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Real Time Implementation of IoT Based on Automatic Irrigation Controller using Fuzzy Rule and Plant Protection

Associate Prof. D.Baskaran, S.K.Bragadheesh, B.Ranganathan, J.Sumathi
Department of Electronics and Communication Engineering,
Nandha College of Technology,
Perundurai - 638052, Tamil Nadu, India.

Abstract-This paper proposes to the smart irrigation system which can be used to controlling the watering or irrigation of flowering plants. It controlling the irrigation of plant the automatically where needed the human intervention can be reduced. To continuously monitor the soil dry and wet condition. There are three type parameter can be monitor the moisture and its pH level protection of agriculture in animals attack to protect using shock. The main objective of this project to design smart irrigation and shock protection of chili plant using fuzzy logic. In this project, implementation of internet of things (IOT) also included where WI-FI node is used mean of connection medium. Fuzzy Logic was implemented control in this system to administrate the flow rate of water. The smart watering system consists of an irrigation controller a solenoid valve. The mobile phone remotely controls the automatic irrigation. It was save the time and labour cost. It suitable for small scale irrigation control in parks, courtyards, traditional irrigation controllers that operate on a present programmed schedule and timers, smart irrigation controllers monitor weather, soil conditions, evaporatio0n and plant water use to automatically adjust the watering schedule to actual conditions of the site.

Keywords:- Smart Farming, irrigation and protection using shock, internet of things, irrigation.

I. INTRODUCTION

Automation of form operations will transform agricultural domain from being manual to intelligence. It is used to higher production with lesser human supervision. Irrigation is one of the primary components in agriculture. Due to outdated techniques in developed and undeveloped countries, there is a large amount of water wasted in this process.

In this project, we have devised a fuzzy logic base smart irrigation controller prototype to put a check on this water wastage by providing an ideal irrigating environment for farming. This project reduces the water usage in the agricultural field and increases the production yield. This smart irrigation model is innovative and unique in the sense that it can the irrigation scheduling for all types of crops, across all climatic conditions for all soil types upon feeding the proper soil-crop growth stage combinations in the inference engine. By using smart irrigation controller, maximum area can be irrigated in less time.

Automatic irrigation system will allow farmers to continuously monitor the moisture level in field. It controlling the supply remotely over the internet. When moisture of the soil goes below a certain level, valve is opened automatically. Thus achieving optimal irrigation using Internet of Things. This automatic irrigation system is an IOT device which is capable of automating the irrigation process by analysing the moisture of soil and the climate condition. Automatic irrigation controller used to save water and also reduce the human intervention in the agricultural field. It continuously monitoring the status of soil through sensors and provide signal taking necessary action. It is to observe the parameters for better yield.

The key features that an irrigation controller should be able to provide are high efficiency, low power consumption with minimal inter-segment producing multi-functioning agricultural water-saving platform.

II. METHODOLOGY

The automatic irrigation system is an IOT based device which is capable of automating the irrigation process by analysis the moisture of soil and the climate condition.

The automatic irrigation controller consists of following steps:

- Acquiring weather and field data via sensors
- To uplink the entire setup on the cloud via the IOT

The methodology of automatic irrigation controller was discussed in this section. Section A, was discussed about working procedure of smart irrigation controller. Next section B was discussed on implementation of fuzzy logic controller and simulation.

Here, the working of smart irrigation controller has explained which according to physical conditions such as atmospheric temperature, moisture level, light intensity sensor , Anemometer these senses the value and give as input to micro controller. This micro controller commands working components to done the required work. In figure.1, explains the procedure of smart irrigation controller.

1. Fuzzy Logic:

To design the Fuzzy logic. Soil moisture and soil pH value are the two input values used in fuzzy logic. The inputs MATLAB software was used conditions will be mapped to three output variables which are the flow rate of alkaline, neutral and acid solutions.

Table 1 shows the fuzzy rules designed for the acid solution. The acid flow is represented by the output condition. The two input condition trigger the water pump and valve. If the pH soil was detected as Acid and Neutral with range of 1 until 8pH, the output was "OFF". That means no output solution from Acid and Neutral.

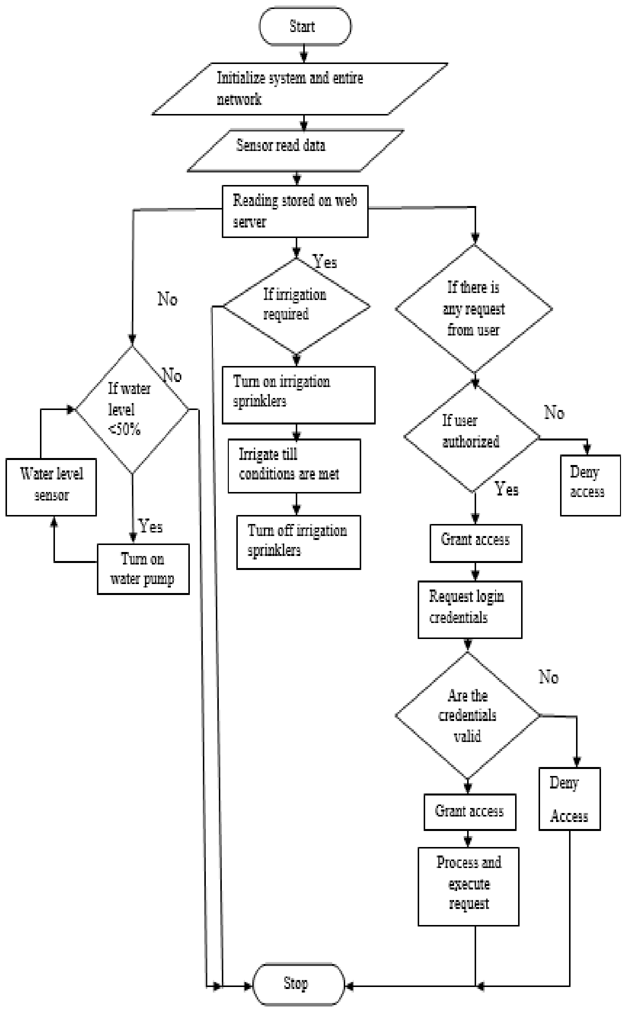

Fig 1. Flow Chart.

When the range of pH soil is between 8.1 to 10 and the moisture is between 0% to 39%, the condition of output for Alkali solution will be 'LOW'. If the pH value is between 8.1 to 10pH while moisture is 40% to 79%, the output of the Alkali solution will be "MEDIUM". Lastly, when the pH value is 8.1 to 10pH value and moisture value is between 80% until 100%, the alkali solution will be "HIGH".

Table II shows the fuzzy rules of Neutral solution. The flow rate of Acid and Alkali solution was in "LOW" condition where the pH soil was in the range of 1 until 4 and 8.1 until 12 with 0% to 100% of soil moisture. If the input of pH value is 5 to 6pH value and moisture value is between 0% to 39%, the output solution of Neutral will be "HIGH". Also, with same value of pH soil where soil moisture was 40% to 79%, the output will be 'MEDIUM and if the soil moisture was 80% to 100%, the condition was "LOW". Table III the fuzzy rules of Alkali solution. When the pH soil was in the range of 1 until 4.9 with 0% to 39% of soil moisture, it is in “LOW” condition of Acid solution.

If the pH soil was remained the same, the moisture was in 40% to 79%, the output was “MEDIUM” and 80% to 100% of soil moisture, the output was “HIGH”. The output condition of Alkali and Neutral solution was “OFF” when pH soil was in the range of 4.1 until 12, with 0% to 100% of soil moisture. Next, membership function of the input and output was implemented using MATLAB software.

Using fuzzy logic system, there are 2 memberships function for input and 3membership function for output. Figure.2 shows the membership functions of input which is pH soil. The input range of pH value are between 0 to 12pH. The acidic soil begins with value of 1pH until 6pH. For medium input, the value begins with 4pH until 8pH where the range are mapped with acidic at the range of 4pH until 6pH and the alkali at the range of 6pH until 8pH.Lastly, the alkali soil begins with 8pH to 12pH.

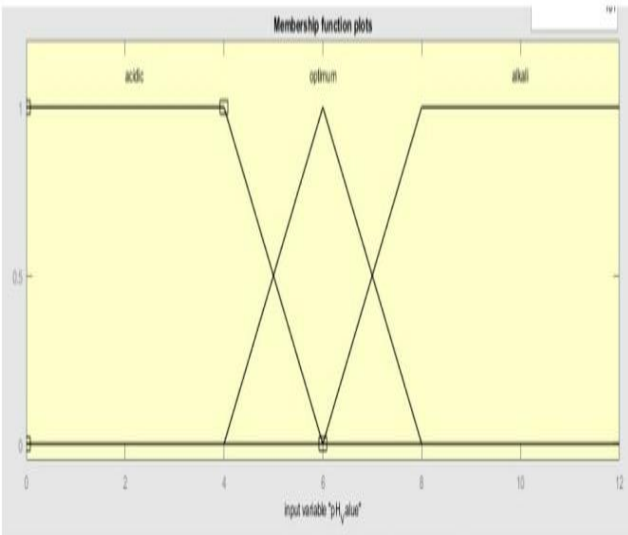

Fig 2. The membership for pH value.

Figure.3 shows the membership function of soil moisture. The range of input was started by 0% until 100%. There are 3 regions of the input which are low, optimum and high. For low region, the value begins with 0 until 35% of input. For optimum, the valuebeginswith 35% until 65%where the rangearemappedwithin35%until50%of lowregionand 50% and 65% of high region. Lastly, the range of high regionbetween 65% until 100% of input.

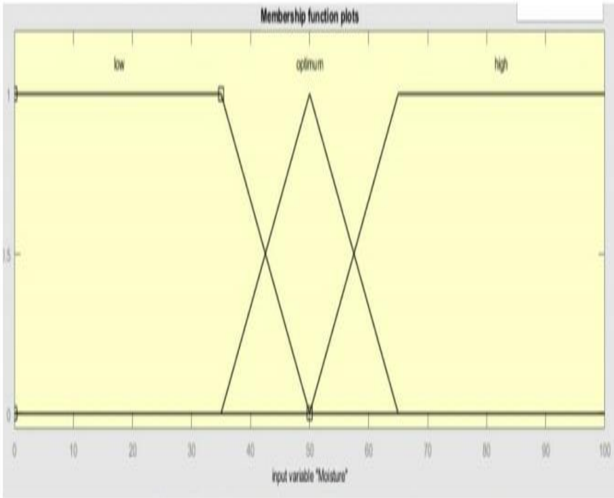

Fig 3. The membership value for moisture.

Figure.4 shows the membership function of Acid solution. The maximum range of the member ship is 80ml. There are 3 regions of the membershipfunctionswhichlow, medium and high forlowregion, therangeofoutputsolutionfrom0mlto 40ml. For medium region, the value begins with25ml to 55ml where the region was mapped to low & high region with 25ml until 40ml and 40ml until 55ml, respectively. Lastly the high region between 55ml until 80ml.

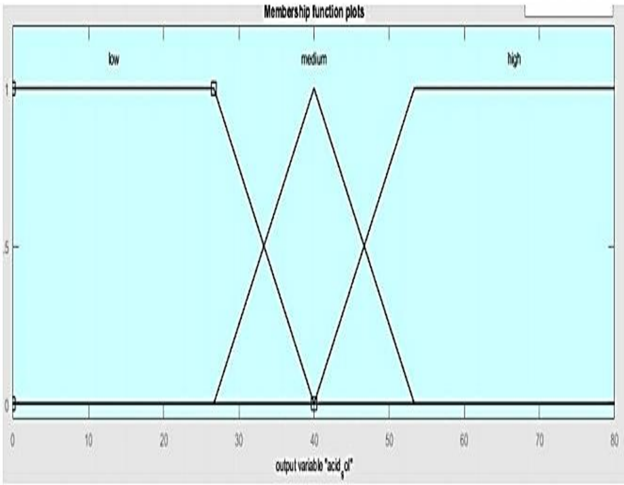

Fig 4. The membership for Acidic solution (tank).

Figure.5 shows the membership function of Neutral solution. The maximum range of output was 100ml. There are 3 region which is low, medium and high. The low region begins with 0ml to 50ml.Next, medium region begins with35ml to 65 ml where the region was mapped to low and high region with range of 35ml until 50ml and 50ml until 65ml, respectively. Lastly, the range of high region was between65ml to 100ml.

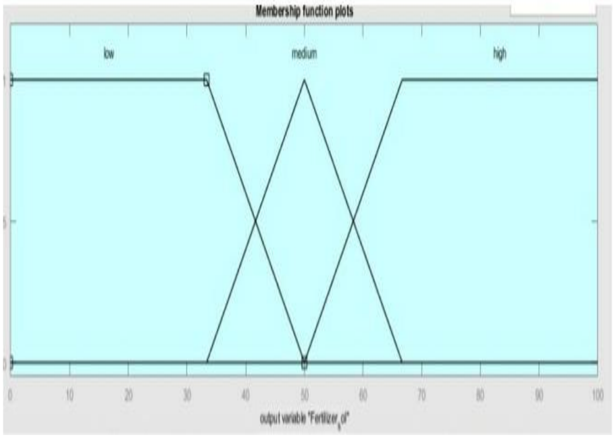

Fig 5. The membership for neutral solution (tank).

Figure.6 shows membership function of Alkali solution. The membership function had maximum Range of 80ml. There are 3 region of output which is low, medium and high.

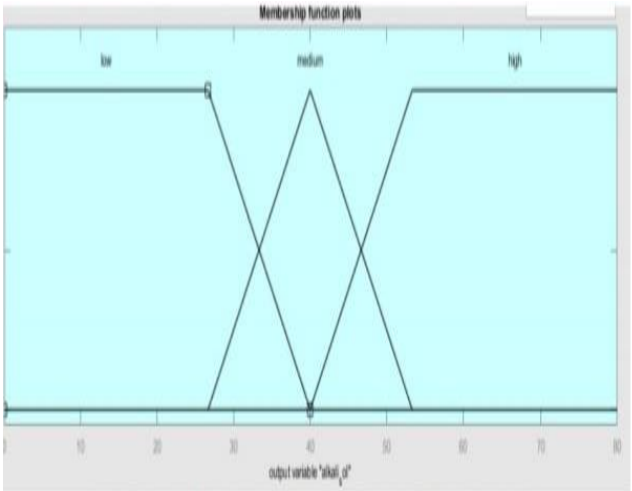

Fig 6. The membership for Alkali solution (tank).

III. COMPONENTS AND EQUIPMENT

In smart irrigation controller the project reduces the working stress of farmers and help in many features. The soil moister sensor (SMS) may be a sensor connected to an irrigation system controlled that measures soil moisture content within the active root zone before each scheduled irrigation event an bypass the cycle if soil moister is above a user-defined point .In this sensor we are using 2 probes to be dipped into the soil as per moisture we'll get analogy output variations from 0.60-12 volts. Input voltage 12 VDC.

A temperature sensor is a device that measures the temperature of environment and converts the input file into electronic data to record, monitor, or signal temperature changes. There are many various sorts of temperature sensors. Output voltage is linearly proportional to the Celsius temperature.

Temperature range is -55 to 150 degree C. A rain sensor or rain switch may be a switching device activated by rainfall. There are two main applications for rain sensors. The primary may be a conservation device connected to an automatic irrigation system that causes the system to pack up within the event of rainfall. An infrared beams at a 45-degree angle on the clear area on windshield from the sensor. For the safety purpose to guard farm from wild animals or unknown trespassers passive infrared sensor (PIR sensor) is an electronic sensor that measures infrared (IR) light radiating from objects in its field of view.

They're most frequently utilized in PIR - based motion detectors. PIR sensors are commonly called simply "PIR", or sometimes "PID", for "passive infrared detector".

Anemometer, device for measuring the speed of airflow within the atmosphere, in wind tunnels, and in other gas-flow applications. Most generally used for wind-speed measurements is that the revolving-cup electric anemometer, during which the revolving cups drive an electrical generator. Water flow sensors are installed at the water source or pipes to live the speed of flow of water and calculate the quantity of water flowed through the pipe. Rate of flow of water is measured as litres per hour or cubic meters.

By using this sensor which stops the motor if there low amount of water or no water within the tank. Light Sensors are photoelectric devices that convert light energy (photons) whether visible or infra-red light into an electrical (electrons) signals. A solenoid valve is an Electro mechanically - operated valve.

Solenoid valves differ within the characteristics of the electrical current they use, the strength of the magnetic flux they generate, the mechanism they use to manage the fluid and therefore the type and characteristics.

A micro controller (MCU for micro controller unit) may be a small computer on one metal-oxide semiconductor (MOS) microcircuit (IC) chip.A micro controller contains one or more CPU (processor cores) alongside memory and programmable input/output peripherals.

IV. DESIGN 0F SMART IRRIGATION CONTROLLER

In this section we discuss about design of components in smart irrigation controller. Here, the input components are sensors, which give input value to the micro controller (ATMEGA328P) to complete required process which reduce the work stress for farmers. Input voltage 230V is step down by transformer into 12V for circuit operation.

Soil sensor (or) Humidity sensor which measures the moisture level of soil and send the data to the micro controller and it commands relay to operate motor to allow water, if water level is reduced than 50% of required moisture level according to the soil.

Rainfall sensor indicates that whether rain fall in field. Light intensity sensor indicates that that intensity of sun light or atmospheric light intensity. PIR sensor that senses the human or other animals and indicates movement then buzzer turns ON.

Anemometer is used to measure speed of wind. Interface between Smart Irrigation Controller and mobile is done by ESP8266 Module cloud server is connected by using Blynk App.

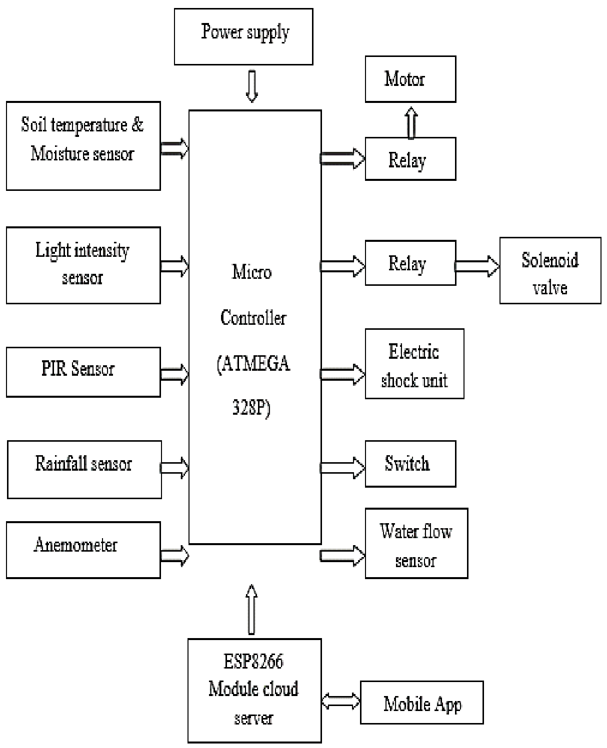

Fig 7. Block Diagram.

V. RESULTS AND DISCUSSIONS

1. Fuzzy Logic Validation Test:

The performance of the output was verified using simulation in MATLAB software to make sure the output flow was accurate.

2. Apps Display:

Blynk may be a platform that permits building interfaces for the control and monitor of hardware projects from IOS and Android device quickly. it's wont to monitor the condition of input which is pH soil moisture, temperature, rainfall detection and lightweight intensity where it's display on mobile. The mobile was connected via Wi-Fi using node MCU to urge the latest update on the condition of the soil and plant. The user also ready to activate and OFF water pumps using the button in mobile apps.

VI. CONCLUSION

TheresultsofRealtimeimplementationofIOTbasedautomaticirrigationcontroller showed thatwater reduced within the agricultural field and production yield isimproved.

So it's inferred thattheobjectivesofthemodeli.e. reduction of water usage and wastage andimprovement in product yield are successfully achieved. We also aim to protection of plants with this technique.

The project was successfully implemented the web of Things (IOT) by using Wi-Fi and mobile as a medium to watch the performance of plants.

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