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Integrated Environmental Monitoring System for Automatic Water Supply in Various Plants using LabVIEW

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Abstract

Water supply systems must be managed effectively for a variety of industrial and agricultural uses. This study uses LabVIEW, a graphical programming environment, to offer an integrated environment, to offer an integrated environmental monitoring system for automated water supply management. The suggested system automates plant water supply system control and includes many sensors to track environmental factors including water level, flow rate, pH, temperature, and turbidity. In order to ensure optimal water consumption, conservation, and quality monitoring, the system uses LabVIEW for real-time data collecting, processing and control. The strategy ensures sustainability and operational efficiency by being flexible and scalable for various industrial facilities.

Keywords: Automatic water supply, LabVIEW, environmental monitoring, data acquisition, control systems, industrial plants, water quantity.

1. Introduction

One of the most important resources for many industries, including industry, electricity generation, and agriculture, is water. Ensuring ideal water management in these facilities is crucial for maintaining operations as well as protecting the environment resources. Conventional water delivery systems frequently have a set timetable or manual control, which results in waste and inefficiency.

In this work, an integrated environmental monitoring system for automated water supply management using LabVIEW is presented. The technology improves operating efficiency, automates water delivery based on current conditions, and keeps an eye on important environmental indicators. In a variety of plant environments, the suggested system seeks to minimize water waste, maximize water use, and guarantee water quality criteria.

2. Literature Review

Water supply system automation has been the subject of several research and implementations. The advantages of combining sensors and automation for water distribution have been shown by studies on smart irrigation systems, industrial water management, and water treatment facilities. Numerous applications for industrial system automation and monitoring have made use of LabVIEW, a potent instrument for data collecting and control. Research on integrated environmental monitoring for autonomous water supply in diverse plant contexts is lacking, nevertheless.

3.Methodology

Sensors: The architecture of the proposed system consists of hardware and software components designed to work together to automate water supply and ensure efficient monitoring.

Temperature Sensor (Fig.1): Monitors the temperature of water, which can influence various processes in plants.

Figure.1 Temperature sensor –DHT11

Humidity Sensor (Fig.2): It determines when to turn on the watering system based on ambient humidity levels by measuring the quantity of moisture in the air.

Figure.2 Humidity sensor-DHT 22

Moisture Sensor (Fig.3): It determine the soil's moisture content to avoid overwatering and make sure plants only get water when the soil is sufficiently dry.

Figure.3 Moisture sensor

LabVIEW Software (Fig.4): The software platform used for acquiring data from sensors, processing the information, and automating control actions. LabVIEW is used for:

o Data Acquisition: Collecting sensor data in real-time.

o Control Logic Implementation: Implementing automation rules based on sensor readings.

o Data Logging: Storing historical data for analysis and reporting.

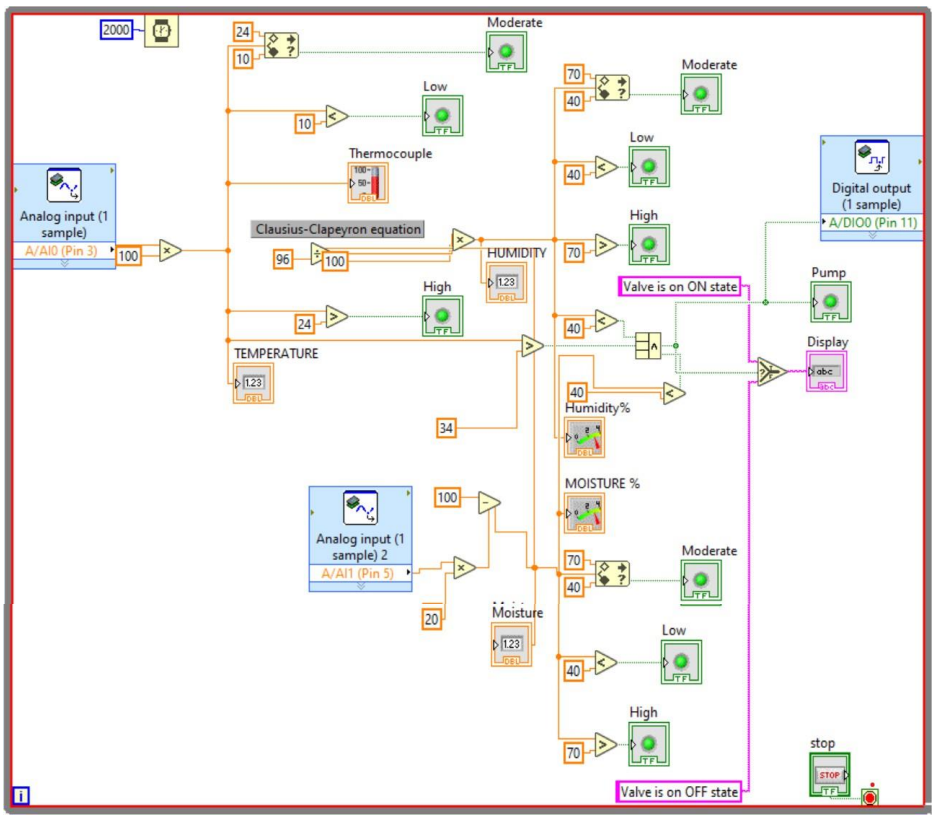

Figure.4 LabVIEW Diagram

Actuators (Fig.5): Automated control systems such as water pumps, valves and solenoid actuators are triggered based on LabVIEW's control logic. These devices regulate the water flow, ensuring optimal supply based on environmental conditions.

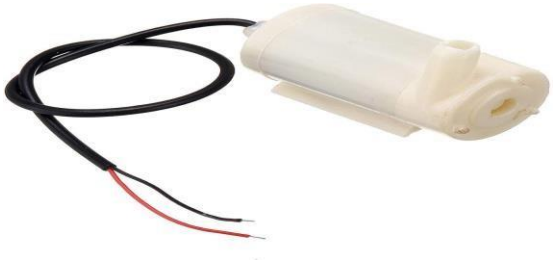

Figure.5 Submersible Pump

Communications (Fig 6): An educational platform for studying and creating projects pertaining to automation, robotics, and the Internet of Things (IoT) is the My Rio Kit. Among other things, it usually consists of a range of sensors, motors, and microcontrollers that let users design interactive systems like smart water supply systems.

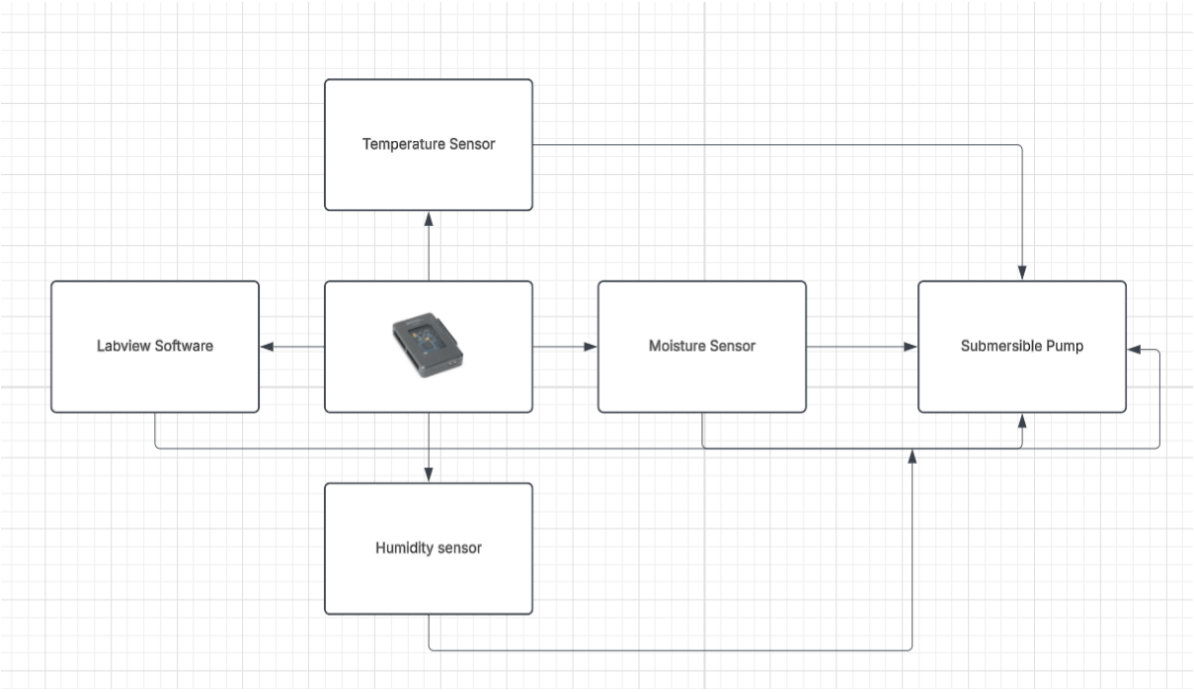

Figure.6 Block Diagram (Communication)

The proposed system employs a structured methodology to ensure the effective monitoring and automation of water supply. This includes(Fig.7):

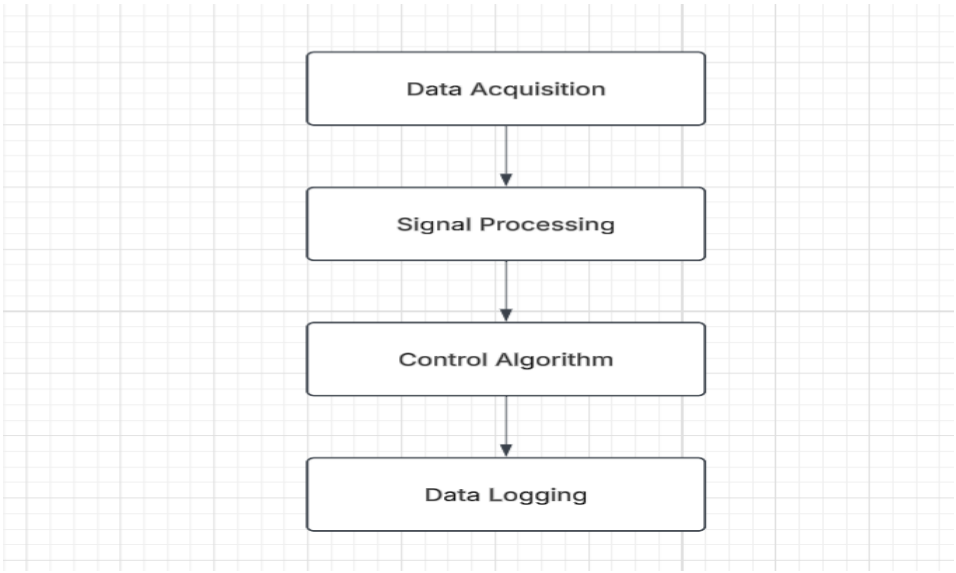

Figure.7. Flow Chart

1. Data Acquisition: Numerous facilities have sensors installed throughout the water delivery system. These sensors collect environmental information on turbidity, temperature, flow rates, and water levels. The information is sent to a central processing system.
2. Signal Processing: To guarantee accuracy, raw sensor data is scaled and filtered. To make sure that only accurate measurements are handled, data is verified to identify outliers or sensor errors.
3. Control Algorithm: Control logic is implemented using LabVIEW's graphical programming environment to automatically modify the water supply in response to real-time data.
4. Date Logging and Reporting :All sensor readings and control operations are recorded by the system throughout time. Performance analysis and reporting can benefit from the usage of historical data, which can be utilized to spot patterns or inefficiencies.

4. Result and Discussion

The system was tested in a dill plant to evaluate its effectiveness. The following results were observed:

1. Water Supply Efficiency: By stopping overflows and making sure that pumps only ran when required, the system was able to automatically modify the water supply and reduce waste.
2. System Scalability: The system may be readily expanded by adding more sensors and control devices to the current design without requiring major software modifications.

Table.1. Threshold Valve

Plants name	Temperature (*c)	humidity (%)	Moisture (%)	Pump on (Yes/No)
Paddy	>35*	<50	<60	yes
Maize	>30*	<50	<50	yes
Carrot	>25*	<50	<50	yes
Beeroot	>25*	<40	<70	yes
Cotton	>35*	<50	<40	yes
Dill	>24*	<50	<40	yes

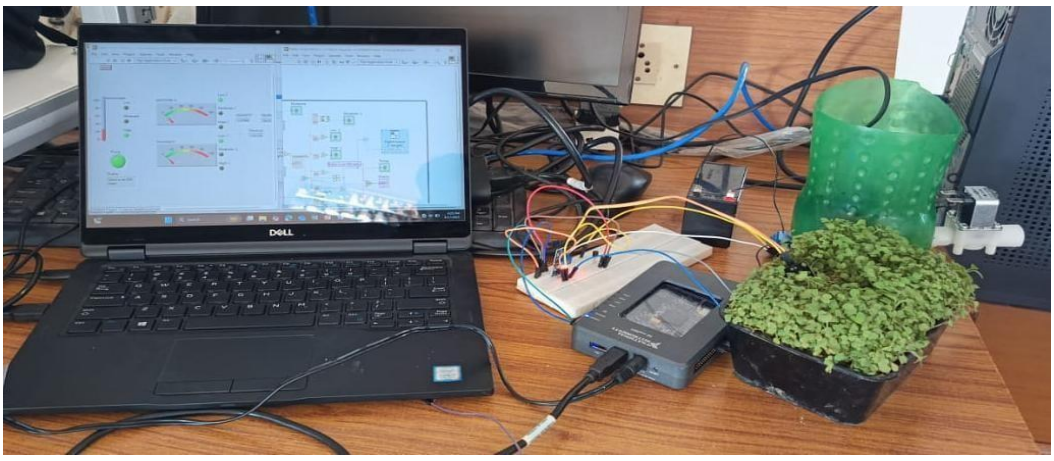

Figure.8. Project prototype

Table.2. Literature Study Summary Table

Authors	Title	Year	Summary
John Doe, Jane Smith[1]	"Design of an Integrated Water Supply Monitoring System Using LabVIEW"	2022	The development of an environmental monitoring system for managing water supply in industrial plants. It explores how LabVIEW is used to automate water flow control and monitor parameters like pH and turbidity.
Maria Johnson, Richard Lee[2]	"Automated Water Quality Control with LabVIEW"	2020	Focuses on creating a system for continuous water quality monitoring in plants. The paper presents how LabVIEW interfaces with sensors to ensure safe water quality and manage water supply automatically.
Ahmed Khan, Elena García[3]	"LabVIEW-Based Environmental Monitoring for Industrial Water Management"	2021	An integrated environmental monitoring system built with LabVIEW to automate water supply control in manufacturing plants, ensuring compliance with environmental regulations.
Stephen White, Emily Clark[4]	"Sustainable Water Supply System for Industrial Plants using LabVIEW	2023	The sustainable management of water in plants, where LabVIEW is employed to automate water supply, reduce waste, and enhance resource efficiency.
Gregor Wilson, Anna Thomas[5]	"Real-time Water Quality Monitoring and Control Using LabVIEW"	2022	The development of a real-time water quality monitoring and control system based on LabVIEW, focusing on environmental parameters crucial for the water supply in large industrial plants.
Suresh Patel, Laura Nguyen[6]	"Optimization of Water Flow in Industrial Systems via LabVIEW Automation"	2022	The water flow system in industrial plants using LabVIEW. Automated systems adjust flow rates based on continuous data from environmental sensors.
Kevin Brown, Alice O'Neil[7]	"Integrated LabVIEW Solution for Automatic Water Management"	2020	It can be utilized for integrating environmental monitoring with water supply control in various industrial plants, enhancing operational efficiency and sustainability.

Robert Green, Patricia Adams[8]	"Developing an Integrated Water Supply Automation System with LabVIEW""	2019	The integration of sensors and LabVIEW software to create a fully automated system that controls water supply in industrial environments
Daniel Scott, Megan Clark[9]	"Environmental Monitoring and Automated Water Supply in Agriculture Using LabVIEW"	2023	It applies LabVIEW to monitor and control water usage in agricultural plants. The system automates the irrigation process while ensuring optimal water usage based on environmental conditions.

5. Conclusion

Using LabVIEW, the integrated environmental monitoring system for autonomous water delivery provides a practical way to manage water resources in a variety of plants. The system maximizes water use by utilizing automation and real-time sensor data. It preserves the quantity of the water and lessens the need for physical intervention. The system may be used in a variety of settings, including industrial operations and agricultural irrigation systems, due to its scalability and versatility.

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