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Novel Approach towards Controlling and Monitoring Nutrient of Soil in Polyhouse

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***Abstract*—** In modern polyhouse, several sensors are required for its automation. Nowadays soil nutrient problem affects plants growth. In this paper various sensing system have been developed for nutrient testing. This technology combines mapping of PH and electric conductivity for soil nutrient management.

In agriculture field water is a main source to increase yield of crop. At present irrigation system is fully automated and controlled by the farmers. The proposed system is controlled and monitored as per soil moisture status. Sensors detect soil moisture, water tank level and depending on that solenoid valve are turned ON/OFF automatically. By using wireless sensor network, all sensors data are stored in database and monitored through local display as well as web service (http client/server).

Keywords- *Automation, PH, Soil moisture, Electric conductivity.*

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I. INTRODUCTION

Cultivation of Polyhouse increases yield of crop, higher productivity and better quality throughout the life of crop.[1] Maximum yield on specific days can be given by cultivation of crops in polyhouse farming(e.g. roses on Valentine's day) and some crops that can't be normally grown in particular environment (e.g. colored capsicum, broccoli, mushrooms). We can cultivate any regular crop off-season, which is fetching the farmers a higher price (e.g. tomato, chilly, capsicum, cucumber, cabbage, cauliflower). [2]

Polyhouse farming of entails construction covered by polythene for collecting light and converts it into heat. In conventional greenhouse, covering material such as plastic or glass walls and roof are being used to control the environment. [2,3]

Water is the main source in agriculture which affects quality and yield of crop. In polyhouse, by estimating accurate evapotranspiration, efficient irrigation can be achieved. Large amount of water get wasted due to improper planning of irrigation and water usage.

Water saving techniques demand in irrigation has been increasing rapidly[4].Various irrigation techniques being used by farmers for getting more crops with less water drops. Such technique gives large production by consuming less fresh water. These techniques work in the regions where scarcity of fresh water.

Due to malnutrition or lack of nutrients to plants the agriculture yield becomes poor. The major reason behind this problem is uncontrolled amount feeding of the nutrients in very less or excess amount even without satisfying the basic needs of plants. It results into poor quality of crop yield. Also nutrients are required in micro and major amount hence precise control must be maintained throughout the crop production, which is only the solution to obtain good yield. For this nutrient management is essential. [5]

Sensor nodes have different computational constraints and energy due to its inexpensive nature and ad-hoc method of deployment. In the system wireless sensor network is used to control environmental parameters of greenhouse and monitoring all sensor information using GSM/GPRS module.

E. D. Lund has designed commercialized sensing system which mapping salt concentration of soil and availability of nutrients for growth of plants. Acidity (PH) and conductivity are important nutrient for plants growth.

Pranay Gopal Umate designed autonomous robots for nutrient management. This system tests nutrient deficiency to perform some soil test and judge water requirement. Depending on nutrient testing it provide fertilizer and water to crop. It can also alter farmer to give fertilizer.

Gayatri Londhe developed the well-known drip irrigation system which is fully monitored and controlled by using ARM9 processor. Here, Soil moisture sensor is used to monitor moisture content of soil and depending on that result solenoid valve gets turned ON/OFF automatically. Sensors detect pH and nitrogen which is important micronutrient in the soil for proper plant growth.

In agriculture environment a normal way to individuals manually taking dimensions and inspecting them at different times. The system uses agriculture monitoring application in which wireless mechanism used for sending data to central server which stores data and also perform analysis on it for displaying on client mobile. In agriculture environment a normal way to individuals manually taking dimensions and inspecting them at different times. The system uses agriculture monitoring application in which wireless mechanism used for sending data to central server which stores data and also perform analysis on it for displaying on client mobile.

Anuj Kumar has researched on necessity of a green house plant for optimum growth and improved yield of crop. In current work devise a DSP processor based on EMS has been attempted to control environment condition by using different mechanism for growth of plant in polyhouse. The developed system is simple, cost effective and easily installable.

The Zigbee technology is a wireless network used for proposed system. Zigbee technology used mesh topology for various nodes and which are deployed inside polyhouse and controlled by one central monitoring unit (CMU). In polyhouse

different sensors are used to keep eye on condition of environment and set threshold values as per requirement then controlled by using various actuators based on the crop. All sensor data are received with respect to the programmed values of crop the CMU is responsible for sending the controlling data to the actuator node for maintaining constant and required environmental conditions.

A sensor is a miniature component which is capable of converting physical readings into signal which can be calculated by the system. In polyhouse various sensors and actuator are used to control and monitor greenhouse parameters. The device must be used to make distributed measure, spreading sensor in greenhouse using distributed cluster.

II. METHODOLOGY

Nutritional problem are causes of poor crop quality and plant losses in greenhouse. Soil pH is a one of the important parameter to solve nutrient problem. It is also detected and measured which will affect the plant growth. pH is the measurement of acidity. pH is a measurement of hydrogen ion concentration of solution. Normally pH range is from 0(more acidic) to 14(most basic). For proper plant growth soil nutrient are helpful and it depends on pH. Farmer can give suggestion to add various fertilizers to measure nutrient of soil. pH of growing substrate affects the availability of nutrient, especially micronutrients like Nitrogen, Potassium, Iron, Boron, Magnesium, Zinc.

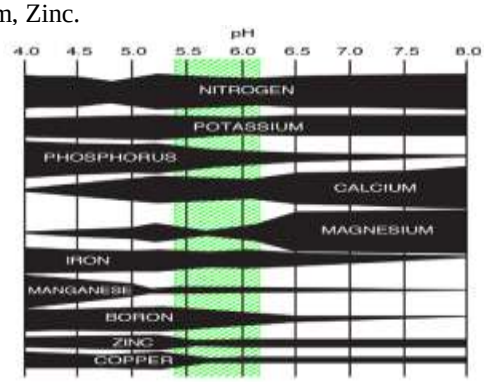

Figure 1: The pH of soilless substrates affects the amount of nutrients available to plants.

At high pH, some micronutrient (iron, manganese, zinc, boron) are unavailable for good plant growth and iron deficiency symptoms will start growing. Iron deficiency is a common problem that occurs when PH is very higher than optimal. Iron deficiency symptom is yellowing leaves. It normally occurs in younger leaves of the plant. Almost all crops prefer slightly acidic pH between 5.4 and 6.0.

At low pH manganese, zinc and boron are highly soluble. If pH is too low, micronutrient becomes very soluble and iron toxicity symptoms which appear as leaf bronzing. For correcting high pH, switching from high nitrate to high ammonium fertilizer is needed. The quick method to decrease pH is to apply one time phosphoric acid drench and sulfuric acid. When we have to raise pH then stop acidifying water if acid being injected and apply potassium bicarbonate drench.

A. *Effect of PH on Soil Nutrients*

PH affects properties of soil in terms of chemistry, physics and biology and plant growth. In case of low or high pH, yield of crops and nutrient growth problems increases or decreases.

CROP				PH		
	4.7	5.0	5.7	6.0	6.8	7.5
	Relative average yield					
Corn	34	73		83	100	85
Wheat	68	78		89	100	99
Oats	77	93		99	98	100
Barley	0	23		80	93	100
Soyabean	65	79		80	100	93
Timothy	31	47		66	100	95

Table 1: Relative yield of selected crop grown in a corn, small grain at different pH level

Electric conductivity is measure of total amount of salt in growing medium. In growing substrate EC as an indicator of the presence of micronutrient, but it gives no more information about the micronutrient. When conductivity of soil is higher than desired, this can be reduced by lowering the frequency of fertilization. When EC is too high of growing substrate then leaching method is used to quickly decrease EC and prevent crop from damage. We can prevent problem of high EC by applying needed amount of fertilizer.

B. *Block Diagram*

Moisture content of soil is continuously observed by soil moisture sensor in percentage. Soil moisture sensor measures water content of soil, if there is no adequate amount of water then water pump starts automatically. Water is directly supplied to the root zone of the crop from the water tank if water level is high otherwise pump will be off.

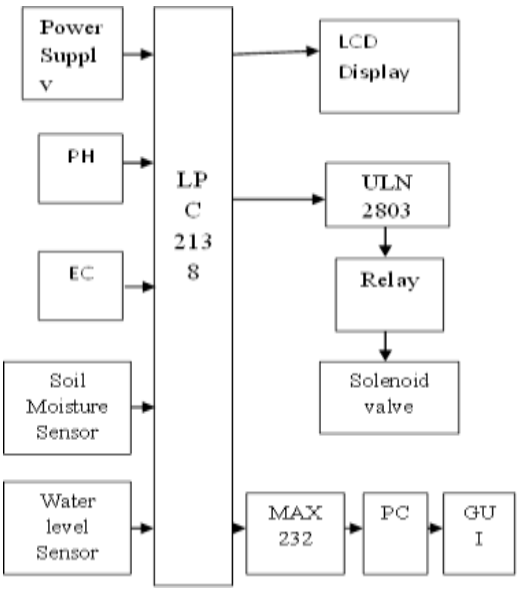

Figure 2: Block Diagram

C. Results

Soil Moisture Value (in % MC)	Water Pump(For drip irrigation)
Below 70	ON
75 to 85	OFF
Above 85	OFF

Table 2: Watering based on soil moisture

III. CONCLUSION

In greenhouse for proper plant growth we are monitoring environmental parameters, but other factors like pH, EC, and Soil moisture are equally important to yield of crop and to solve nutrient problem. We can prevent almost all nutrient-related problems by monitoring EC and pH of growing medium. Regular monitoring will be given an indication of the availability of micronutrient for detection of possible problems that affect the plant growth and quality. Another important feature is that soil moisture sensor measures moisture content and irrigate right amount of water. The system gives efficient information regarding the soil pH and EC to improve production and profit.

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