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Detection of Nuetrients of Soil using ARM9 Processor for Green House

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***Abstract*—Improved nutrient management combined with proper irrigation water distribution and management. Sensing the soil contents (using sensors), Calculating the net required nutrients for the plant. Uniform distribution to the field nutrients and moisture. In this system nitrogen, phosphorous, light intensity, moisture, humidity, temperature will be measure and controlling of irrigation through measurement of soil moisture also by using color sensor we measure amount of nitrogen and phosphorous in the soil. Automatic control of nitrogen and phosphorous if they are in less amount. DC motors are control through ARM 9 for proper irrigation and proper nutrient's. By using this system productivity of plant should be increased which will helpful to our growing population. Display will display all parameters specific values like temperature, moisture, humidity, light intensity,nitrogen, phosphorous content in the plant and plant environment.**

Keywords—LPC1769 ARM Microcontroller, MATLAB Software, Sensors, LCD Display, Camera, DC Motors.

I. INTRODUCTION

The irrigation industry has experienced major changes over the past 20 years. To, mention just a few items:Irrigation management and water supply decisions are now often based on consideration of the environment, rather than on economics. Drip irrigation was in its infancy 20 years ago; now we have drip irrigation, irrigation, and SDI (sub surface drip irrigation) for both permanent and field/row crops. In many states, the predominant method of irrigation has switched from surface irrigation to drip/micro irrigation.

A. Methodology

The main objective of project is sensing the content of phosphorus, Nitrogen, temperature, moisture, sunlight, humidity in soil. An addition of required amount of phosphorus and Nitrogen in water through irrigation for plant provides required amount of water for plant.

This project reduces manpower also avoid wastage of water and provide fertilizer in required amount & use of ARM 9 for controlling and monitoring green house. By sensing the color parameters like R, G, B and H, S, V value of standard color and compare with soil sample in test tube. If N & P value is less then automatically adds nitrogen and phosphorous in water for proper growth of plant. Moisture sensor senses the moisture content in the soil and if soil is dry automatically DC motor start and plant gets water. Light intensity sensor, humidity sensor, temperature senor can sense parameters and display value for farmer observation.

B. Proposed System Description

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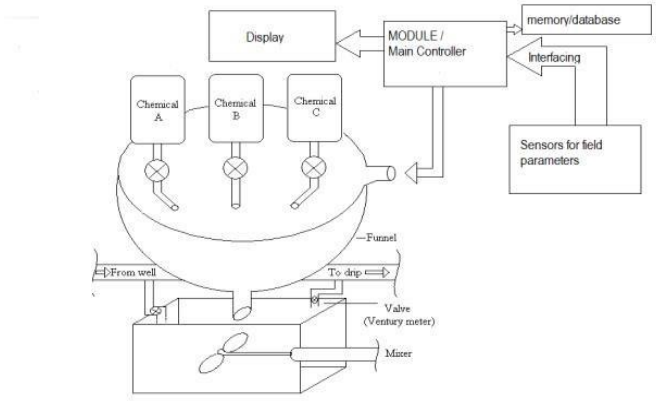

Figure No.1. Proposed System Diagram

II. GENERALIZED SYSTEM BLOCK DIAGRAM

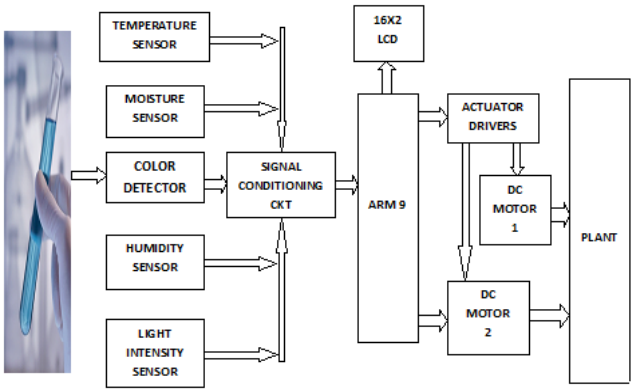

Figure No.1. Block diagram of Green Growth Management.

The system block diagram consist of ARM 9 Controller, Sensors, LCD Display, DC Motors &Camera. Each of the above is having specific function. ARM is the heart of whole system; all sensor information is processed and display through ARM processor. DC motors are provided for irrigation and N&P distribution if it is in fewer amounts.[6]

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A. Arm Control Module

The LPC1769 are ARM Cortex-M3 based microcontrollers for embedded applications featuring a high level of integration and low power consumption. The ARM Cortex-M3 is a next generation core that offers system enhancements such as enhanced debug features and a higher level of support block integration. The LPC1769 operates at CPU frequencies of up to 120MHz.

B. Sensors

- The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature
- Moisture Sensor Capacitive Type Humidity SensorThe HC Series of SY are capacitive humidity sensors produced by thin film technology.
- Light Dependent Resistor An LDR is an input transducer (sensor) which converts brightness (light) to resistance.

C. Nitrogen and Phosphorous color Detection Method

We are going to use sunroom color sensor. It gives either blue, gray or pink color at its output depending on the fertilizer being tested-whether it is nitrogen, phosphorus.The color sensor will detect this color and convert it into an electrical signal i.e. it will act as a transducer.This electrical signal is then passed on to the signal conditioning circuit.

Table No.1 Specifications of color detector

Parameter	Value	Unit	Notes
Operating Voltage	5	Vdc	Provide Regulated 5v supply
Current	20	mA	-----
Colour Detecting Capacity	16.7 millions	RGB	R= 8bit(2^8=256 levels) G= 8bit(2^8=256 levels) B= 8bit(2^8=256 levels) 256x256x256=16.7 millions shades detection
Colour Measuring Range	350-750	Nm	-----
Luminance Range	100	Lux	
Response Time	500	Ms	
Output Data Baud	9600	Bps	5v level output UART Properties (8 N-1) Start bit: 1bit Data bits: 8 bits Parity: None Stop bit : 1bit

D. Signal Conditioning Circuit

This circuit is used for converting the input from color sensor into a form suitable for the ARM Controller.The output from the color sensor is analog in nature and the ARM Controller being digital needs digital input

E. NPK Measurement

NP measurement kit is used for measuring the amount of Nitrogen, Phosphorous in soil. The soil testing kit contains everything needed to perform the test on-site. The "PRERANA" kit attempts to provide a fairly accurate idea about the nutrient level in the soil. The users get an idea as to whether the nutrient rating is very low, low, medium, high or very high. For measurement purpose reagents of Nitrogen, Phosphorous are provided along with kit.

Table No.2 NPK Standard Values

Sr.No.	Parameter	Range Tested by kit
1	Available Nitrogen(kg/ha)	140,280,420,560,700
2	Available Phosphorous(kg/ha)	7,14,21,28,35

F. LCD Diplay

We have used the 16X2 LCD that means it can display the two lines containing 16 characters each.

Figure No.2 16X2 LCD display

G. Camera

A digital camera is used for detection of color using MATLAB code. This camera is suitable for about mean color calculated:
R -> average value of Red component in the 80x80 pixel window. Range 0-255.
G -> average value of Green component. Range 0-255.
B -> average value of Blue component. Range 0-255.
H -> HUE-> Based on the color. Certain range of hue stands for specific color. Range 0-100.
S-> Saturation->Denotes the purity of color. More saturation, means more pure colour. Less saturation, more mixture of other colors hence more white. Range 0-100.
V-> Value->Denotes the illumination of the color. Less Value means less illumination i.e. more darkness. Range 0-100.

- 10x Digital Zoom Camera
- f=8.85mm


Figure No.3 Camera

H. DC Motors

The dc motor translates electrical pulses into mechanical movement.Have only + and – leads. Connecting this to voltage source, motor moves in one direction and vice versa. Here we use two dc motors for reverse and forward direction of the robot for dispensing the N, P nutrients in the farm.

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III. WORKING WITH DESCRIPTION

To fulfill food requirement of our country, the productivity of plant should be increased. Also quality of product also increased. For that purpose proper irrigation and nutrients management is essentials. In this project proper irrigation and distribution is done through ARM9 Processor.

1. Here we are have implemented a system in which the system is able to detect the moisture content to find out water requirement. If soil is dry then automatically motor will start and supply water to plant.

2. Humidity, light intensity, temperature sensors are used to observe the environmental conditions.

3. To find out N&P, take soil , mix chemicals in soil in it observe color and compare this mixture of chemical and soil with standard color.

4. This solidified soil mixture color is capture by using camera which is interface to ARM 9 processor. Using MATLAB program with Camera is interface with arm controller. MATLAB coverts camera image in to digital value which is transfer to ARM 9 through device. MATLAB digital value and standard color value is compare and LCD display will display N&P value, if N&P is low then automatically DC motor run for specific time to provide N&P.

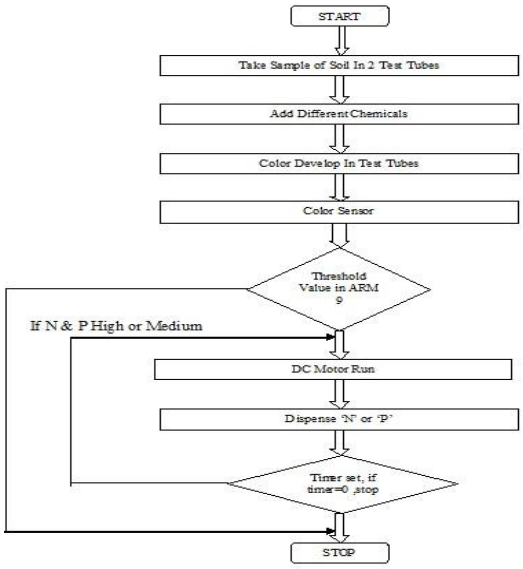

Figure No.4 Flow Chart

IV. PROPOSED RESULTS

This method is mainly focus on quantity of total of phosphate, temperature, moisture, humidity, lightintensity from plant. All outcomes are measured in electricalmethod. We can then plot the chart of each parameteracross with principles for analyses the capacity of parameter.
This is one of them but the unique quality of this system is that it dispenses the desired quantity of only that macronutrient which is deficient in the soil. Thus individual testing of each component helps the crop. This result carried out by following testing can be taken and shown below by graphically. There are three types of soil testing readings taken by using this module with its standard value with soil comparison. In Alluvial soil content of nitrogen according to standard range of Laboratory is 350, Phosphorous is 210 &Potassium is 160. In Red soil content of nitrogen according to standard range of Laboratory is is 300, Phosphorous is 340 &Potassium is 230. In Black soil content of nitrogen according to standard range of Laboratory is 150, Phosphorous is 200 &Potassium is 360.

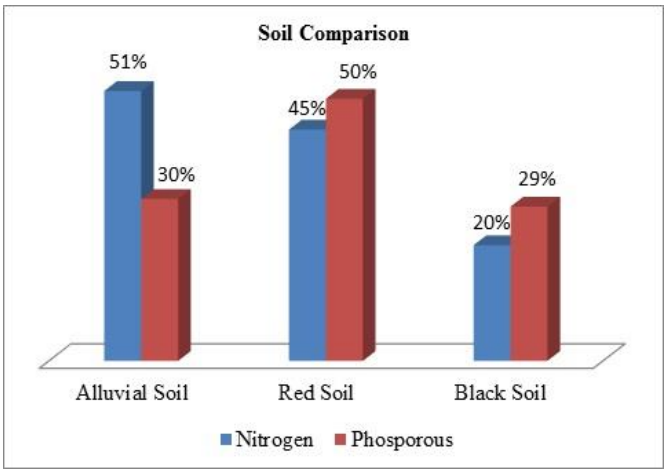

Figure No.5 Soil Testing

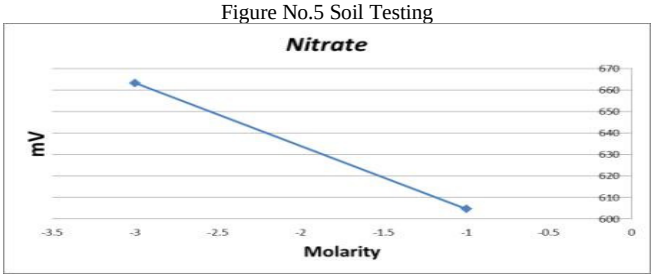

Figure No.6 Nitrogen

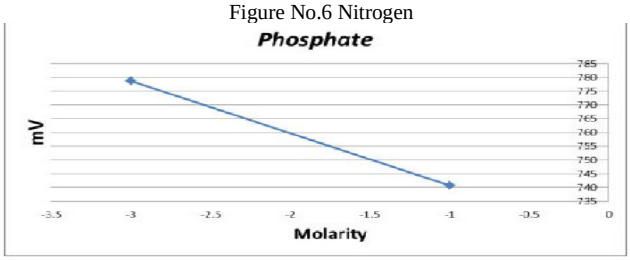

Figure No.5 Phosphorous

After operation of the above method in farming field this system has given the results of all the sensors as below.

A) Temperature Sensor

These analysesare occupied and plotted in the form of graph as shown below. This temperature will be shown on LCD display and as soon as the reaches threshold value (e.g 35) processor will send data temperature in ^{0}C.

S NO	TEMPERATURE(˚C)	TIME(s)
1	26.2	11.15
2	26.1	11.16
3	27.4	11.17
4	26.9	11.20
5	25.9	11.21

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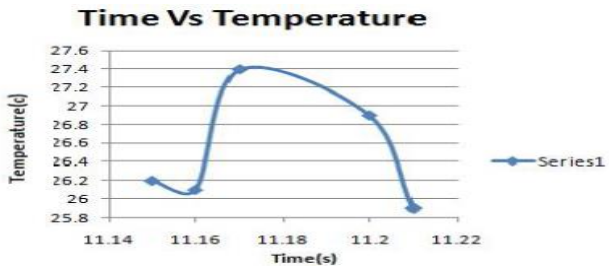
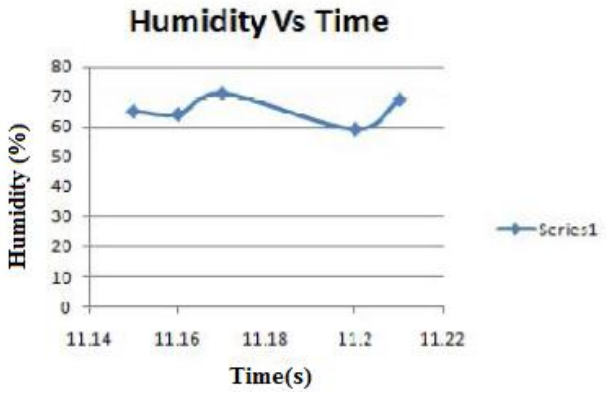


B)

Humidity sensor

The humidity will display on LCD display in the method of small standards (like 0004 0006 etc.) which is transformed into percentage and shown in table and plotted in the graph as shown below.

S NO	HUMIDITY(%)	TIME(s)
1	65	11.15
2	64	11.16
3	70	11.17
4	60	11.20
5	69	11.21



C) Soil moisture sensor

In this circumstance two leads are taken out of the sensors which are dipped in the soil, which will check the soilmoisture content, if the soil is dry the Processor will send the data to the user like "DRY" then automatically motor will start watering thefield soil will become wet, processor will send the data to user like "WET"also it will be displayed on LCDdisplay.

V. CONCLUSION

By using this module automation in irrigation and fertilizer will be possible. Productivity of plant can be increase. Man power reduces Efficient use of water can be possible. Many applications or systems have been developed to increase the crop growth. This is one of them but the unique quality of this system is that it dispenses the desired quantity of only that macronutrient which is deficient in the soil. Thus individual testing of each component helps the crop. The program written is also user friendly so that the thresholds can be changed very easily as per requirements.Initially the system design contained DC motor for controlling the dispensing of the fertilizers. This system is flexible to measure and dispense any type of fertilizer other than NP as well. The only requirement is that the tests conducted for measurement should have a unique color so that the color sensor can detect it. Thus we successfully designed and built the desired system.

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