IOT BASED IRRIGATION AUTOMATION SYSTEM

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Introduction:
In developing countries like India drip irrigation is probably the only technology adapted by farmers, that too in very recent years. But now farmers are getting educated and have started using technology for agriculture. Currently, farmers manually monitor the need for irrigation. This approach is subjective. The system can be made fool proof by using sensors to determine the need for watering. Programmable Logic Controller is best way to control the water management. The system controls irrigation need based on two inputs. One is from the moisture sensor and another is from the weather sites on the internet. Based on the input from moisture sensor, system decides to irrigate if the soil is dry. Based on the weather report, decision is made to irrigate if there is no predicted possibility of rain. In case if the weather prediction fails, irrigation is done after a preset waiting period is over. Need for fertilization is determined using sensor. The quantum and frequency of fertilization hence can be controlled using PLC. Usage of latest and state of the art technologies like Internet of things (IoT) and PLC for irrigation control saves energy, water, and fertilizer. All these concerted efforts increase the yield and profitability of farming. Since agriculture is the major contributor to the GDP of the country, it becomes all the more important to improve its profitability by all the means at our disposal.

Objectives:
The main objective of proposal is to conserve water, fertilizer and energy in agriculture by incorporating new technologies like internet of things (IOT) and PLC’s in farming.

Farming is a water intensive activity. Farmers mainly depend on rainfall for all their irrigational needs. The proposed system uses weather predicting device based on information provided from weather monitoring websites. This information is used for scheduling irrigation intelligently.

Fertilizers play a very important role in field of agriculture. They help to increase productivity of plants. The proposed project designs a smart fertilizer dispensing mechanism. Sensors are used to measure the need for fertilization of the soil and controller intelligently dispenses fertilizer if there is a need to do so.

The farmers keeping on changing their crops based on market value of the crops. Different crops have different irrigational needs. For example, horticulture needs water on daily basis but vegetables need water on alternate days. These varied requirements are met by providing different modes of operation of controller.
Methodology:

Programmable logic controller (PLC) is used to control the irrigation. PLCs have the advantage of ease of programming because of the ladder logic like programming language. They are also reprogrammable; hence facilitate scalability of the setup. Sensor inputs are received from the field, the ladder logic is executed, and the outputs are updated based on the input measurements. Soil moisture sensor is a dielectric moisture sensor that measures volumetric water content with Time Domain Transmission (TDT) technology. Soil fertility meter shows the level of soil nutrients by measuring the soil-water electrical conductivity. It measures the combination of NPK (nitrogen phosphorus potassium) values.

Both sensors are connected to Arduino UNO board for transmission of the measured values. The values are sent and received through RF transmitter and receiver which is connected to the PLC through control relays. Based on the values of moisture sensor and soil fertility meter the PLC makes the decision of supplying water and fertilizer to plants by controlling the pump of respective tank. The water level in the water tank is monitored by PLC using float switch in the tank. Irrigation scheduling is done based on the weather reports provided by weather stations in their websites.

PLC is the heart of the irrigation control system. The controller will work in 3 different modes-

1. Automatic mode:
In this mode, the PLC has ability to make decisions. In this mode, the system works without any human intervention. The controller controls the process using the sensory inputs and the IOT data.

2. Timer Mode:
In this mode basically works based on the time. The schedule of irrigation is entered by the user using a Graphic Operating Terminal (GOT).

3. Manual Mode:
In this mode, operation is based on user needs. This mode is neither time based nor sensor information is used. The farmer uses his intelligence to decide on the irrigation scheduling.
The most important energy saving feature is IOT based weather reporting technology incorporated to control the irrigation of agricultural land.

**Results, conclusion and future work:**

The outcomes of the project are that the controller is able to acquire weather information through internet and control the irrigation. Based on sensory data, irrigation is scheduled with three different modes of operation and mobile application (mobile app) developed to remotely monitor and control irrigation.

The usage of the sensors and IoT to generate control signals for the irrigation of the farm, there is a substantial saving of the resources. The system also relieves the farmer from being physically present in the farm to operate the irrigation system. The time saved can be used for managing the rest of the activities on the farm. The system also enables the farmer to manage a large farm with minimum manpower. This reduces the production cost of the produce. This in turn increases the profit earned by the farmer.

As PLCs are robust and time tested industrial automation controllers, they can endure all the harsh conditions to which they are exposed. They are rugged by design. They hardly fail. This high level of reliability of the system makes it fail proof. Extensive testing was done on the prototype system to make the logic fool proof.

Applications of the system that it can be used to irrigate larger areas of land with single human interface and advanced drip irrigation with fertilizer control.

The project has tremendous scope in developing it and making it more user-friendly and with additional features like:

- A webcam can be installed along with the device to capture the photos of the land, crops, the farmer or any pests/disease infected plants that can be sent to database.
- Speech based option selection can be implemented for those who are unable to read.
- A GPS can be integrated to the device to provide the specific location of the farmer and more accurate weather reports.
- All the features on the device end can be developed in the regional language, which helps in easy reading for the farmers.