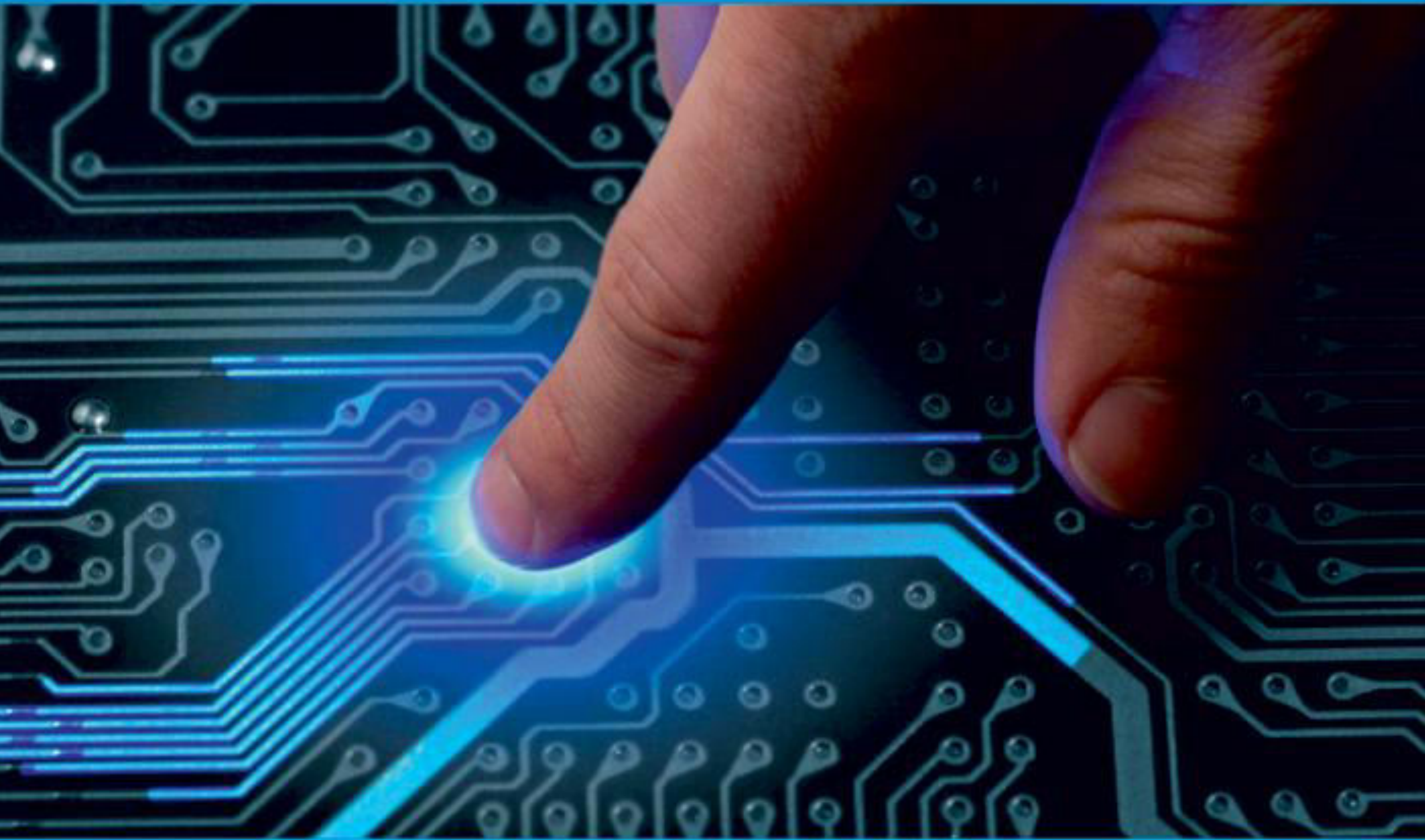
IJIRCCE

e-ISSN: 2320-9801 | p-ISSN: 2320-9798



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 9, Issue 6, June 2021

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 7.542

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 7.542 |

|| Volume 9, Issue 6, June 2021 ||

| DOI: 10.15680/IJIRCCE.2021.0906196 |

Smart Bot for Soil Nutrients Level Prediction with Analysis

Kranti Thakare[1], Rutuja Pundkar[1], Pratiksha Sable[1], Mrunal Deshmukh[1], Ankita Deshmukh[1]

Prof R. D. Sushir[2]

U.G. Student, Department of Electronic and Telecommunication Engineering, P. R. Potepatil College of Engineering and Management, Amravati, Maharashtra, India[1]

Department of Electronic and Telecommunication Engineering, P. R. Potepatil College of Engineering and Management, Amravati, Maharashtra, India[2]

ABSTRACT: The information that crops offer is turned into profitable decisions only when efficiently managed. Current advances in data management are making Smart Farming grow exponentially as data have become the key element in modern agriculture to help producers with critical decision-making. Valuable advantages appear with objective information acquired through sensors with the aim of maximizing productivity and sustainability. This kind of data-based managed farms rely on data that can increase efficiency by avoiding the misuse of resources and the pollution of the environment. Data-driven agriculture, with the help of robotic solutions incorporating artificial intelligent techniques, sets the grounds for the sustainable agriculture of the future. This paper reviews the current status of advanced farm management systems by revisiting each crucial step, from data acquisition in crop fields to variable rate applications, so that growers can make optimized decisions to save money while protecting the environment and transforming how food will be produced to sustainably match the forthcoming population growth.

I. INTRODUCTION

Production of crop depends on the interaction between soil and plant properties. Maximization of production of crops is reflected by biological, physical, chemical condition of the soil. To improve the production of crops, fertilizers are used. Fertilizers are synthetic or natural origin materials which are applied to the plant tissues and also to the soil for supplying plant nutrients crucial to plant growth. For efficient plant growth, nutrients are more important In soil, the nutrients are classified into micronutrients and Macronutrients. Micronutrients consist of copper (Cu), manganese (Mn), zinc (Zn), chlorine (Cl), boron (B) and some more. Macronutrients consist of potassium (K), phosphorus (P), nitrogen (N) which in short identified as NPK nutrients. Macronutrients are essential for plant growth. Plants consume20% of micronutrients and 80% of macronutrients.

Excess use of fertilizers affects the living organisms and leads to abnormal life of human beings Use of an excess amount of fertilizers hampers the growth of crops. To avoid the excessive use of fertilizers, the pH level of nutrients must be known. By determining the pH level of nutrients in the soil, amount of fertilizers to be used can be reduced. When the level of soil nutrient is 80%, then 35% of fertilizer can be used. Medium amount of fertilizer is used if the soil nutrient level is of 50%. Moreover, for the values less than that, we can use more fertilizers to the plant, Along with that, the temperature level of land, humidity, and moisture of the soil is determined. To get the correct amount of nutrients to be provided and to choose the right crop for multiple cropping in the same land, we need to measure the actual amount of nutrients present in the soil. By determining the soil moisture, wastage of water can be reduced. Using these, farmers can decide the type of crop to be planted.

The values determined are updated in the database for further improvement in agriculture. Plants extract nutrients that they need for growth and development from the soil, which is classified into (NPK) are primary macronutrients.
Understanding the need for soil quality in crop production, we have used a soil quality detector and interfaced it with a bot to bring in automation to the system. The system is designed in such a way that the bot is attached with the various soil quality detector sensors. Moreover, as the bot moves in the field, the sensors are inserted in different parts of the field. In such a way, the whole field of soil quality data is collected. Also, we have created a system in which we measure the pH of the soil, NPK values of the soil, and the soil moisture using the respective sensors.

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III. PROBLEM DEFINATION

Looking at the existing technology and technique which are available in today's market; most of the technology is expensive and not helping the farmer's real-world problems. Most of the technology today deals with high-end robots and machines which help in performing the basic farming process and helps farmer to kill the weeds and spray pesticides and chemical on the field and also the problem of use of poor quality of sensors and understanding this we have used higher quality sensors and created a suitable algorithm to reduce the error in measurement. Existing system deals with a significant challenge is that many soil sensors are integrally fragile as well as frequently produce unacceptable data. This method permits users to use available sensors deprived of sacrificing data integrity, though diminishing the human capitals required.

IV. METHDOLOGY

COMPONENT DISCRIPTION:

4.1 PH level sensor

The analog pH sensor is specially designed for Arduino controller and has a built-in simple,convenient, practical correction and features. It has an LED that works as the power indicator, a BNC indicator and a pH 2.0 sensor interface. To use it just connect the pH sensor with the BNC connector and plug the pH 2.0 interface into analog input port of any aurdinocontroller.

The pH electrodes connected to the BNC connector on the pH meter board and then use the connection lines, the pH meter board is connected to the analog port 0 of aurdinocontroller. When the aurdinocontroller gets power, the blue LED on the board is ON. The pH level sensor module is connected to an electrode in which the output is given in the form of the analog values, where the analog values given by the soil pH level sensor, this value is fed to the microcontroller for further process

Fig 4.1:Analog pH sensor

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4.2 COLOR SENSOR

A color sensor is used to measure and to detect the presence of NPK content of soil. The color sensor's photodiode is designed to decide the amount of additional contents of these nutrients that has to be added into the soil to increase soil richness and fertility. The color sensor is implemented as a nutrition detection sensor which consists of four LEDs as light source and a photodiode as a light detector. The light from LEDs falls on soil and reflected back after absorption. The TCS3200 color sensor is associated with eight * eight arrays of photodiodes with four completely different filters. By suitably selecting the photodiode filter's readings, able to find the intensity of the various colors

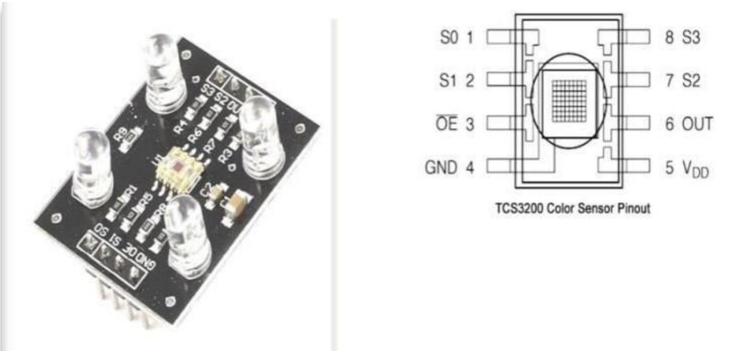

Fig 4.2:TCS3200 color sensor

4.3 SOIL MOISTURE SENSOR

Soil moisture sensors measure the volumetric water contentin soil. Since the direct gravimetric measurementof free soil moisture requires removing, drying, and weighing of a sample, soil moisture sensors measure the volumetric water content indirectly by using some other property of the soil, such as electrical resistance, dielectric constant, or interaction with neutrons, as a proxy for the moisture content.

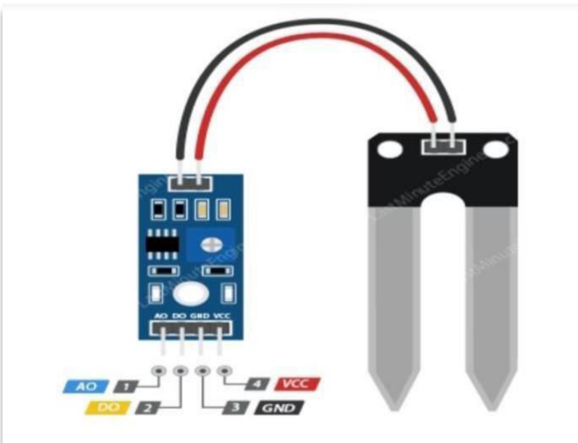

Fig 4: soil moisture sensor

4.4ARDUINO

Arduino is an open source computer hardware that designs and manufactures. microcontroller based kits for building digital devices and interactive objects that can sense and control objects in physical world. This system provides sets of digital analog I/O pins, serial communication interfaces, USB port for loading programs from the personal computer. For programming the microcontrollers, it provides an integrated development environment (IDE) based on processing project which support for C, C++, Java programming languages. The main features includes Atmega328, 32 KB of flash memory of which 0.5 KB used by bot loader, 2KB of SRAM, 1KB of EEPROM, 16MHz

International Journal of Innovative Research in Computer and Communication Engineering

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clock speed, ICSP header, power jack, 6 analog I/O pins, 14 digital I/O pins, 6 pulse width modulation output pins, input voltage is 712v and its operating voltage is 5v.

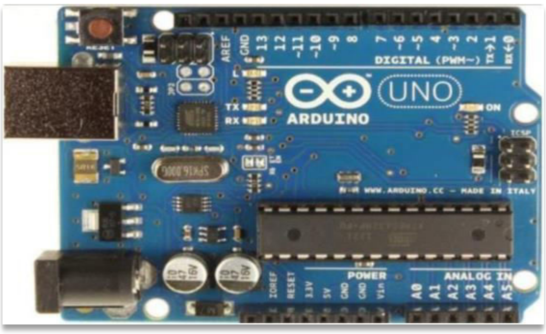

Fig5: Arduino Uno Microcontroller

4.5 SERVO MOTOR

SG-90 Servo Motor Equivalent MG90S Metal Gear, MG995 High Torque Metal Gear, VTS-08A Analog Servo

Most of the Servo motors operates from 4.8V to 6.5V, the higher the voltage higher the torque we can achieve, but most commonly they are operated at +5V. Almost all servo motors can rotate only from 0° to 180° due to their gear arrangement so make sure you project can live with the half circle if no, you can prefer for a 0° to 360° motor or modify the motor to make a full circle. The gears in the motors are easily subjected to wear and tear. the commonly available one is the 2.5kg/cm torque which comes with the Towerpro SG90 Motor. This 2.5kg/cm torque means that the motor can pull a weight of 2.5kg when it is suspended at a distance of 1cm.

Fig 4.5: Servo motor

V. ADVANTAGES

- They are invented to meet increasing demand of food by maximizing yields with minimum resources such as water, fertilizers and seeds.
- They fulfill this by conserving resources and mapping fields.
- They are simple to use and easy to install.
- They are cheaper. In addition to agricultural use, they can also be used for pollution and global warming.
- They are equipped with wireless chip so that they can be remotely controlled.

VI. DISADVANTAGES

- Smart farming and IoT technology require continuous internet connectivity. This is not available in developing coutries such as INDIA and other part of the world.
- There is presumption in the market that consumers are not always ready to adopt latest IoT devices equipped with agriculture sensors.

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- The basic infrastructure requirements such as smart grids, traffic systems and cellular towers are not available everywhere. This further hinders the growth of its use

VII. CONLUSIONS

Agricultural management systems can handle farm data in such a way that results are orchestrated to address customized solutions for each farm. This aid for farmers in the form of digital solutions combines forces with robotics and artificial intelligence to launch the imminent idea of Agriculture 5.0. After thirty years of great expectations—and disappointments—by the application of robotics to agriculture, the timing seems right for the first time. However, in order to take the most advantages from Agriculture 5.0, deep training needs to be delivered to users, ideally young farmers eager to learn and apply modern technologies to agriculture and granting a generational renewal still to come. It seems to be the right time to move forward towards a modern and sustainable agriculture that is capable of showing the full power of data-driven management to face the challenges posed to food production in the 21st Century. The evolution to Agriculture 5.0 is in the agenda of most major farm equipment makers for the next decade, and therefore off-road equipment manufacturers will play a key role in this move if agricultural robots are considered as the next—smarter—generation of farm machine.

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