IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

SMART FARMING USING AUTOMATION

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Abstract: This paper is based on developing a "Smart Farming Using Automation" which operates on the three modes namely, timer mode, Soil moisture mode and PH Sensor mode as per the benefit of farmer. This paper present an automatic drip irrigation system based on PLC. Utilizing soil moisture sensor and PH sensors. The function of soil moisture sensor is to identify the amount of water required for irrigation; then PLC control the water solenoid valves through solenoid valve based on moisture content that is less or at correct level. Fertilizer providing system is also added to the water irrigation system based on pH content in the soil This paper is concentrated on the agricultural system that can be used to control the parameters of agricultural field. Observation by implementing this work shows efficient use of water to crop, improvement in losses due to change in climate, proper usages of fertilizer in the agricultural field. The proposed automation scheme is implemented in real time using Mitsubishi FX3 PLC platform. Water scarcity and increasing demand for agricultural productivity have driven the need for efficient irrigation systems.

In this study, we propose an automatic drip irrigation system using a PLC for precise control and management of the irrigation process. The system integrates sensors for monitoring soil moisture, temperature, humidity, and weather conditions, which are connected to the PLC. The PLC processes the sensor data and uses predefined logic-based programming to control the operation of valves, solenoid valves, and other components of the irrigation system.

Index Terms **– Automation, Mitsubishi FX 3 PLC, Soil Moisture sensor, PH sensor, Solenoid valves.**

I. INTRODUCTION

A Smart Farming Using Automation is carried out by Mitsubishi programmable logic controller (PLC) is a modern and efficient method of watering plants or crops. Drip irrigation is a type of irrigation that delivers water directly to the roots of plants through a network of tubes or pipes with emitters and collect the moisture level and PH value through sensor, which release water in controlled amounts to individual plants. A PLC, on the other hand, is a digital computer-based control system that uses logic-based programming to automate various processes.

When a PLC is used in conjunction with a smart farming system, it can provide precise control over the timing, duration, and amount of water delivered to each plant, resulting in efficient water usage and optimized plant growth. The PLC can be programmed to monitor and control various parameters, such as soil moisture level and pH of soil to ensure that the plants receive the right amount of water at the right time. The PLC can also be integrated with sensors, actuators, and other devices to automate the operation of valves, solenoid valves, and other components of the irrigation system.

The advantages of using a PLC in an automatic drip irrigation system increased water efficiency, reduced water wastage, improved plant health and growth, and the ability to monitor and control the irrigation process remotely. The system can be customized and programmed to suit specific crop requirements, soil conditions, and environmental factors, making it a flexible and scalable solution for agricultural and horticultural applications.

Overall, a Smart Farming Using Automation provides a modern and sophisticated approach to irrigation, offering precision, efficiency, and automation for optimal plant growth while conserving water resources.

Agriculture and irrigation field are based on one of the most precious natural resource water.

In previously [2], the work has done with two modes but in this paper all three modes are merged.

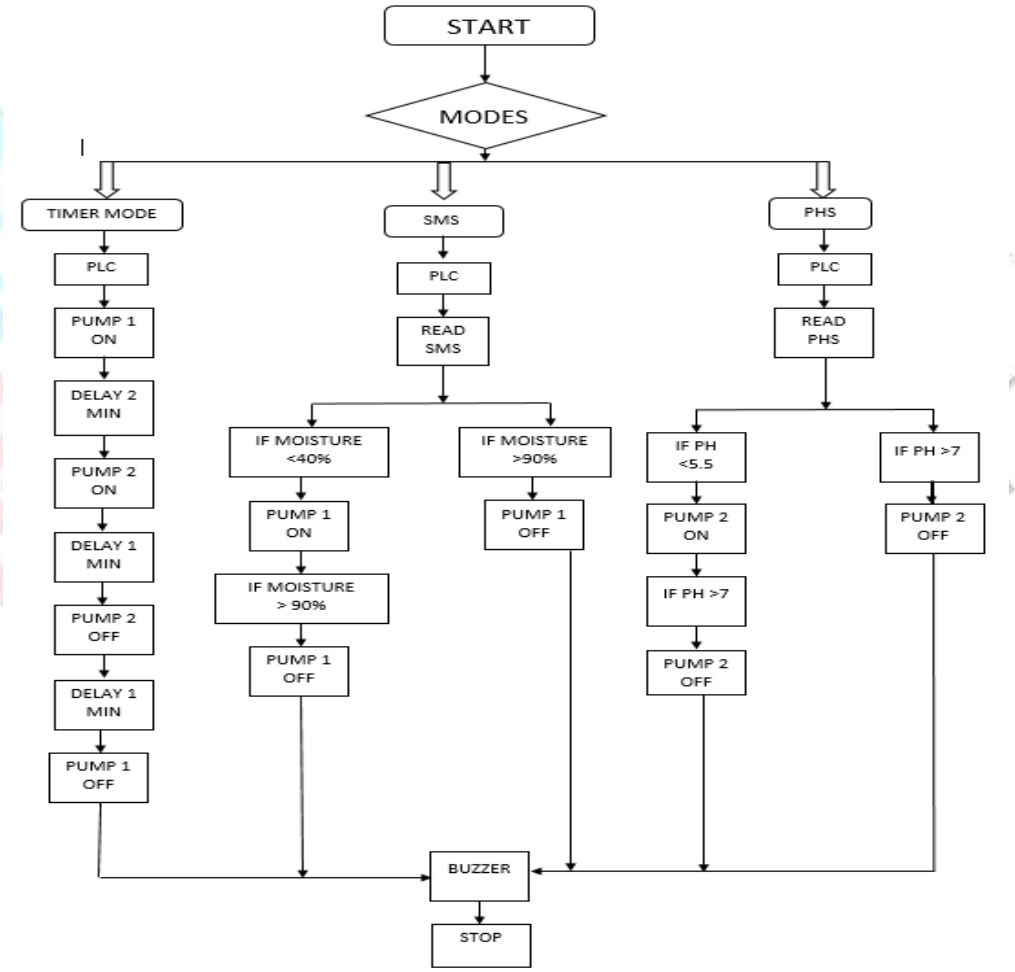
In previous papers pairs of mode use such as Timer mode & Moisture sensor modes, pH sensor mode & Moisture sensor mode and Timer mode & pH sensor mode. In this paper all three modes are combined the main advantage is to controlled the supply of water and fertilizer to the crop and save time and water & it improves the productivity.

Sensor will send the data to the PLC which will compare it with predefined value and depending upon the analysis the system will perform the task automatically.

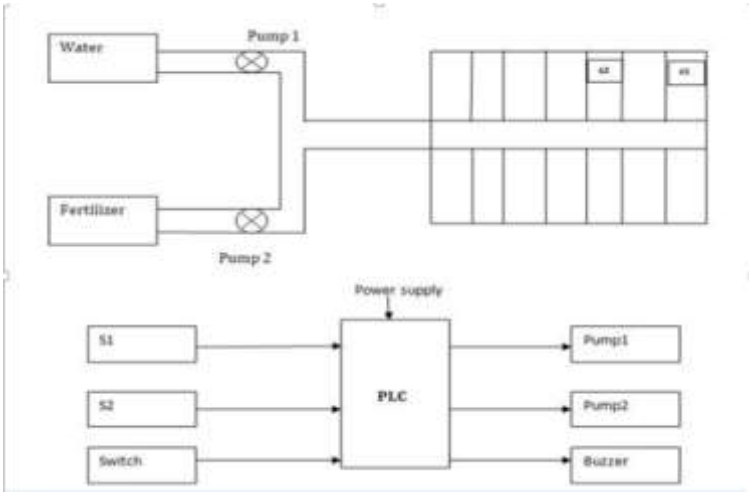
LITERATURE SURVEY

1. In [1], Vaishnavi Mantri et.al said "Automatic Drip Irrigation System Using Plc." the use of Drip Irrigation we can save water and fertilizer provided to the crops. This project is concentrated on developing an automatic drip irrigation system using plc. which is operated on two modes namely timer mode and sensor mode as per the convenience of farmer.
2. In [2], Weishun ma, Yan Wei, et.al said "Designed Of PLC Automatic Water and Fertilizer Integrated System ". This gives idea about hardware and software design idea of PLC & got idea about soil moisture and PH valve of soil
3. In [3], Shridhar Raja .D.et.al said "Application Of PLC In Agriculture for Irrigation & Fertilizer Sprinkling." This gives idea about from this we conclude about the version sensor and components required for projects.
4. In [4], Diksha s.Dalore et.al said "Automatic Irrigation Control System". This gives idea about controlling the system using the microcontroller.
5. In [5], B. Nandini "Automatic Irrigation System Using Plc." This gives an idea about controlling and building of project using PLC logic and benefits of using this technology in the field of agriculture.

II. FLOW CHART



III. BLOCK DIGRAM



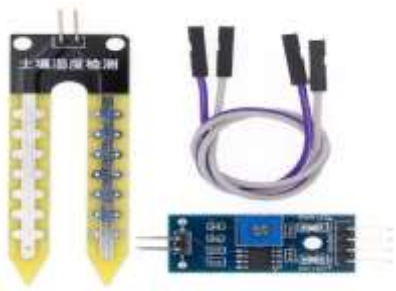
1. The block diagram with consist of 3 input and 3 output.
2. Sensor one (S1), sensor two (S2) and switch as input devices and pump one (P1) Pump 2 and buzzer is the output devices connected to PLC.
3. If the S1 sensory is operate the pump one is turns on and this pump is used for water supply.
4. If sensor S2 operate the pump 2 which is used for fertiliser turns on and in last the buzzer is used for the indication.

IV. SOFTWARE DETAILS

- Mitsubishi FX 3 PLC:

A programmable logic controller is unit of hardware used to control and automate the number of processes. It has many “input” terminals, through which it interprets “high” and “low” logical states from sensors and switches. PLCs are used in many machines, in many industries. It consists of many output terminals, through which output goes high and low for making the device turn ON and OFF. Here we are using Allen Bradley Micro-logix1400, series-B plc. Which has 20 digital input and 12 digital output to control our system. Also, it has 4 embedded analogs inputs, 2 embedded analog outputs and Maximum 7 I/O Modules used with a single controller.

- Soil moisture sensor :



Soil moisture sensors measure the volumetric water content of soil. Since the direct gravimetric measurement of free-soil moisture requires removing, drying, and weighing of a sample, soil moisture sensors measure the volumetric water content indirectly by using some other property of the soil, such as electrical resistance, dielectric constant, or interaction with neutrons, as a proxy for the moisture content. The relation between the measured property and soil moisture must be calibrated and may vary depending on environmental factors such as soil type, temperature, or electric conductivity. The relation between the measured property and soil moisture must be calibrated and may vary depending on environmental factors such as soil type, temperature, or electric conductivity. In this project the soil moisture sensor is used to manage the irrigation system more efficiently. The module uses LM393 comparator to compare to soil moisture level with the present threshold when the soil moisture deficit module outputs a high level and vice versa.

- PH value sensor:

A pH sensor helps to measure the acidity or alkalinity of the water with a value between 0-14. When the pH value dips below seven, the water starts to become more acidic. Any number above seven equates too more alkaline. Each type of pH sensor works differently to measure the quality of the water. PH level is an important indicator in many scenarios, especially in monitoring soil conditions and water quality. A pH sensor is widely used in farming, gardening, hydroponics, aquaponics, swimming pool and spas, sewage treatment, education, environmental monitoring, and many other applications.

- Solenoid Valves:
  - 

Water pump is a device which is used to pull out the water and the fertilizers from the water tank and fertilizer tank respectively. Here two pumps are used, one to provide water and other to provide fertilizer. The turning on and off of both the pumps are controlled by the plc.

V. SOFTWARE DETAILS

1. GX Works 2:

   GXWorks2 is a software package produced by Mitsubishi Electric to program its PLCs. It is a complete integration package that houses the configuration function of the intelligent function module and the simulation function needed for PLC programming. It uses mostly ladder logic programming language. GX Works 2 also uses Sequential Function Chart (SFC) language, Instruction List (IL), Function Block Diagram (FBD) and Structured Text (ST).

2. Ladder logic: -

Ladder logic is a programming language that represents a program by a graphical diagram based on the circuit diagrams of relay logic hardware. It is primarily used to develop software for PLCs used in industrial control applications. In this language resembles ladders, with two vertical rails and a series of horizontal rungs between them. In this project we are using ladder logic for programming our PLC in different modes. Namely Sensor mode.

VI. APPLICATIONS

The application of an automatic drip irrigation system using PLC (Programmable Logic Controller) can be wide-ranging and diverse, encompassing various fields of agriculture, horticulture, and landscaping. Some potential applications of an automatic drip irrigation system using PLC include:

1. Field Crops: PLC-controlled drip irrigation systems can be used in field crops such as grains, vegetables, fruits, and oilseeds. These systems can provide precise and controlled water and nutrient delivery to the plant roots, optimizing irrigation schedules based on crop requirements and environmental factors, leading to increased crop yields, water efficiency, and reduced labour.
2. Greenhouses: PLC-controlled drip irrigation systems can be used in greenhouses for controlled cultivation of crops. Greenhouses provide a controlled environment, and by integrating a drip irrigation system with PLC, farmers can precisely control irrigation parameters such as water flow rates, nutrient levels, and irrigation timing, tailored to the specific needs of the crops being grown, resulting in improved crop quality and yield.
3. Orchards and Vineyards: PLC-controlled drip irrigation systems can be utilized in orchards and vineyards to efficiently water trees or vines. These systems can be programmed to deliver water directly to the plant roots, reducing water wastage and promoting healthy growth. The precise control offered by PLC can be particularly useful in managing irrigation for different stages of plant growth, optimizing water usage, and improving fruit quality.
4. Landscaping and Gardens: PLC-controlled drip irrigation systems can be used in landscaping applications, such as public gardens, parks, and residential gardens. These systems can provide automated and efficient watering of plants, lawns, and shrubs, based on specific watering schedules and environmental conditions, resulting in well-maintained landscapes with reduced water usage and labour requirements.

5. Commercial Agriculture: PLC-controlled drip irrigation systems can be applied in large-scale commercial agriculture operations, such as farms, plantations, and nurseries. These systems can be designed for scalability, allowing for irrigation of vast areas of crops with precise control over water and nutrient delivery, resulting in increased productivity, reduced water waste, and improved resource management.
6. Urban Agriculture: PLC-controlled drip irrigation systems can be used in urban agriculture initiatives, such as rooftop gardens, vertical farms, and community gardens. These systems can be integrated with smart city technologies, allowing for remote monitoring and control, efficient water usage, and optimized crop production in urban environments.

In summary, the application of an automatic drip irrigation system using PLC can be diverse and extensive, spanning various agricultural and horticultural settings, and offering benefits such as increased water efficiency, improved crop yields, reduced labor requirements, and enhanced sustainability.

VII. FUTURE SCOPE

His future scope of an automatic drip irrigation system using PLC (Programmable Logic Controller) is vast and promising. With advancements in technology and increasing awareness about sustainable agriculture practices, automatic drip irrigation systems with PLC control are likely to play a crucial role in modern agriculture. Here are some potential future advancements and applications of automatic drip irrigation systems using PLC:

1. Smart Irrigation: PLC-controlled drip irrigation systems can be integrated with advanced sensors, weather stations, and other IoT (Internet of Things) devices to create smart irrigation systems. These systems can dynamically adjust watering schedules based on real-time weather conditions, soil moisture levels, plant needs, and other parameters. This can lead to more efficient water usage, reduced water wastage, and improved crop yield.
2. Precision Agriculture: PLC-controlled drip irrigation systems can be integrated with precision agriculture techniques, such as remote sensing, GIS (Geographical Information System), and data analytics. This can enable farmers to collect and analyse data related to soil quality, crop growth, water usage, and other factors, and make data-driven decisions to optimize irrigation schedules, fertilizer application, and pest management strategies, resulting in increased productivity and reduced costs.
3. Automation and Remote Monitoring: PLC-controlled drip irrigation systems can be automated and remotely monitored, allowing farmers to control and monitor their irrigation systems from anywhere using mobile apps or web-based interfaces. This can provide farmers with real-time visibility into their irrigation operations, allowing them to remotely monitor and control water flow rates, pressure, and other parameters, troubleshoot issues, and make adjustments as needed, saving time and effort.
4. Energy Efficiency: PLC-controlled drip irrigation systems can be optimized for energy efficiency by integrating with renewable energy sources, such as solar panels or wind turbines, to power the irrigation system. This can reduce dependence on fossil fuels and lower energy costs, making the system more sustainable and environmentally friendly.
5. Scalability and Flexibility: PLC-controlled drip irrigation systems can be designed to be scalable and flexible, allowing farmers to expand or modify their irrigation systems as needed based on changing crop types, field layouts, and water availability. This can provide farmers with the flexibility to adapt their irrigation systems to different crops, field conditions, and farming practices, resulting in more efficient and sustainable irrigation practices.
6. Enhanced Crop Quality: PLC-controlled drip irrigation systems can be fine-tuned to provide precise control over water and nutrient delivery, resulting in improved crop quality. By delivering water and nutrients directly to the plant roots in a controlled and consistent manner, drip irrigation systems can help optimize plant growth and development, leading to higher-quality crops with better taste, appearance, and nutritional value.

VIII. CONCLUSION

In this project we implemented our knowledge related plc. To develop process of Agriculture and we found that it is well beneficiary to farmer for its cop as well as land. In conclusion, the use of PLC (Programmable Logic Controller) in Smart farming Automation systems offers significant advantages for modern agriculture. PLC-controlled systems provide precise control over water and nutrient delivery, leading to efficient water usage, increased crop yields, and improved crop quality. Automation and remote monitoring capabilities allow for ease of operation and real-time adjustments, optimizing irrigation schedules and reducing labor requirements. Integration with advanced technologies such as IoT, precision agriculture, and renewable energy sources further enhances the potential of PLC-controlled drip irrigation systems. Overall, the future scope of Smart Farming systems using PLC is promising, with opportunities for increased sustainability, scalability, flexibility, and productivity in modern agriculture practices.

X. REFERENCES

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