fiber Optic Sensor," in Proc. IJRAT, 2015, pp. 13-14.
- [6] R.Sindhuja and B.Krithiga, "Soil Nutrient Identification = Using Arduino," in Proc. AJAST, 2017, pp. 40-42.
- [7] Rigor G. Regalado, Jennifer C. Dela Cruz, "Soil pH and Nutrient (Nitrogen, Phosphorus and Potassium) Analyzer using Colorimetry,"