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AI Based Automatic Irrigation System Using IoT

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***Abstract*—** In tropical countries, the temperature is very high and evaporation is more rapid. So, the automatic irrigation is necessary for ample supply of water and to prevent scarcity of water in the dry winter season. To achieve the benefits of the ecosystem such as water and solar energy conservation the efficiency of irrigation system must be improved. By using modern technologies to control the water level of farming and providing the automatic fertilization as per the nutrition requirements in the plants. The use of organic fertilizers may lead to a reduction in the use of chemical fertilizers such as pesticides, insecticides, chemical manures etc. The automation of the process is further induced by using WI-FI module which will lead to control the process from various distances apart. The manpower is ultimately reduced by subsequent improvement in the drip irrigation system. The basic aim of the project is to improve the efficiency of the irrigation system. This proposed system has overcome limitations of previous systems like distance problem, range problem.

Keywords—AI**,** IoT, Microcontroller, Sensors.

I. INTRODUCTION

Irrigation is defined as the artificial application of water to land or soil. Irrigation process can be used for the cultivation of agricultural crops during the span of inadequate rainfall and for maintaining landscapes. An automatic irrigation system does the operation without human involvement. Every irrigation system such as drip, sprinkler, and the surface is automated with electronic appliances and detectors such as computer, timers, sensors and other mechanical devices [1]. An automatic irrigation system does the work quite efficiently that involves a positive impact on the place where it is installed. Once it is installed in the agricultural field, proper water distribution to crops and nurseries becomes easy that does not require any human support to perform the operations permanently. Sometimes automatic irrigation is performed by using mechanical appliances such as clay pots or bottle irrigation system. It's very hard to implement mechanical irrigation systems because they are very expensive and complex in their design. By taking these basic points into consideration we have proposed an automatic irrigation system by using different sensors.

II.OBJECTIVES

It is proposed to supports aggressive water management for the agricultural land. Raspberry Pi 3 used in this system promises about the increase in systems life by reducing the power consumption. Its application can be extended to cricket stadiums or golf stadiums and also in public garden area for proper irrigation[2]. The automated irrigation system has a huge demand and future scope too. The implementation of this project has numerous advantages like reduction in human error, time-saving etc., which leads to maintain soil moisture level,to maximize the net profits in accordance to factors like sales, quality, and also the growth of their product. Since it was obtained in low cost and reliable operation it can be used in commercial agriculture irrigation also. This application of sensor-based site-specific irrigation has some advantages such as preventing moisture stress of trees, diminishing the excessive water usage and ensuring rapid growth of weeds. Different kinds of sensors (that is, temperature, humidity etc.) are implemented in irrigation, so it can be said that an Internet-based remote control of irrigation automation will be possible. The developed system also facilitate the application of fertilizer and the other agricultural chemicals (calcium, sodium, ammonium, zinc) to the field by adding new sensors and control valves.

III.COMPONENTS

Solar energy source power supply for the processing is provided by storing the solar energy in a battery by using solar panel. The output voltage or current to a specific value can be controlled by a regulated power supply[3][4] the controlled value is held nearly constant despite variations in either voltage supplied or load current by the power supply's energy source. The solar energy systems must incorporate storage in order for maintaining the energy needs during nights and on cloudy days.

A solar inverter converts the variable direct current (DC) of a photovoltaic (PV) solar panel into a frequency alternating current (AC) that is fed into a commercial electrical grid or could be used by a local electrical network. The critical balance of system (BOS) components a photovoltaic system, allowing the use of ordinary AC-powered equipment[5].

Solar power inverters have been adapted for use with photovoltaic arrays, including maximum power point tracking and anti-islanding protection[6].

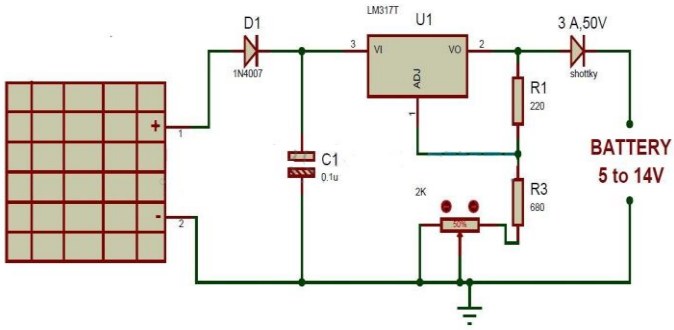

Fig.1. Solar Circuit Diagram

The Soil Moisture Sensor measures the volumetric water content of the soil. The soil moisture probe is made up of several soil moisture sensors[7]. Watermark Sensor (granular matrix sensor) is a soil moisture and soil temperature sensor. The sensor measurements between irrigations, measures the rate at which the soil is drying out.It uses capacitance to measure dielectric permittivity which is a function of the water content in the soil in the surroundings. A voltage which is proportional to the dielectric permittivity is created by the sensor and the water content in the soil.

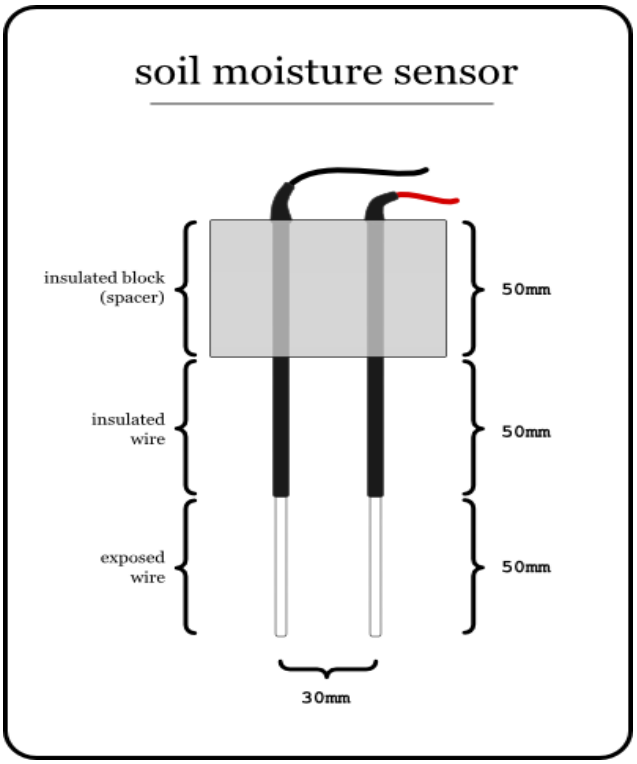

Fig.2. Soil moisture sensor

Humidity is defined as the amount of water vapor in an atmosphere of air or other gases. A humidity sensor (or hygrometer) measures and reports both moisture and temperature in air. The ratio of moisture in the air to the highest amount of moisture at a particular temperature in air is called relative humidity which is an important factor to be considered for comfort[8]. Humidity sensors detect changes that alter electrical currents or temperature in the air. The basic types of humidity sensors are capacitive, resistive and thermal[9].These sensors monitor minute changes in the atmosphere and calculate the humidity in the air.

Fig.3. Humidity sensor

A temperature sensor is a device, typically, a thermocouple or RTD provides temperature measurement through an electrical signal. A thermocouple (T/C) is made from two dissimilar metals that generate an electrical voltage which is directly proportional to the changes in temperature. An RTD (Resistance Temperature Detector) is a variable resistor that will change its electrical resistance which is directly proportional to the changes in temperature in a repeatable linear manner.

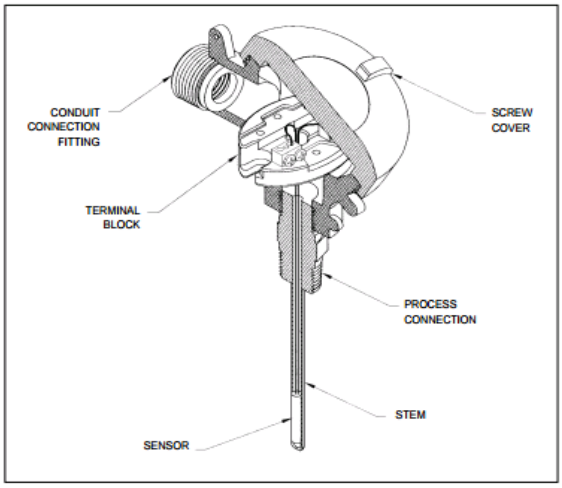

Fig.4. Soil moisture sensor

A pump is a device that moves fluids (liquids or gases), or sometimes slurries, by mechanical action. Pumps can be classified into three major groups based on the movement in fluid: direct lift, displacement, and gravity pumps.

Fig.5. 10v DC Pump

The relay is an electrically operated switch which controls several circuits by one signal or by a low power signal. It can handle the high power required to directly control an electric motor or other loads with a contactor. They performed logical operations in early computers and telephone exchanges.

Fig.6. Relay board

Valves are found in every industrial process, including water and sewage processing, mining, power generation, processing of oil, gas and petroleum, food manufacturing, chemical and plastic manufacturing and many other fields.

Fig.6. solenoid sensor

IV.METHODS

The solar energy is used as the power source. The output voltage or current to a specific value can be controlled by a regulated power supply, in fig 1 shows the Block Diagram of Irrigation System controlled value is held nearly constant despite variations in either voltage supplied or load current by the power supply's energy source. The solar energy systems must incorporate storage in order to take care of energy needs during nights and on cloudy days. The stored energy is used to supply motor and raspberry pi 3[10].

Whenever there is a change in temperature and humidity of the surroundings, these sensors sense the changes in temperature, moisture content, and humidity and give an interrupt signal to the raspberry pi 3. The entire operation will be done by raspberry pi 3 which is programmed by C language.To achieve the benefits of the ecosystem, water, and solar energy is utilized and conserved[5]. Modern technologies are used to control the water level of farming and providing the automatic fertilization as per the nutrition requirements in the plants.

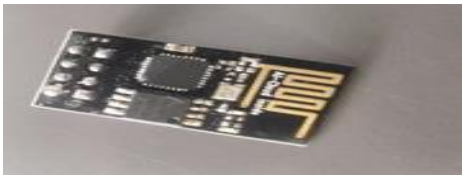

Fig.6. solenoid sensor

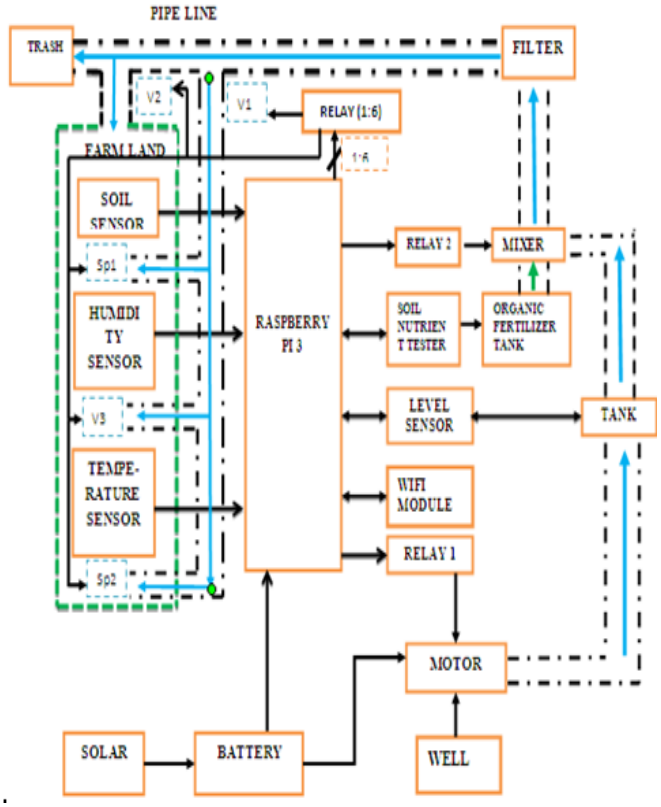

Fig.7. Block Diagram of Irrigation System

Fig.8. Hardware setup

V.CONCLUSION

Currently, farmers use various irrigation techniques through manual control, in which a person has to irrigate a garden/land at regular time intervals. This process will not consume more water and not results in water wastage. Fertilizer and nutrient loss is minimized due to the localized application and reduced leaching. Fields that are irregular in shapes are also easily accommodated. Moisture within the root zone can be maintained at field capacity. Soil type plays a less important role in the frequency of irrigation. Weed growth is lessened. Water distribution is highly uniform which is controlled by the output at each nozzle. Variation in supply can be regulated by using the valves and drippers. Fertilization can easily be included with minimal waste of fertilizers. Drip irrigation is used in farms, commercial greenhouses, and residential gardeners which is adopted extensively in areas of acute water scarcity and especially for crops and trees.

Fig.9 The implementation of the project was held in this field.

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