Smart watering system of fields by calculating the critical farm attributes.

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Abstract: Our application precisely controls water requirements by keeping soil at optimal moisture levels. By internet cloud applications, our prototype combines data with third party inputs like weather reports from national weather services which lets our smart irrigation system make intelligent decisions about where and when to release water, and in what quantities. If no rain was predicted the system could decide to release water immediately. But if rain was in the forecast the system could wait, measure the results, and recalculate the amount of water.
Furthermore our system records the critical farm attributes like temperature, humidity and the pH values of that particular area.

Keywords – moisture, temperature, humidity, weather analysis.

I. INTRODUCTION

Water is one of the most important inputs essential for the production of crops. Both its shortage and excess affect the growth and development of a plant directly and, consequently, its yield and quality. Major consumption of water is for agriculture, industrial production and domestic purposes. In India rainfall is notoriously capricious, causing floods and droughts alternately. Its frequency distribution and amount are not in accordance with the needs of the crops. Hence 63% of the full control irrigation depends on ground water. With the modern technology and intensive marketing an agriculturist can increase his production.
The biggest challenge in traditional farming is accurately determining how much and when to water. Irrigation scheduling depends on the farmers' decision process, 'when' to irrigate and 'how much' water to apply in order to get maximum yield. This requires knowledge on Type of soil, Crop water requirements, constraints specific to each irrigation method, limitations relative to the water supply system and weather. Thus, the consideration of all these aspects makes irrigation scheduling a very complex decision making process, one which only very few farmers can understand and therefore adopt. It is recognized, however, that the adoption of appropriate irrigation scheduling practices could lead to increased yields and greater profit for farmers, significant water savings, reduced environmental impact of irrigation and improved sustainability of irrigated agriculture.
There are some plants which grow more in acidic soil and other in basic soil. Furthermore the measurements of temperature, humidity and the pH values of a particular area will give a clue to the farmer about the choosing of the crop.

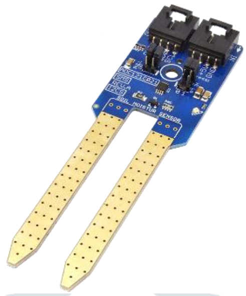
II. COMPONENTS

- ✓ **NodeMCU**

NodeMCU is an open source LUA based firmware developed for ESP8266 wifi chip. By exploring functionality with ESP8266 chip, NodeMCU firmware comes with ESP8266 Development board/kit i.e. NodeMCU Development board. Since NodeMCU is open source platform, their hardware design is open for edit/modify/build. NodeMCU Dev Kit/board consist of ESP8266 wifi enabled chip. The **ESP8266** is a low-cost Wi-Fi chip developed by Espressif Systems with TCP/IP protocol. For more information about ESP8266, you can refer ESP8266 WiFi Module.

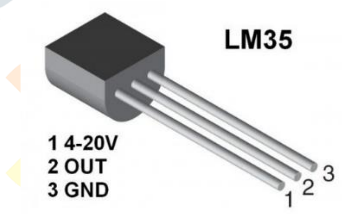
✓ **Soil Moisture Sensor**

A soil moisture sensor measures the quantity of water contained in a material, such as soil on a volumetric or gravimetric basis. The soil moisture sensor consists of two probes which are used to measure the volumetric content of water. The two probes allow the current to pass through the soil and then it gets the resistance value to measure the moisture value. When there is more water, the soil will conduct more electricity which means that there will be less resistance. Therefore, the moisture level will be higher. Dry soil conducts electricity poorly, so when there will be less water, then the soil will conduct less electricity which means that there will be more resistance. Therefore, the moisture level will be lower.



✓ **Temperature Sensor**

The Temperature Sensor LM35 series are precision integrated-circuit temperature devices with an output voltage linearly proportional to the Centigrade temperature. The LM35 device has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from the output to obtain convenient Centigrade scaling. The LM35 device does not require any external calibration or trimming to provide typical accuracies of ±¼°C at room temperature and ±¾°C over a full −55°C to 150°C temperature range.



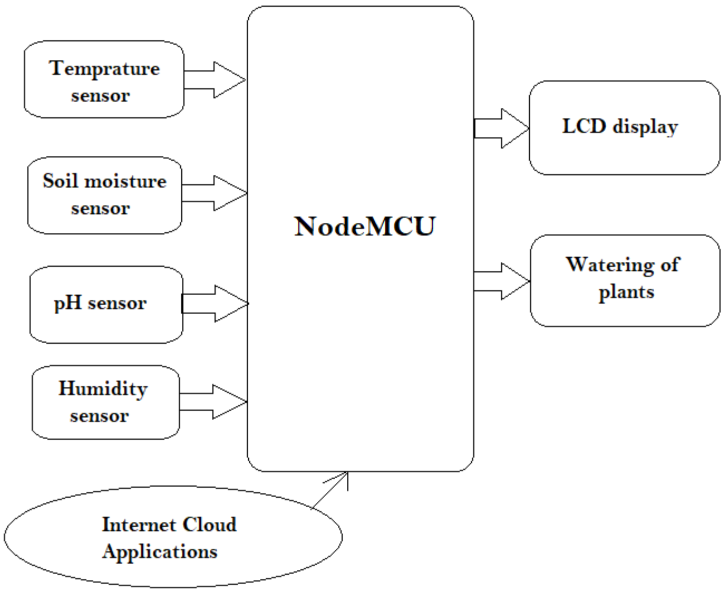
✓ **Humidity Sensor**

Humidity is defined as the amount of water present in the surrounding air. This water content in the air is a key factor in the wellness of mankind. For example, we will feel comfortable even if the temperature is 00C with less humidity i.e. the air is dry. But if the temperature is 100C and the humidity is high i.e. the water content of air is high, then we will feel quite uncomfortable. Humidity is also a major factor for operating sensitive equipment like electronics, industrial equipment, electrostatic sensitive devices and high voltage devices etc. Such sensitive equipment must be operated in a humidity environment that is suitable for the device.

✓ **pH Sensor**

A pH measurement loop is made up of three components, the pH sensor, which includes a measuring electrode, a reference electrode, and a temperature sensor; a preamplifier; and an analyser or transmitter. A pH measurement loop is essentially a battery where the positive terminal is the measuring electrode and the negative terminal is the reference electrode. The measuring electrode, which is sensitive to the hydrogen ion, develops a potential (voltage) directly related to the hydrogen ion concentration of the solution. The reference electrode provides a stable potential against which the measuring electrode can be compared.

III. DESIGN AND IMPLEMENTATION



This proposed method consists of sensors namely pH sensor, temperature sensor, humidity sensor and soil moisture sensor. In this system, the soil moisture sensor plays a major role. The watering of the field depends on the soil moisture sensor. All the above mentioned sensors are connected to the nodemcu. A threshold value is given to the soil moisture sensor. Whenever the moisture content in the soil reaches to that level, then the watering of plants will be done automatically. When the soil gets the optimal water then automatically the watering will be stopped. By using the internet cloud applications, we can continuously observe the weather conditions. If in case the rain is predicted, then no water will be allowed into the soil. If it doesn't rain even though the rain is predicted, then by calculating the moisture content levels in the soil through soil sensor, the watering of plants will be done.

It is strongly believed that, the excess and shortage of water may effect the growth of plants along with its yield and quality. Hence the technique which we are using will help the farmer a lot. The calculation of the temperature, humidity and pH will allow the farmer to know about the details of the farm. There are some plants which will grow more in acidic soil, like tomatoes, potato, blue berries, beans, cabbage and spinach. Similarly the plants like radish, cauliflower, mustard and onion. By using the pH values it is easy for the farmer to choose the crop. So that he will get the good yield.

The DHT11 sensor provides the current temperature are humidity readings. The DHT11 gives out analog output and is connected to the analog input of the micro-controller A0. The dht11 sensor has 3 pins. Along with temperature and humidity the other values that are calculated or derived from the dht11 sensor is the dew point, heat index etc. The dew point is the temperature at which air in the atmosphere freezes to become water droplets and the heat index is the heat felt by the human skin from the environment. This is important in places with high humidity. Even though the temperature maybe lower, the body still feels warm. This is due to the high humidity in the air. Humidity is the moisture content in the air. High humidity in the air generally makes one to sweat or perspire. The lm35 is a general purpose temperature sensor. The need of this sensor is to get an additional reading of the temperature. Along with the dht11 sensor's temperature reading, we calculate the lm35 sensors temperature reading as well and an average of the two readings are taken to get an accurate reading of the surrounding temperature. Fig. 2 sensor arrays used in the system. Bmp180 sensor is used to measure the atmospheric pressure and the temperature as well. The atmospheric pressure is used to determine the relative air pressure experienced in the surrounding. This is very useful if we are using the system in high altitude environment and a calibrated value of the altitude along with other environmental readings provides a good projection of the surroundings weather pattern and we can notice changes with increase or decrease in altitude.

IV. RESULTS & DISCUSSION

In this IoT based smart watering system, we are able to calculate the critical farm attributes like temperature, humidity, and pH sensor. There are some plants which will grow more in acidic soil, like tomatoes, potato, blue berries, beans, cabbage and spinach. Similarly the plants like radish, cauliflower, mustard and onion. By using the pH values it is easy for the farmer to choose the crop. So that he will get the good yield.

By considering the weather forecast, if it is going to rain, then there will no water for the field. In case there is no rain, then our system will release water to the field by calculating the values of the soil moisture sensor.

V. CONCLUSION

As we have sorted out the problems faced by traditional farmers, we came up the solution to meet the few requirements of them, as we have made our system completely automatic. By internet cloud applications, our prototype combines data with third party inputs like weather reports from national weather services which lets our system make intelligent decisions about where and when to release water, and in what quantities. If no rain was predicted the system could decide to release water immediately. But if rain was in the forecast the system could wait, measure the results, and recalculate the amount of water from the soil and then releases the water to the field. The measurements of the temperature, humidity and pH values of the particular area will lead the farmer to decide which crop to sow.

VI. FUTURE SCOPE

As there is a great chance for undesirable effects of cold, unseasonal rains, and wind, the crop may get spoiled. In order to protect it we can arrange a sheet which automatically covers the crop when there is a change in the weather conditions.
Moreover we can also combine this system with precision agriculture with minimum investment, and drones can be used in order to sow the seeds and spray the fertilizers.

VII. REFERENCES

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