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IOT BASED IRRIGATION MONITORING AND CONTROLLING SYSTEM

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ABSTRACT

Agriculture plays an important role in countries' development. More than 72% of people depends directly or indirectly on agriculture sector. Also agriculture sector contributes only 18% of total GDP which employs more than half of the population of country. But farming techniques used in the country nowadays are so traditional that which are not able fulfil food needs as by 2050 India to overtake china to become world's most populous country. By the year there will be serious problem of food security, so developing agriculture sector should be prioritized by linking it with modern technologies. These days' framers are suffering due to uneven rainy water and scarcity of water in various region of country. Whereas region like south India has a lot of water and rain water but natural calamities like cyclone and floods affect farmland and farmers life. From research it is concluded that farmers cannot reach the field to save their crops in situation of natural calamities. So new techniques for farming are required. Developing IOT technologies could be the possible solution to the problems could be used to increase farm production. By using sensors and computer technologies linking together we can make farming more economical, profitable and effortless. This system attempt towards smart irrigation system concept. An electronic device responsible for sensing the temperature and moisture and condition. Along with that Wi-Fi functionality is linked to hardware device which can be controlled remotely through mobile devices. Intensive or excess uses of fertilizers is addition to these problems to eliminate this NPK values which are nitrogen phosphorus and potassium which are generally used fertilizers can be determined in the soil using OPTICAL TRANSDUCER SENSOR setup which could be the possible replacement of costlier NPK SENSOR. It can be used beneficially while all the essential data available for the farmers.

Keywords:

IOT (Internet of Things), sensors, NPK (Nitrogen-Phosphorous-Potassium)

INTRODUCTION

The macro nutrients like Nitrogen, Phosphorous and Potassium are three mostly used ingredient in all the fertilizer. For optimal growth of crops sufficient amount of nutrient should be available in the root zone of the crop. Those nutrient can be partly supplied by soil and should be partly added with organic manures and fertilizers. Soil contains different types of nutrient depending upon the type of soil, climate condition, presiding crops etc. along with NPK soil contains calcium, magnesium, and sulphur in some amount. The availability of NPK in soil should be sufficient, but not too high. The low availability of nutrient in the soil hampered growth and low yield, while too high availability of one or more nutrient in the soil may lead to disturb plant growth and adverse effect of yield and quality of harvested product, so availability of NPK in the soil should be balanced. Healthy soil are the foundation of the food system. In India there

is lack of proper understanding of the need of fertilizer. This will push farmers into loss of their money and hazardous effect on their land. Heavy use of fertilizer, water mismanagement, low fertility of soil and major challenges in front of farmers now, as we said earlier, agriculture sector gives employment nearly half of the population it will directly affect on their life .So unless corrective measure are taken there may be irreversible damage to the environment and resource base .Agriculture should now be shifted towards resource based technology. Current scenario along with increasing population are putting tremendous strain on the limited and dwindling land and water resources. Generally very less farmers in India are curious about fertility rate and all because of the farmers does not know about new farming techniques and also lack of laboratories and farming infrastructure as laboratories are in big cities only. Presently it is carried out by collecting soil sample from plantation and transported to laboratories for analysis of nutrients present in the soil. These process takes nearly one to two week to obtain the result. Nevertheless this technique take lot of time and requires high cost and variable effecting crops cannot be verified and optimised in real time. Due to the lack of this system analysis of nutrient concentration in the soil cannot be well defined.

So there is need of alternate method to analyse the soil nutrients which is easy to use and will take less time to give result also technique which is very pocket friendly. The present study deals with actual detection of NPK values of the soil using optical transducer method. The nutrients NPK has tendency to absorb light of different wavelength. This technique carried out through interaction between light and physical and chemical level of soil. When sample was illuminated with light of certain wavelength the bonds present in the nutrients vibrate within the varying electric field , this vibrating bonds in the NPK absorb optical energy and cause less light to be reflect off the sample. This reflected light then received by the receiver which is photo diode. The photodiode converts optical energy which is coming from the soil into electric energy and shows the result. The combination of LEDs as a light and photodiode as a detector is constructed as a spectroscopy for direct detection of NPK nutrient present in the soil. In addition we used the sensors to sense the temperature and moisture in the soil to help farmer to know their actual condition of soil and their crops from remote area.by these crop quality will increase and the initial cost and efforts in the farming will reduce. That will surely impact on the overall profit in farming sector and life of small farmers

Motivation of the project

India's population is reached beyond 1.3 billion and ground water levels are at alarming level. Majority of region is facing uneven rainfall causing low water level at the time of sowing. Effective utilization of resources and increased productivity using technology will be beneficial for both the farmers and environment. The main objective of this paper is to provide an alternative to conventional processes using an automatic irrigation system and soil fertility indication (NPK levels) remotely as a result saving energy, money and time of
farmers. The traditional farmland irrigation techniques require manual intervention. With the automated irrigation, the human intervention and error caused by it can be minimized.

Literature survey

In GSM Based Automated Irrigation Control using Rain Gun Irrigation System mentioned about using automatic Micro-controller based rain gun irrigation system in which the irrigation will take place only when there will be intense requirement of water that save a large quantity of water.
These system brings a change to management of field resources where they developed a software stack. Android is used for mobile devices that include an operating system, middle-ware and key applications. Mobile phones have almost become an integral part of us serving multiple needs of humans. This application makes use of the GPRS feature of mobile phones a solution for irrigation control system. These systems covered lower range of agriculture land and not economically affordable. The System Supports Excess Amount of water in the land and uses GSM to send message and an android app is being used they have used a methodology to overcome under irrigation, over irrigation that causes

leaching and loss of nutrient content of soil they have also promised that Micro-controller used can increase System Life and lower the power Consumption. There system is just limited to the automation of irrigation system and lacks in extraordinary features.

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Methodology

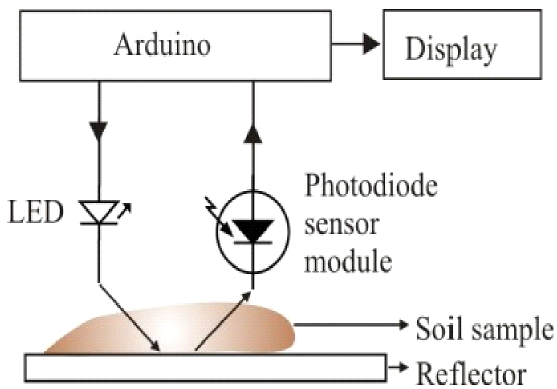

Fig 2.Schematic diagram of optical sensor method

The schematic diagram of the integrated optical sensor with the vertical construction of light transmitting system and light detection system. It consists of two LEDs as a light source while a photodiode as a detector incorporating a signal conditioning circuit and a transparent container made of PET (Polyethylene Terephthalate). Arduino is employed to generate a square wave signal in order to monitor the operation of the LED such as controlling the frequency, sequences and the duration of the light emission. The LED wavelength used to detect the nutrients are LED N (470 nm) for Nitrogen, LED P (950 nm) for Phosphorus and LED K (660 nm) for Potassium. The light signal from the LED is emitted with frequency modulation at 1 kHz and duty cycle at 45 %. As the light travels along with the transparent container, the luminosity is directly interacting with the nutrient sample. The remaining light resulting from the absorption of nutrients is received by the Si photodiode with peak wavelength of 850 nm and converted into a photocurrent. The observed value is normally in the rate of few Nano amperes and the signal conditioning is developed to convert the signal to a proportional voltage. The signal conditioning circuit consists of low pass filter to pass the 1 kHz modulation frequency and high pass filter to block the noise frequency normally at 120 Hz. The output signals are then displayed on an oscilloscope.
Here the diagram of optical transducer with microcontroller which exactly shows how transducer works and give readings to the system via microcontroller.

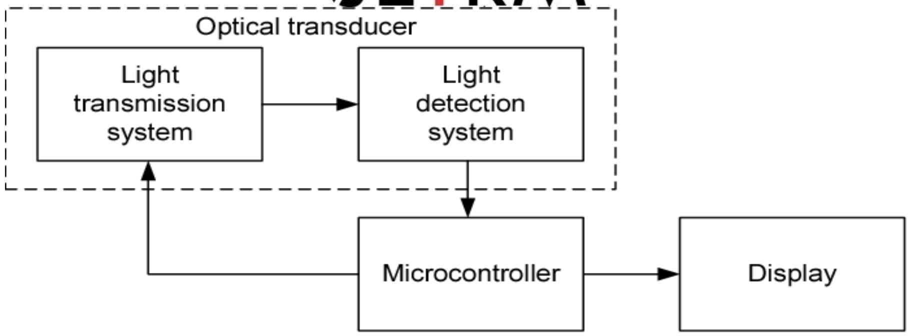

Fig 3.Block diagram of integrated optical transducer with microcontroller

Components used

- Arduino uno
- Relay
- AC power supply
- Temperature sensor (DTH 11)
- Soil moisture sensor (YL 69)
- GSM module
- Breadboard
- Optical Transducer
- Reflector surface
- Light Emitting Diode(LEDs)
- Photodiode

Fig 4. Setup

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Arduino code-

```
#include <SimpleDHT.h>


// for DHT11,
//      VCC: 5V or 3V
//      GND: GND
//      DATA: 2
int pinDHT11 = 2;
SimpleDHT11 dht11(pinDHT11);
const int sensor_pin = A0;
void setup() {
  Serial.begin(9600);


}
void loop() {
   float moisture_percentage;
  int sensor_analog;
  sensor_analog = analogRead(sensor_pin);
  moisture_percentage = ( 100 - ( (sensor_analog/1023.00) * 100 ) );
   byte temperature = 0;
  byte humidity = 0;
  int err = SimpleDHTErrSuccess;
  if ((err = dht11.read(&temperature, &humidity, NULL)) != SimpleDHTErrSuccess) {
    Serial.print("Read DHT11 failed, err="); Serial.print(SimpleDHTErrCode(err));
    Serial.print(","); Serial.println(SimpleDHTErrDuration(err)); delay(1000);
    return;
  }
```

```
Serial.print("Moisture Percentage = ");
Serial.print(moisture_percentage);
Serial.print("% ");
Serial.print("  Temperature = ");
Serial.print((int)temperature);
Serial.print(" C");
Serial.print("  Humidity = ");
Serial.print((int)humidity);
Serial.print("%\n\n");
delay(3000);
}
```

Table 1 for NPK nutrients wavelength readings:

Nutrient	Absorption wavelength (nm)	LED type	Wavelength (nm)
Nitrogen (N)	438-490	LED 1	460-485
Phosphorus (P)	528-579	LED 2	500-574
Potassium (K)	605-650	LED 3	635-660

Table 2 for normal values of output wavelength of NPK nutrients

Nutrient	Low (V)	Medium (V)	High (V)
Nitrogen	3.5<x<3.8	3.8<x<4.1	x>4.2
Phosphorus	2.45<x<2.8	2.9<x<3.3	x>3.4
Potassium	1.6<x<2.2	2.3<x<2.8	x>2.9

Innovation

There are various other parameters that are needed to be considered while growing crops. The current system only checks for Nitrogen (N), Phosphorus (P) and Potassium (K). But with certain modifications it can also be used to detect other elements like Sulphur (S) ,Magnesium (Mg) and various other elements that are necessary for the proper growth of the crops. Testing of the soil pH level can also be added as it is essential for proper growth of crops. pH level tells whether the soil is acidic or basic, according to which fertilizers can be added in order to change the pH level of the soil to our requirements. The current system depends on an external power supply to work. By adding a solar panel the system can be made self-sufficient. Artificial intelligence and machine learning can also be used to learn the pattern of crop growth for different crops and how much water is needed for a good crop yield in different seasons.

Conclusion

The said technology can be utilized effectively in the agriculture section. As the cost of the system is less, it provides a cheap yet effective method for the farmer to increase the crop yield of their farms. It is also helps with water management, because of the use of moisture sensors. So regions with water scarcity would be greatly benefitted from the irrigation system. The irrigation system can be controlled via a mobile device with internet access. This system can do the irrigation process automatically without any intervention from the farmer, which was done manually by the farmer before. It can be used to save time of the farmer. As mobiles phones become increasingly popular, Internet of Things (IoT) can be more effectively utilized. As most of the data from the irrigation system can be easily accessed via mobile phones by the farmer. The estimation of the elements essential for crop growth would be of great help to the farmers as they would be able to know when the element content decreases in the soil in order to use the fertilizers again. In future, various other things can added to further improve the performance of the irrigation system. Methods used by the optical transducer need further research so more accurate results can be obtained.

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