Research Article

IoT Based Farm Automation

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INFO

ABSTRACT

The Indian economy is based on agriculture - about 70% of its population depends on agriculture and it contributes to 1/3rd of the national income. Therefore Automation of farm activities can transform agricultural domain from being manual and static to intelligent and dynamic leading to higher production with lesser human supervision. This project proposes an automated irrigation system which monitors and maintains the desired soil moisture content via automatic watering. Microcontroller PIC16F877A is used to implement the control unit. The setup uses soil moisture sensors which measure the exact moisture level in soil. This value enables the system to use appropriate quantity of water which avoids over/ under irrigation, Temperature sensor LM35 is used to measure the temperature of the farm and Water level sensor is used to indicates water level of the tank. IOT is used to keep the farmers updated about the status of sprinklers. Information from the sensors is regularly updated on a webpage using ESP8266 through which a farmer can check whether the water sprinklers are ON/OFF at any given time. Also, the sensor readings are transmitted to a Thing speak channel to generate graphs for analysis.

Keywords: Microcontroller (PIC16F877A), Soil Sensor, Temperature Sensor, Water Level Sensor, Wi-Fi Module (ESP8266)

Introduction

Agriculture is the unquestionably the largest livelihood provider in India. With rising population, there is a need for increased agricultural production. In order to support greater production in farms, the requirement of the amount of fresh water used in irrigation also rises. Currently, agriculture accounts 83% of the total water consumption in India. Unplanned use of water inadvertently results in wastage of water. This suggests that there is an urgent need to develop systems that prevent water wastage without imposing pressure on farmers.

Over the past 15 years, farmers started using computers and software systems to organize their financial data and keep track of their transactions with third parties and also monitor their crops more effectively. In the Internet era, where information plays a key role in people's lives, agriculture is rapidly becoming a very data intensive industry where farmers need to collect and evaluate a huge amount of information from a diverse number of devices (eg., sensors, faming machinery etc.) in order to become more efficient in production and communicating appropriate information. With the advent of open source PIC Microcontroller along with cheap moisture sensors, it is viable to create devices that can monitor the soil moisture content, temperature, water level and accordingly irrigating the fields or the landscape as an when needed. The proposed system makes use of microcontroller PIC16F877A and IOT which enable farmers to remotely monitor the status of sprinklers installed on the farm by knowing the sensor values and temperature and water level of the tank thereby, making the farmers work much easier as they can concentrate on other farm activities.

Agriculture played important role in countries. This

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agriculture issued to improve the economy of country, but for improvement of agriculture the farmers has diverted there attention towards utilization of science and technology is key issue in irrigation.

Aim of developing this system the people are working towards the automation with some level of intelligence to replace or minimize the human effort from the processes. This project proposes an automated irrigation system which monitor and maintain the desired soil moisture content via automatic watering PIC Microcontroller.

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Problem Statement

Irrigation Study Irrigation is the artificial application of water to the soil usually for assisting in growing crops. In crop production it is mainly used in dry areas and in periods of rainfall shortfalls, but also to protect plants against frost.

Types of Irrigation

- Surface irrigation
- Localized irrigation
- Drip Imgation
- Sprinkler irrigation

Drip irrigation also known as trickle imgation or micro imgation is an irrigation method which minimizes the use of water and fertilizer by allowing water to drip slowly to the roots of plants, either onto the soil surface or directly onto the root zone, through a network of valves, pipes, tubing, and emitters.

Concept of Modern Irrigation System

The conventional imgation methods like overhead sprinklers, flood type feeding systems usually wet the lower leaves and stem of the plants. The entire soil surface is saturated and often stays wet long after irrigation is completed. Such condition promotes infections by leaf mold fungi. The flood type methods consume large amount of water anu the area between crop rows remains dry anu receives moisture only from incidental rainfall.

On the contrary the drip or trickle irrigation is a type of modem irrigation technique that slowly applies small amounts of water to part of plant root zone. Drip irrigation method is invented by Israelis in 1970s. Water is supplied frequently, often daily to maintain favorable soil moisture condition and prevent moisture stress in the plant with proper use of water resources.

A wetted profile developed in the plants root zone is as shown in Figure. Its shape depends on soil characteristics. Drip irrigation saves water because only the plants root zone receives moisture. Little water is lost to deep percolation if the proper amount is applied. Drip irrigation is popular because it can increase yields and decrease both water requirements and labor.

System Discription

This soil sensor will be deployed at the start of the farm and at the end of the farm, when motor is ON, water will start moving from the start to end and when there is sufficient water at the end of the farm then the sensor present at the end of the farm will detect whether sufficient water is there or not if found sufficient water it will give signal to the microcontroller through the signal conditioning circuit and the MOTOR supply will cut.
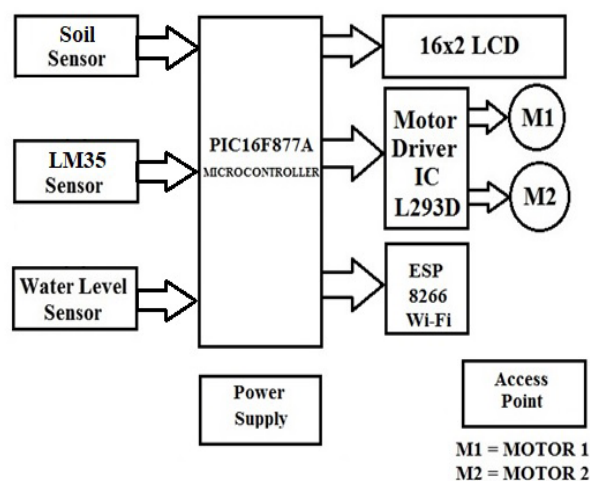

Figure 1.System Block Diagram

The PIC16F887A is one of the latest products from *Microchip*. It features all the components which modern microcontrollers normally have. For its low price, wide range of application, high quality and easy availability, it is an ideal solution in applications such as: -

The control of different processes in industry:

Pin Description

Most pins of the PIC16F877 microcontroller are multi-functional. For example, the fifth pin of the microcontroller is marked as RA3/AN3/Vref+/C1IN+ which indicates that it has the following functions:-

- RA3 Port PORTA third digital input/output
- AN3 Third analog input
- Vref+ Positive voltage reference
- C1IN+ Comparator C1 positive input

This principle of multifunctionality is commonly applied when designing microcontrollers as it enables the microcontroller package to be much more compact yet not affecting the operation of the microcontroller.

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Various pin functions cannot be used simultaneously, but can be changed at any point during operation.

16*2 LCD Display

A Liquid Crystal Display is an electronic device that can be used to show numbers or text. There are two main types of LCD display, numeric display and alphanumeric text displays.

The display is made up of a number of shaped 'crystals'. In numeric displays these crystals are shaped into 'bars', and in alphanumeric displays the crystals are simply arranged into patterns of dots'. Each crystal has an individual electrical connection so that each crystal can be controlled independently. When the crystal is 'off i.e. when no current is passed through the crystal, the crystal reflect the same amount of light as the background material, and so the crystals cannot be seen.

However when the crystal has an electric current passed through it, it changes shape and so absorbs more light. This makes the crystal appear darker to the human eye - and so the shape of the dot or bar can be seen against the background.

It is important to realize the difference between a LCD display and an LED display. An LED display often used in clock radios is made up of a number of LEDs which actually give off light and so can be seen in the dark.

Water Level Sensor

Level sensors detect the level of liquids and other fluids and fluidized solids, including slurries, granular materials, and powders that exhibit an upper free surface. Substances that flow become essentially horizontal in their containers (or other physical boundaries) because of gravity whereas most bulk solids pile at an angle of repose to a peak.

Also important are the application constraints: price, accuracy, appearance, response rate, ease of calibration or programming, physical size and mounting of the instrument, monitoring or control of continuous or discrete (point) levels. In short, level sensors are one of the very important sensors and play very important role in variety of consumer/industrial applications. As with other type of sensors, level sensors are available or can be designed using variety of sensing principles. Selection of an appropriate type of sensor suiting to the application requirement is very important.

Soil Sensor

The Soil Sensor is used to measure the volumetric water content of soil. This makes it ideal for performing experiments in courses such as soil science, agricultural science, environmental science, horticulture, botany, and biology.

Use the Soil Sensor to:

- Measure the loss of moisture over time due to evaporation and plant uptake.
- Evaluate optimum soil moisture contents for various species of plants.
- Monitor soil moisture content to control irrigation in greenhouses.
- Enhance your Bottle Biology experiments.

Tempreture Sensor (LM 35):

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centi-grade scaling.

It can be used with single power supplies, or with plus and minus supplies. As it draws only 60 μA from its supply, it has very low self-heating, less than 0.1ÊC in still air. The LM35 is rated to operate over a −55Ê to +150ÊC temperature range, while the LM35C is rated for a −40Ê to +110ÊC range (−10Ê with improved accuracy). The LM35 series is available packaged in hermetic TO-46 transistor packages, while the LM35C, LM35CA, and LM35D are also available in the plastic TO-92 transistor package. The LM35D is also avail-able in an 8-lead surface mount small outline package and a plastic TO-220 package.

Wi-Fi Module (ESP8266)

ESP8266 offers a self-standing Wi-Fi networking with TCP/IP protocol stack which can give Wi-Fi connection to any microcontroller.. ESP8266 when connected on-board it has storage and processing capabilities hence can be easily connected to the sensors based on the application.

ESP8266 is a complete and self-contained Wi-Fi network solution that can carry software applications, or through another application processor uninstall all Wi-Fi networking capabilities. ESP8266 when the device is mounted and as the only application of the application processor, the flash memory can be started directly from an external Move. Built-in cache memory will help improve system performance and reduce memory requirements. Another situation is when wireless Internet access assumes the task of Wi-Fi adapter, you can add it to any microcontroller-based design, and the connection is simple, just by SPI / SDIO interface or central processor AHB bridge interface. Processing and storage capacity on ESP8266 powerful piece,

Motor Driver (L293D)

The L293D is a monolithic integrated high voltage, high current four channel driver designed to accept standard DTL or TTL logic levels and drive inductive loads (such as relays solenoids, DC and stepping motors) and switching

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power transistors. To simplify use as two bridges is pair of channels is equipped with an enable input. A separate supply input is provided form the logic, allowing operational at a low voltage and internal clamp diodes are included. This device is suitable for use in switching applications at frequencies up to 5 KHz. The L293D is assembled in a 16 lead plastic package which has 4 center pins connected together and used for heat sinking.

Power Supply

When working with electronics, you always need one basic thing is Power. In every electronic circuit power supply is required. The electric power is almost exclusively generated, transmitted and distributed in the form of alternating current as an economical proposition. However for many applications we require dc supply. Batteries cannot be used for the purpose as they are costly and require frequent replacement. Therefore, it is necessary to convert available ac supply into the required dc supply. This is achieved by an electronic device known as rectifier. The proper working of each and every component, the exact amount of voltage and current to be supplied to it. If the powers exceed its limit, it can be fatal.

DC Motor

A machine that convert DC power into mechanical energy is known as DC motor. Its operation is based on the principle that when current carring conductor is placed in magnetic field the conductor experiences force the direction of the force is given by Flemings left hand rule.

V.advantages

- Relatively simple to design and install.
- It is very useful to all climatic conditions any it is economic friendly.
- It makes increase in productivity and reduces water consumption.
- We are micro controllers so there is error free.
- His is safest and no manpower is required. Permit other yard and garden work to continue when irrigation is taking place, as only the immediate plant areas are wet.
- Educe soil erosion and nutrient leaching.
- Educe the chance of plant disease by keeping foliage dry.

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