Design of Automatic Irrigation System Using Labview

S.Ramachandran[1], R.Ranjani[2], R.Preethii[3], S.Jerine Sumitha[4]
[1, 2, 3, 4] Department of Instrumentation & Control Engineering
[1, 2, 3, 4] Saranathan College OF Engineering,Trichy-620012,India

Abstract- *The aim of the paper is to promote the contribution for the green house plants production development. The system gives the solution by using the LabVIEW which is user friendly to automate the irrigation process in the green house. The irrigation process is done automatically using the LabVIEW software. The irrigation process must take place for the selected period of time. LabVIEW is a visual programming language. It is a system design platform and development environment. In LabVIEW, the current time and date in seconds from the computer is received in the block diagram panel. The time is converted into cluster of time values. The time chosen by the user to start the irrigation process is compared with the system time. When the time from the computer equals the initial time given by the user the irrigation process gets started. In a tank, water and fertilizer is mixed. The motor with the blade arrangement is used to mix the fertilizer with water. When the mixing tank less than the set point and the initial time equals to computer time then the solenoid valve operation gets started.*

Keywords- *Irrigation, LabVIEW, myRIO.*

I. INTRODUCTION

Cultivating the plants is both art and science. Most of the plants and crops are grown in an open field. Since it is possible to grow them in natural environmental conditions. Some exceptional plants also exist which cannot be grown in an open field. So man has developed green house technology used to grow the plants in temperate regions where the climatic conditions are very cold.

Irrigation process plays a vital role in crop production. Performing the irrigation process in proper timing is very important factor for crop production. Automating the irrigation process provides the potential to the usage of water efficiently. The proposed system provides the water to plants for the given period of time. The whole irrigation process is controlled by the conditions given in the block diagram panel of LabVIEW software. LabVIEW is the combined form of both the customised software and modular hardware. It is used to create user defined measurement system which are generally used for data acquisition, industrial automation, controlling instruments and on various platform. LabVIEW is beneficial because of its feasible interfacing property.

II. PROCESS EXPLANATION

(i) WITH FERTILIZER

Water from the water tank flows to the mixing tank through the solenoid valve.MyRIO generates the voltage to the solenoid valve. When the voltage is generated, the solenoid valve opens and when zero voltage is generated, the solenoid valve gets closed. Thus the LabVIEW is used to automate the ON/OFF control of the solenoid valve.

In the mixing tank, fertilizer is mixed with water. DC motor with blade arrangement is used to perform the mixing process. Level switch is used to indicate the amount of water on the mixing tank. Two level switches hav been used to indicate the upper and the lower level of the tank. When the level of the water and fertilizer reaches upper level of the mixing tank, the level switch generates voltage which in turn is fed to the myRIO. Then the solenoid valve is closed. The motor acquires the voltage generated by the level switch and the mixing process is started. The mixing process takes place for a particular period of time (e.g. 15 seconds)(ensuring the mixing process is completed).The motor stops automatically and the myRio generates the voltage to run the DC pump. The DC pump is used to equalise the flow from the mixing tank to all the plants in the green house. The process is diagrammatically explained in the following section.

(ii) WITHOUT FERTILIZER:

It is same as the previous mode except that fertilizer is not used. Fertilizers are not used every day for the plants. They are always irrigated with water. Water from the tank flows through the flow sensor and solenoid valve to the mixing tank. Mixing operation is not needed in this mode as fertilizer is not used. When the water level in the mixing tank reaches the upper level, a voltage is generated by the level switch which is fed to the myRIO, which makes the solenoid valve closed. At the same time, the DC pump is switched ON which waters the plants.

III.PROCESS FLOW DIAGRAM

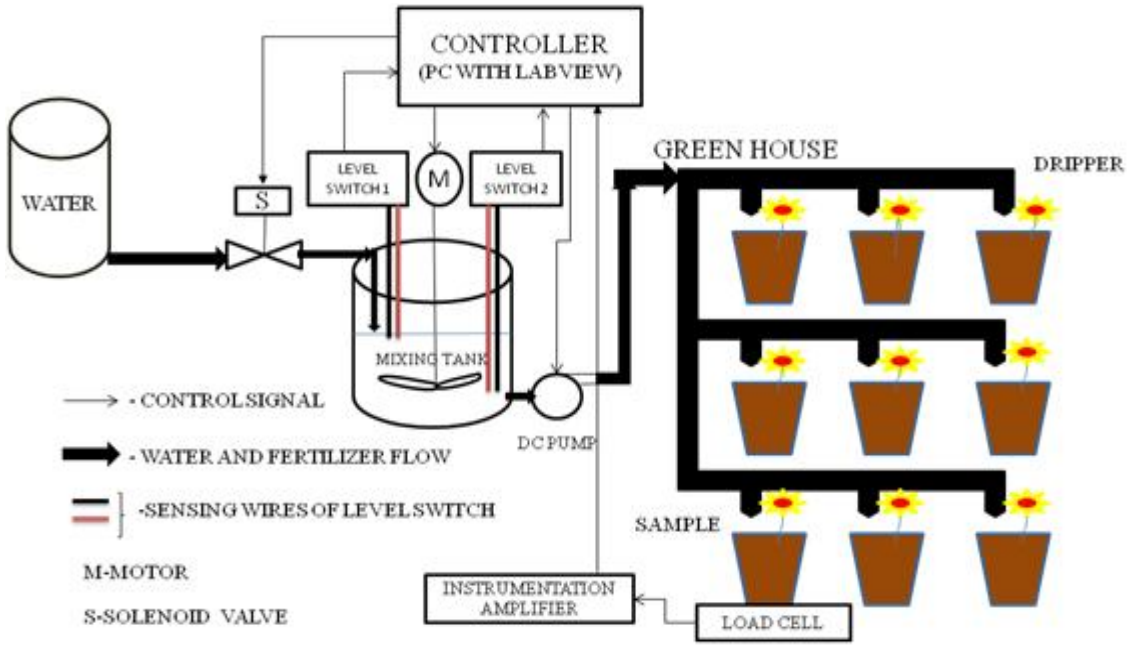

FIG-1 PROCESS FLOW DIAGRAM

The above figure shows the entire irrigation process taking place in green house with the help of the system explained above.

IV. HARDWARE COMPONENTS

SOLENOID VALVE: A solenoid valve is an electromechanically operated valve. The valve is controlled by the electric voltage through a solenoid. In our application, solenoid valve is used to control the flow of water from the water tank to the mixing tank. It is controlled by digital output through LabVIEW. A 24V solenoid valve is used in the application with a relay circuit.

When the digital output is switched to ON state, then the solenoid valve opens and when the digital output it is switched to OFF state, the solenoid valve closes.

The level switch given is implemented to sense the level of water reached in the mixing tank. As the presence of level is indicated, the motor turns ON to start the mixing process.

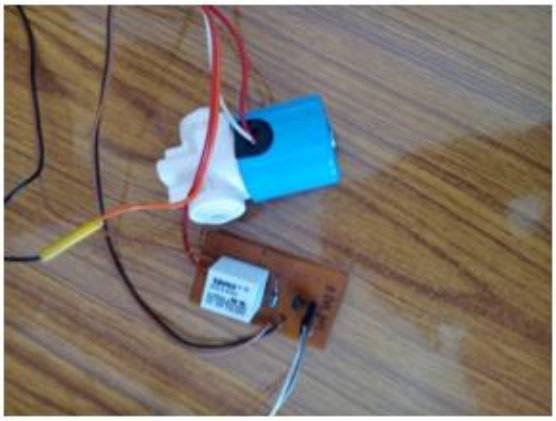

FIG-2 SOLENOID VALVE WITH RELAY CIRCUIT

LEVEL SWITCH: A level switch is a device which is used to detect the level of the liquid within a tank. The level switch circuit is designed by using NOT Gate (7404). The input voltage is given to the pin 5 and pin 14 of the NOT Gate and pin 7 is grounded. Two wires are fixed at a certain limit in the tank to sense the presence of water. As the water level is reached and the contact is made because of the water and the output voltage is attained.

The level switch given is implemented to sense the level of water reached in the mixing tank. As the presence of level is indicated, the motor turns ON to start the mixing process.

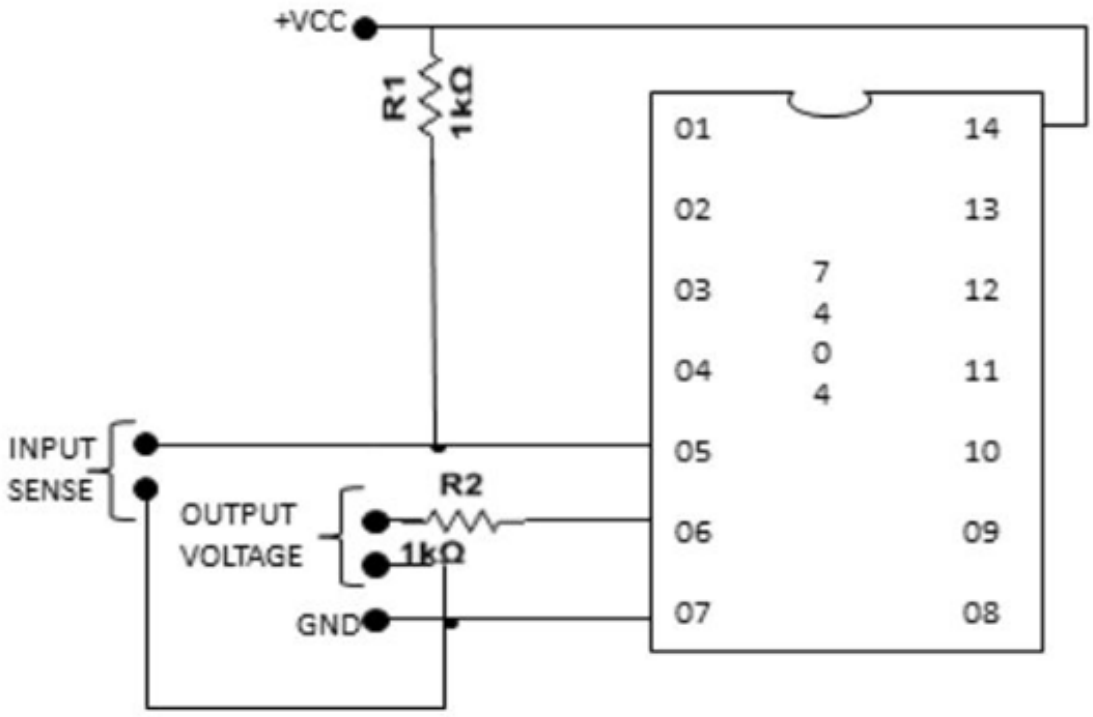

FIG-3 CIRCUIT DIAGRAM OF LEVEL SWITCH

DC MOTOR: The DC motor is used for mixing the fertilizer with water. The motor is attached with a mixing blade arrangement to ensure the proper mixing of the fertilizer with water. It is controlled by digital output through LabVIEW. When the digital output is switched to ON state, then the motor operates and when the digital output it is switched to OFF state, the motor stops.

A motor driver circuit is used to connect myRIO with the motor. It acts as an interface between the myRIO and the motor. Motor generally require a high current for operation which cannot be directly supplied from myRIO. Hence a motor driver is used . It is a high voltage, high current dual full-bridge driver designed to accept standard TTL logic levels and drive inductive loads such as relays, solenoids, DC and stepper motors.

When the digital output is switched to ON state in LabVIEW, the myRIO provides an voltage of 5V to the driver circuit which makes the motor to operate. When the digital output is switched to OFF state, the voltage to the motor driver circuit is not provided which in turn switches OFF the motor.

FIG-4 PCB LAYOUT OF MOTOR DRIVER CIRCUIT

DC PUMP: The DC pump is a device which has a sealed motor close-coupled to the pump body. In our process, it is used for equalising the flow of water from the mixing tank to the plants. When the pump is switched ON, it pumps the fluid from the mixing tank to the plants.

It is controlled by digital output through LabVIEW. When the digital output is switched to ON state, the DC pump operates and when the digital output it is switched to OFF state,the DC pump also stops pumping.

FIG-5 PICTORIAL REPRESENTATION OF DC PUMP

V. EXPLANATION OF VI

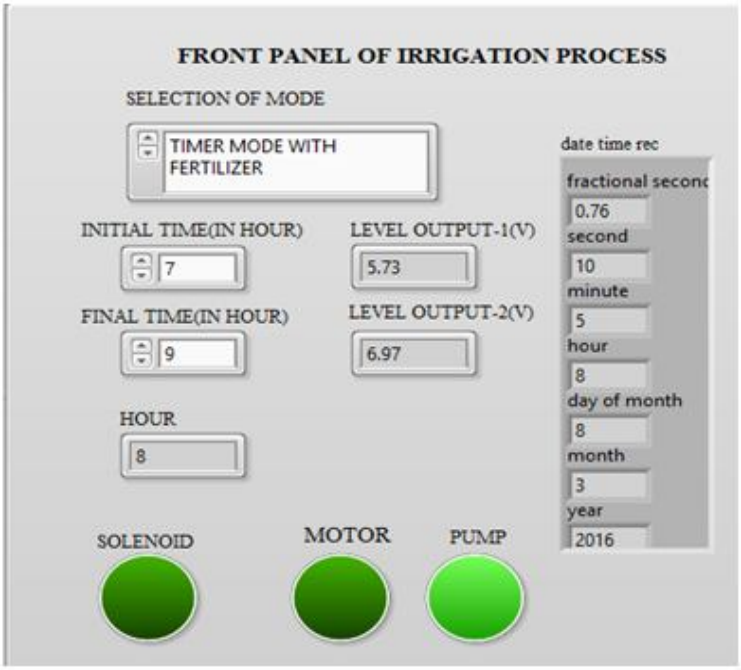

FIG 7-FRONT PANEL OF THE VI

The LabVIEW front panel of the process is as shown above. At first, the mode of operation has to be selected. An enum control is provided to select the mode of operation to be performed. An enum is a special type of data type in LabVIEW which acts as string data type to the user and an integer to the system. The mode of operation is programmed with the help of case structures. The case structure executes only the case which has been selected. As of now, there are two cases-TIMER MODE WITH FERTILIZER AND TIMER MODE WITHOUT FERTILIZER, which are selected with the help of an enum control. The initial time and the final time has to be specified by the user. The plant is irrigated only between the time intervals. The time interval can be given as seconds, minutes or even hours depending upon the practical application. As soon as the system time reaches the initial time specified, the process is started.

This mode of operation uses water and fertilizer to irrigate the plants. TIMER MODE WITH FERTILIZER is selected in the enum control. When the system time reaches the initial time specified the operation starts. At first the level in the mixing tank is checked and when it is below the set point, the solenoid valve is opened by sending signals via myRIO. When the level of the mixing tank reaches the upper level, a voltage is generated which is taken to the system with the help of myRIO. Now the solenoid valve is closed and the motor is made to operate.

The motor with the mixing blade rotates to perform the mixing operation which is performed only for a particular time (assume it to be 10s). After the mixing operation is performed, the motor is stopped and the DC pump is turned on so that the water fertilizer mix is given to the plants.

(i) TIMER MODE WITH FERTILIZER:

The above process is repeated till the final time is reached. The process is made repeated with the help of flat sequence. When the system time reaches the final time specified the process gets stopped automatically.

The solenoid valve, motor and the DC pump are represented by LEDs to check the process operation from the system itself.

(ii) TIMER MODE WITHOUT FERTILIZER:

This mode of operation uses only water to irrigate the plants. Fertilizers are not used as they are not needed every time. TIMER MODE WITHOUT FERTILIZER is selected in the enum control in the front panel. When the system time reaches the initial time specified the operation starts.

The level in the mixing tank is checked and when it is below the lower level switch, the solenoid valve is made open. When the level of the mixing tank reaches the upper level, a voltage is generated which in turn is taken to the system with the help of myRIO. Now the solenoid valve is closed.

As soon as the solenoid valve is closed the DC pump is operated which irrigates the plants. The above process is repeated until the system time reaches the final time. Motor is not operated in this mode as mixing of water and fertilizer need not be done as in the case of TIMER MODE WITH FERTILIZER.

VI. CONCLUSION

Thus the automatic irrigation system for the green house plants has been designed using LabVIEW. This system serves to be a cost efficient and user friendly which also provides efficient water and fertilizer control. The irrigation process starts only during the initial time specified and the process is continued till the final time is reached. The time duration of the irrigation and the mode of operation to be performed is user defined which increases the effectiveness of the system.

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