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Automatic Pressure Monitoring and Pipeline Protection for Irrigation

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***Abstract*— As India is one of the Agro-based countries, most of the water resources are depleting by means of inefficient irrigation methods. In addition to this, farmers' negligence in operating irrigation systems has led to the damage of irrigation systems. In this work, we have created a prototype to prevent system damage due to overpressure and make the farmer aware of the issue. The pressure sensor is installed at the outlet and continuously monitors the pressure. The Arduino collects the data from the digital pressure sensor and converts it into pressure value and displays it on the LCD. The saturated value can be set using a keypad and when the measured pressure value exceeds the saturated value, it cut off the supply power to the motor using a contactor. The contactor is controlled using a relay drive. This system protects the irrigation system from damage and prevents the wastage of cost and water.**

Keywords— irrigation, Pressure sensor, Arduino NANO, Relay Driver, IoT

I. INTRODUCTION

Irrigation is one of the most indispensable things in agriculture. In the age of advanced technology and electronics, we have developed many automated systems to make the irrigation process more efficient and simpler. However, in some instances, there may occur some damage in the supply system due to the carelessness of farmers and some clogs in the pipes. It results in an irrigation delay since it takes some time to fix it. In this project, we have come up with a solution for solving issues related to the damage of pipes due to over-pressure.

II. EXISTING METHOD

To match the pressure set point the valve decrease the pressure value, opening as the pressure falls and closing as it rises. Pressure relief valve is made in such a manner, as it opens when the pressure inside the pipe exceeds the saturated point. In current methods such as pressure reducer and pressure regulator, there is a possibility of cracking of pipes beyond these devices. No over Pressure alert system in the current system. Due to this, it result in damage in the supply system. There is also a wastage of water in the pressure relief valve method. In the existing system, if pressure exceeds than the prescribed limit then the pipe lines and the entire systemmay damage due to over pressure.

III. LITERATURE REVIEW

Kazeem B et al [1] has proposed their work on Burst Leakage-Pressure enslavement in Water Piping Networks. The special effect of Pressure Dependency on

Leak Openings in Water Piping Networks Using a leaking model from the literature, this study explores the effect of changing water pressure on leak holes in a pipe. The nature of different pressure dependence on its various leakages was also investigated in this paper. The cause of pressure fluctuation is more prominent on leak holes with shape of rectangular, as evidenced by the fact that the cause of variation in pressure is more prominent on them.

Chuang Yu et al [2] has proposed their work on fuzzy Intelligent technique for Irrigation System Control. The simulation demonstrates that fuzzy control may be used to provide intelligent irrigation system control. Intelligent algorithms are employed to manage the inverter to achieve consistent water pressure using the pressure feedback input from each nozzle. It may serve several objectives, including energy conservation, water conservation, and improved irrigation efficiency.

Wegelin et al [3] has proposed their work on completion of pressure managing in municipal water supply systems. According to the findings of the three case studies covered in this paper, pressure management is very effective in many aspects and may be done successfully on a broad scale in specific areas.

Aktham Hasan Ali et al [4] has proposed their work on IoT based smart monitoring system to support pressure regulator. In this, a replacement made for pressure controller to monitor the pressure using on IoT was used. The communication was create between the Thing Speak server and also the Node MCU to regulate the pressure, monitoring the pressure transducers and controlling the systemreference.

Lu Chao Chen Lisheng et al [5] has proposed their work on monitoring system with smart IoT based regulator. The system control platform realizes real-time field data collection and monitoring of field working status.

IV. IMPLEMENTATION STRACTURE

Here we have a pressure detector that is connected to the Arduino and continuously checks the water flow pressure [6] The contactor is controlled by the Arduino

through a relay instruction that counts the pressure at the output. The input device is used to line the saturation pressure price that the Arduino determines the atmospheric pressure, and the alarm is used to warn of the atmospheric pressure [7] The pressure price is displayed to the user on an LCD panel.

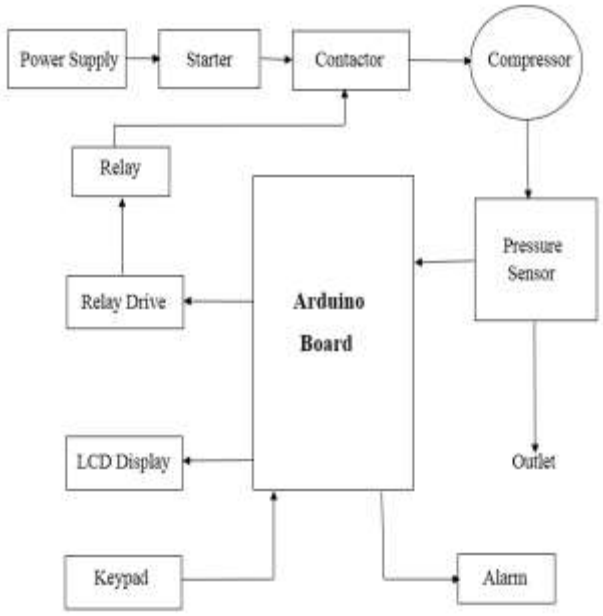

Fig. 1. Block Diagram of the System

V. WORKING PRINCIPLE

A pressure sensor is installed at the outlet of the compressor. It measures the pressure value of the air in the outlet pipe [8] A valve is connected at the end of the pipe setup to vary the pressure of the air the pipe. Initially, the valve is in open condition and the pressure value measured is normal.

The saturation pressure value can be set using the keypad. When the valve is closed slowly, the pressure value measured by the sensor keeps on increasing correspondingly. Once the measured pressure value exceeds the set value, the Arduino senses the overpressure and as a result, the relay is turned off, which in turn turns off the contactor. Therefore the compressor gets turned off and produces the buzzer sound which indicates the Over pressure in the outlet.

Thereby it prevents any damage that occurs due to the overpressure in the system and ensures the safety of the system[9].

VI. HARDWARE IMPLEMENTATION

In this artical to monitor of the pressure continuously and prevent damage to the system caused by overpressure [11]. This is a prototype model which demonstrates the same process by monitoring the air pressure using air pressure sensor [12] In this work, ARDUINO NANO ATMEGA328 was implemented.

The technical specifications of the Arduino controller as specified by the Table.1. Arduino senses the overpressure by connecting the sensor and UNO ground pins were connected. Similarly, 3.3 V fed to Vcc and UNO board. The serial clock and data such as SCL and SDA UNO connect with corresponding sensor pins.

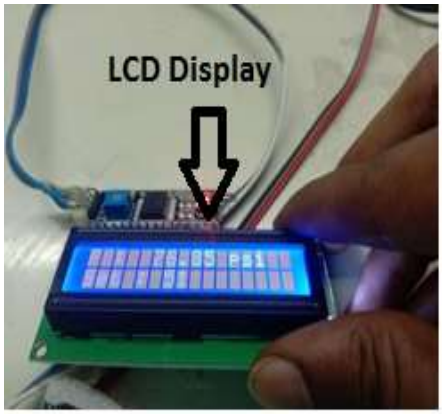

Fig. 2. Pressure Valve Measured and Set Value in LCD

Pressure sensor and the saturation pressure value set by the user are displayed. i.e., in the first row, 76.85 PSI is a pressure value measured by the sensor and in the next row, 51 PSI is the set value of pressure. Here, PSI means Pounds per Square Inches which is used to indicate the pressure of the pipe. The set value that we have to fix, is based on the pressure capacity of the pipes that vary for different dimensions.

TABLE I. ARDUINO SPECIFICATIONS

Parameter	Range
Microcontroller	ATmega328
Voltage	5 V
Clock Speed	16MHz
I/P Voltage range	7 to 12 V
Pins of Digital I/O	22
PWM O/P	6
Size of the PCB	18 x 45 mm

In the Fig 3, the measured pressure value is lesser than the set value. Therefore the pressure is normal and the relay is in ON state which is indicated by the glowing of led in it.

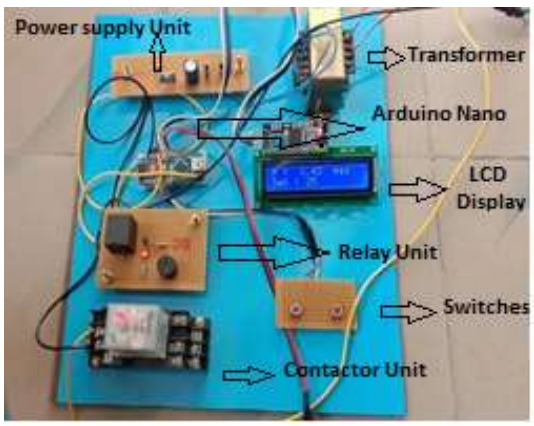

Fig. 3. Pressure Below the Set Value

In the Fig 4, the measured pressure value exceeds the set value. Therefore, Arduino senses the over-pressure and turn OFF the contactor using relay. Here contactor and relay is in OFF state which is indicated by the state of LED.

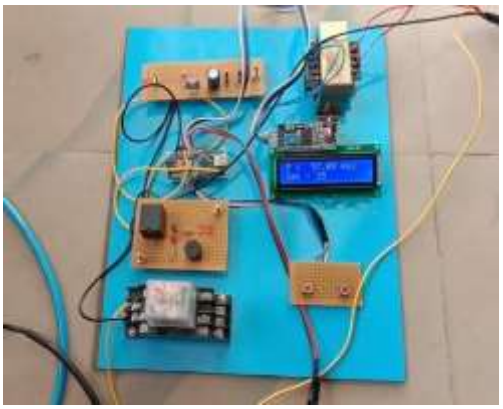

Fig. 4. Pressure Above the Set Value

VII. CONCLUSION AND FUTURE SCOPE

This system prevents the damage in the Water distribution pipes due to over pressure and reduces the human interference in checking of the pressure as often as needed. This system helps to avoid the delay occurs in irrigating crops and saves the time taken to fix the issues that occur due carelessness of farmers. This will also use to monitor the flow and pressure of the water output and used to determine the efficiency of the motor and pumps. The damages due to the blockage of water in water filters and mismatch of gate valve can be prevented. Energy expenses, system maintenance, and water loss may all be reduced using pressure monitoring. By measuring the pressure at the beginning and end of the pipeline, this technology may also be used to determine pipeline leakage over a long distance. For both over and under pressure scenarios, a warning systemmay be created.

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