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Smart Irrigation Model Using IOT

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ABSTRACT

In this paper we summarize the importance of healthy irrigation practices with the help of IOT controlled systems. With advanced farming techniques backed by today's advanced scientific methodologies, the frequency of crop production has increased and with that we have over used the resources required for production. The Smart Systems would assist in increasing the production of crops and promote sustainable resource utilization which in turn optimizes the timing and volume of water distribution in the fields. The proposed systems are flexible in nature that would enable us to either increase or decrease the scale for which it would be applied hence targeting both the casual backyard farmers and professional farmers. Our proposed system is simple enough to be used by a farmer with minimal technical knowledge.

Keywords: Irrigation, IOT, Farmer, Crop, Sensor, Soil Moisture, Temperature Sensor, Humidity Sensor

INTRODUCTION

The need to design a smart irrigation system is to replace the monotonous job of checking the field frequently for irrigation status which includes over irrigation, water flow in canals and under irrigation. In a small field this can be manageable. But for large fields this would be very tedious as they have to keep on travelling around their field for frequent inspection.

The farmers need to irrigate the field based on their gut feeling which isn't always sunshine and rainbows. Sometimes they under irrigate and have to repeat the irrigation process all over again and sometimes they over irrigate and can do nothing but hope for the best. About 16% of Indian Economy depends on agriculture.

The vast majority of industries are agriculture based and get their raw materials from the agricultural industry which signifies that agricultural production plays a vital role in Indian economy. Considering all these factors, a smart sensor- based system for water irrigation is a must and can be optimized depending upon the planted crops as Indian farmers plant different types of crops throughout the year.

This irrigation model hopes to eradicate this exact problem for the farmer by providing accurate real time data of the fields in their mobile phone. If any problem is detected in the field, the farmer will be notified through an alert on the phone.

If this model fails at any point in time and encounters a problem with valves (opening and closing), the farmer can override the system through his phone and gain instant control of the situation. The water usage at the early stages of a plant's life ishigh and relatively slows down throughout the plant's life cycle.

If the sprout is under-irrigated, it not only affects the growth and development of the crop but also decreases the soil quality. If the sprout is over-irrigated then it will loosen the soil around the roots and cause the sprout to be malnourished. Similar to the sprouts, in later stages of plant's life, under irrigation would not provide enough water for the plant's development in the reproduction stage which would result in irregular to no yields and over-irrigation tends to sweep away essential nutrients from the soil and causing the plant to unroot as the loose soil would mean that the plant cannot hold its weight by itself. Hence, an adequate amount of water needs to be supplied to the crop for maximum yields and increased overall production.

LITERATURE SURVEY

The objective of this project was to improve the farming and provide a big help to the farmer using it. The main idea of the project by G. Parameswaran and K. Sivaprasath [1], is to water the plants automatically based on the sensor data so, the growth of the plant can be enhanced. Actually, at this time it is very difficult to find caretaker for the garden since everyone thinks doing business is the key to get quick success. But they are forgetting that agriculture is the very basic to what every human being needs. Also, the people who are taking good care of their garden, are not always there for their garden, meaning they might get stuck in a busy schedule and may not be able to see their garden for some time. So, we have proposed this model so that it helps the people do their work and alongside they can take care of their farm by sitting on their table and the result will be better than before. Here we have a web page idea by G. Prasanna, S. Parvatham, and D. Krishna [2], which helps us view the sensor data on our phone and laptop.

Here in this system, the moisture in the air which helps us to know whether it is raining or not and the moisture in the soil helps us to know the exact amount of water in the soil, or if the soil is dry or wet, if the soil is dry we can water the plants and enhance the growth of plants. Sometimes what happens is, the soil looks like it is wet from outside but it is not from inside. Here we can know the moisture of the soil and water the land as per requirements.

People are getting busy as the world is growing too quick to get alongside, we need to do multi-tasking for that we have a local server web application which will help to know the exact information in your laptop or mobile phone and get easy access to the data and the motor control. Here we can send the data which will help you know whether is your farm doing good or not.

EXISTING SYSTEM

The existing system in place is pretty much farmer's experience and gut feeling. The field is irrigated by seeing the colour change in the leaf of a plant or by judging the dryness of the soil with naked eyes. The canal doors are opened and water is let into the field. There is no definitive time allocation for how long the water is to be supplied and level of moisture in the soil to be maintained while irrigating. The existing method is unscientific and entirely depends on the farmer's experience and level of expertise on the subject matter.

PROPOSED SYSTEM

The proposed smart system provides accurate information of the irrigation status with the help of sensors. The input is collected from different areas. Rain Projection API is used to collect information about possibility of rain. Although the proposed Rain Projection API can be replaced with a rain sensor and humidity sensor for generating data at the local level, this replacement increases the cost of manufacturing and also would not provide any forecasting data. Soil Moisture Sensor collects information about the moisture level in the soil in real time. Temperature sensor collects information about the temperature of the area it is placed in. Hence, it can be placed outside the soil to measure current environment temperature or inside the soil to measure current soil temperature. The environment temperature sensor can be replaced with a Temperature API for large fields which will provide aggregate temperature of the environment. There are APIs that predict soil temperature via satellite imaging but soil temperature depends on different factors like moisture level and shades froma plant which leads to inaccurate data. Hence, a temperature sensor inside a soil is recommended for measuring soil temperature. These collected inputs are then sent to the microcontroller which processes this information and generates outputs. The outputs are projected on a smart phone. Figure 1 shows the block diagram of the proposed system.

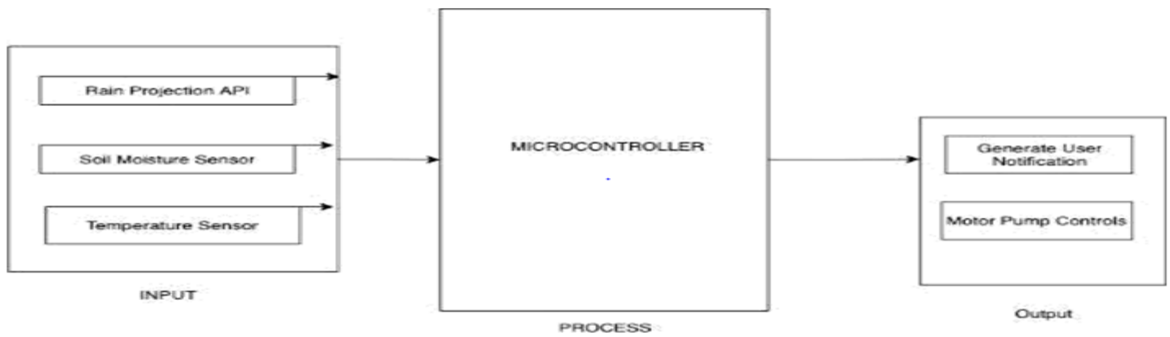

Fig 1: Block Diagram of Proposed System.

WORKING PRINCIPLE

In the Figure 2 which shows the work-flow diagram, when the system starts, it reaches the START state where it first collects data from the soil moisture sensor. The microcontroller analyses the data and determines whether the soil is wet or dry. If the soil is wet, it notifies the user and proceeds to the STOP state by checking if the motor is on or off. If the motor is off, it proceeds to the STOP state and if the motor is on, it proceeds to turn the motor off and loops back to notify the user. If the soil is dry it proceeds to the next state. In the next state, the microcontroller determines the possibility of rain by collecting data from the rain sensor. If the data from the rain sensor is above threshold, then the system proceeds to STOP state by performing necessary operation like notifying user and determining if the motor is ON or OFF. If the data from the rain sensor is below threshold, then the system turns the motor on. When the motor is turned on, the system goes into WAITING state where it waits for a certain period of time and loops to the top of the flowchart until the soil is wet or it is raining.

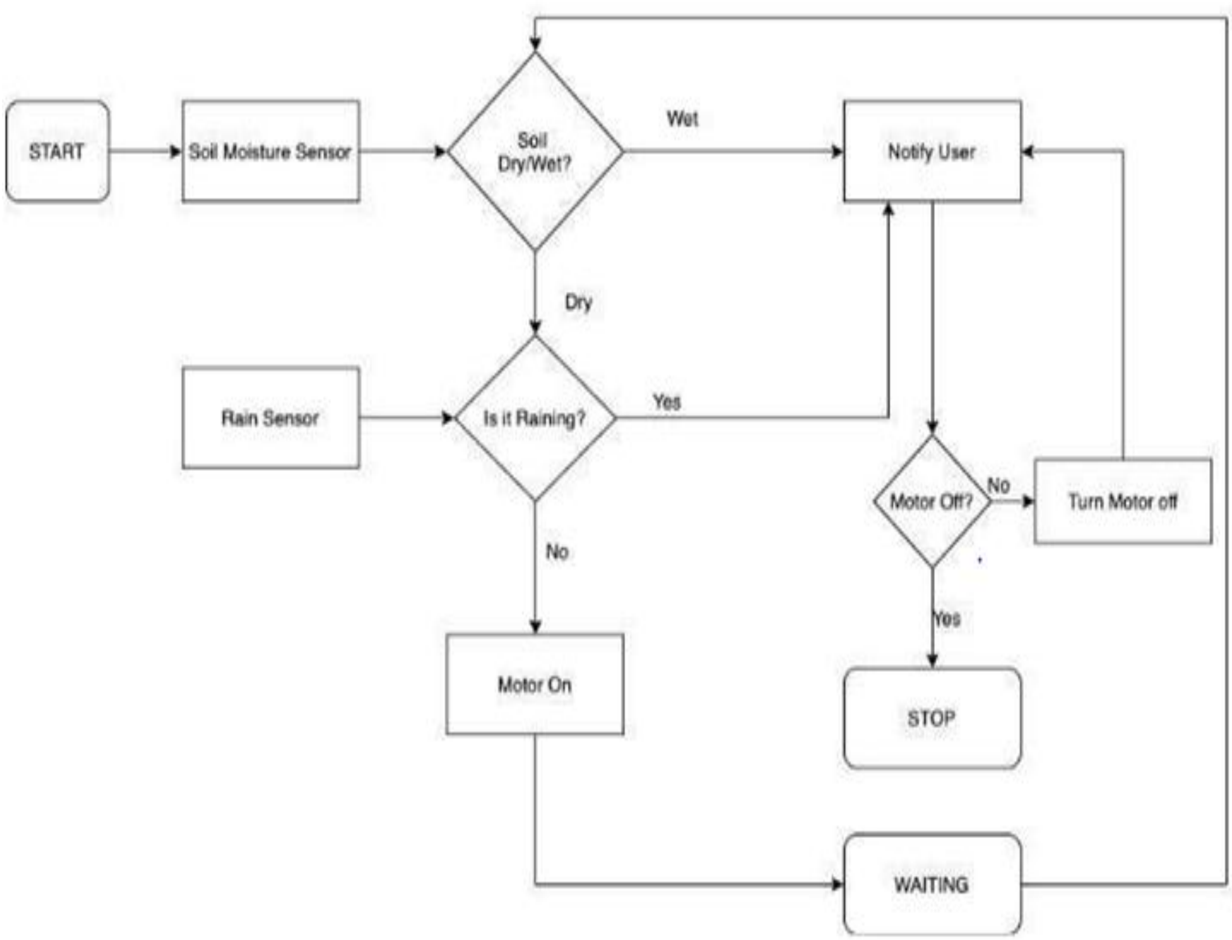

Fig 2: Work-flow diagram

COMPONENTS USED

Soil Moisture Sensor

In the Figure 3 which shows the Soil Moisture Sensor, there are two components combined together to measure the soil moisture level. The first component is a two-legged lead that goes inside the soil. The soil moisture sensor used here is “RC-A-4079” from “Robocraze”. This first component is then connected to the second component which is an amplifier. The second component is then connected to the microcontroller. This type of soil moisture sensor measures the moisture level of the soil by measuring the electric resistance and dielectric constant. The output generated with these components can either be analogue or digital. This all depends upon the use case and project requirement. The analogue output is a number between 0 and 1024 where larger obtained number signifies dry soil and lesser obtained number signifies wet soil. With analogue output exact dryness or wetness of the soil can be known. However, with digital output, we either know if the soil is in dry or wet state. This can be projected on an onboard LED of the microcontroller by Programming the sensor.

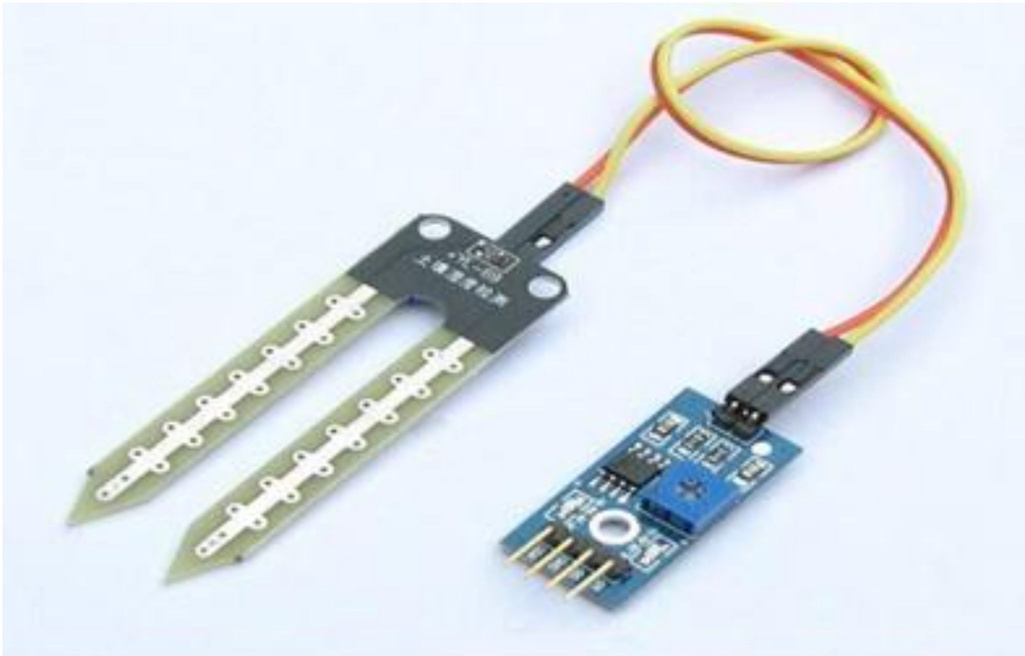

Fig 3: Soil Moisture Sensor

Temperature Sensor

Figure 4 shows the Temperature Sensor Temperature, which are variable resistors that change their resistance with temperature. In the proposed irrigation system, LM 35 DZ temperature sensor is used. Its operating temperature is −55° and + 150° C and operates between 4 V and 30 V. These sensors linearly produce an output voltage of

10 mV per degree centigrade change intemperature. These sensors are made from a semiconducting material that has been heated and compressed to form a temperature sensitive conducting material which contains charge carriers that allow current to flow through it. High Temperature causes the semiconducting material to release more charge carriers and hence temperature is detected.

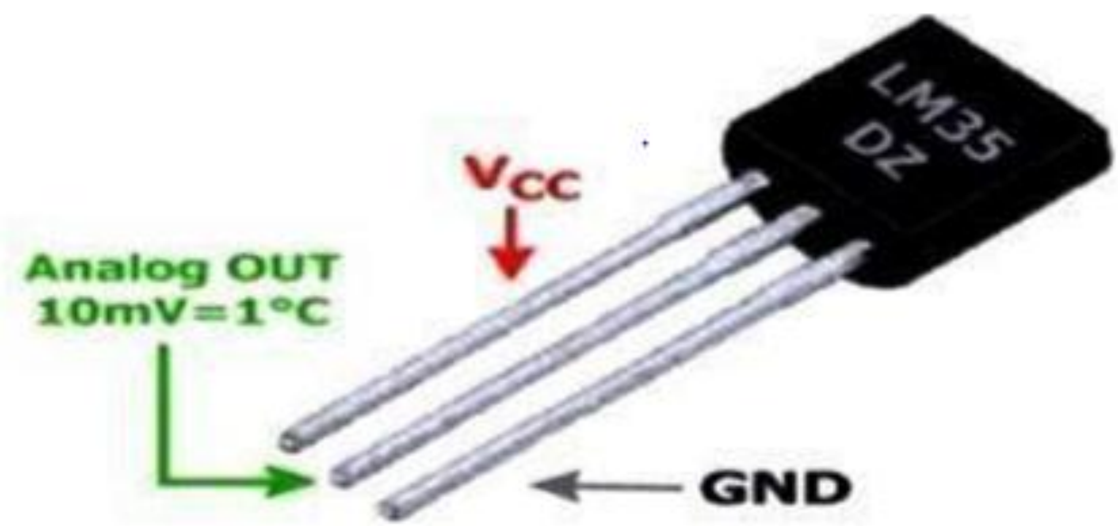

Fig 4: Temperature Sensor

Humidity Sensor

Figure 5 shows the Humidity sensor, which is an electronic device used to measure the humidity in the environment and convert those signalsto electrical signal. The amount of water vapor in the air can be measured

by adjusting the potentiometer in the sensor module and the value is inversely proportional to the amount of resistance at a fixed temperature. The humidity sensor used in this project is “DHT11 Digital Temperature Humidity Sensor Module”. Its operational range is 20% to 95% at a temperature range from 0 to 60 degree Celsius. Its operational voltage requirement is between 3.3 V to 5 V and is able to produce both analogue and digital output.

Fig 5: Humidity sensor

A microcontroller is an integrated circuit (IC) used to process the information or data received from other individual components connected to its input terminal. It processes these collected information or data via a microprocessor unit (MPU), on board volatile memory, input and output peripherals. These devices are optimized for embedded applications and have minimal requirements for memory and program length with no operating system and low software complexity. They usually contain general input/output pins or GPIOs. These pins are software configurable to either an input or output state. To information sent by the sensors is in analogue form. Since Microcontrollers are digital devices, an Analogue to Digital Converter is used in order to make it understandable to the microcontroller. A dedicated pulse-width modulation (PWM) block is used to control power converters, resistive loads and motors by the CPU. A Universal Asynchronous Receiver/Transmitter (UART) block is used to receive and transmit data over a serial line with very little load on the CPU.

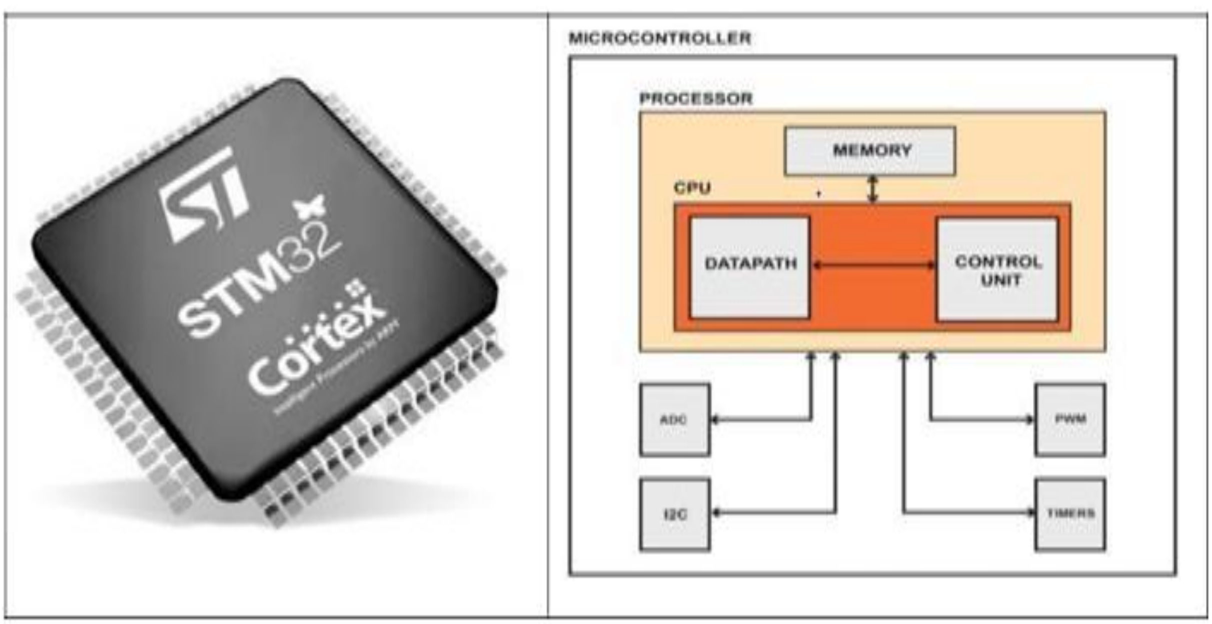

Fig 6: Microcontroller

CONCLUSION

The proposed smart irrigation system decides the necessity of irrigating the field according to the information received by the microcontroller from the attached sensors. It is obvious that the “Smart Irrigation System” consumes less water for production and saves more water for future use. The proposed system is a no-contact i.e., the farmer need not be involved with the operation of the system. The proposed system would also be non-invasive i.e., the operation of the system in no way affects the habitat of the plants, its growth and overall, it’s lifespan. So, by using this model we can grow good crops by providing the field very less time so at same time we could take care of the field as well as another work which we want to do.

FUTURE SCOPE

The world is growing quick and to match up with it we need to be advanced and do multi-tasking, we need to earn more money but we need food too. Farming might seem easy and less time consuming but it is not that it takes a lot of care of the crops to grow some healthy crops and a small mistake could lead to very less crop growth or it might not grow at all. The proposed system can further be expanded with equipping other non-irrigation related sensor like “Soil pH Sensor” which measures the acidity in the soil, “Ammonium Sensor” and “Nitrogen Sensor” which measure the soil’s ammonia and nitrogen level respectively to increase the effectiveness of the system.

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