Monitoring and Control System for Irrigation System

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Abstract: **Food production techniques have to be improved because of rapid demand in food. Since India has agriculture as the main source of production, proper irrigation schemes are to be employed for an efficient outcome. Water insufficiency has been a great issue for agriculture.**

This design automates the irrigation process thereby reducing the manual interference and the water losses. It is more useful in the places where water scarcity is seen more. It consists of two sensors which takes the values of temperature of atmospheres and moisture level of soil. Output of these sensors are given to microcontroller. Microcontroller compares the values with the threshold values and drives the relay which controls the motor. LCD display is used to display data in the field. The design is cost effective and also affordable.

Keywords: **Agriculture, Irrigation, Sensors, Microcontroller, LCD Display, etc.**

I. INTRODUCTION

As the world population increases there is an increasing demand of food production because of which agriculture became vital. In the area of agriculture, using an efficient method of irrigation is important. Designing a system capable of fully automating the irrigation process helps in reduction of human intervention and water wastage. [1]

Agriculture is the foundation of our country. India is an agrarian nation where the majority of the populaces rely upon agribusiness. Investigation in farming is pointed towards expanding efficiency and profit. There are several automated systems already available which are developed for irrigation control and environmental monitoring in the field. Hence this project aims to monitor the plant growth and take decisions accordingly. [3]

In an advanced agriculture the consumption of water is very high. Due to the developments in technology, efforts are being channeled into automation of irrigation systems to facilitate remote control of the irrigation to optimize crop production and cost effectiveness. In agriculture field, the current agricultural practices need to intensify the rate of food crop production for the rate of population growth with available resources. Irrigation is the process of artificially supplying water to land where crops are cultivated. Traditionally hand pumps; canal water and rainfall were a major source of water supply for irrigation. At present, the requirement of water is growing at more than twice the rate of population increases. Due to the shortage of water resources, there is a need for water saving irrigation technology for agriculture. The dry regions having very little amount of water and that has to be utilized very efficiently. In conventional water irrigation system the wastage of water is very high. Therefore, the conventional method can be replaced by drip irrigation technology. [4]

So, the proposed system is more useful in the places where water scarcity is seen more. It consists of two sensors which takes the values of temperature of atmospheres and moisture level of soil. Output of these sensors are given to microcontroller. Microcontroller compares the values with the threshold values and drives the relay which controls the motor. LCD display is used to display data in the field. The design is cost effective and also affordable.

II. METHODOLOGY

The block diagram below briefly explains the design of the system. As the first step, temperature values of surroundings, moisture level of different soils and PH of soil is noted down at different times for 1 complete day. Then mean and standard deviation of the values were calculated and the threshold value for moisture was taken as 70% and that for temperature is 40°C.

LM35D is the temperature sensor used that measures the temperature of surroundings and the soil moisture sensor that measures the moisture level in soil. Outputs of sensors are given to microcontroller.

Microcontroller compares the input data with the threshold values. If the input value of moisture is less that 70% irrespective of temperature, motor will be ON. If the input temperature is more than 40°C, motor is ON. This ON and OFF of motor is done through relay which acts as switch. Another is the water level sensor is used which monitors the water in the tank. If the tank is empty then pressure relief valve is off and tank is overflow then pressure relief valve is open. Simultaneously the temperature, moisture, PH values are displayed using a 16×2 LCD display.

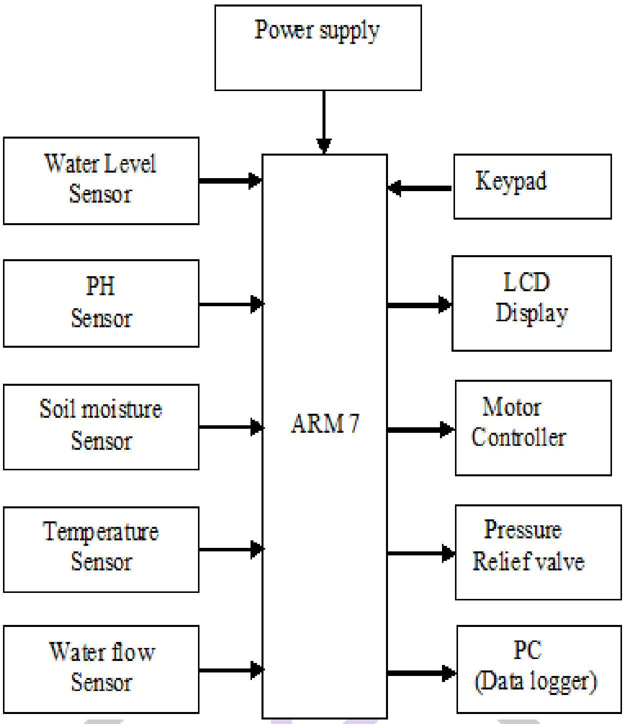

Fig 1. Block Diagram of Design

III. HARDWARE IMPLEMENTATION

- ARM 7 Microcontroller –

An ARM processor is one of a family of CPUs built on the RISC construction developed by Advanced RISC Machines (ARM). ARM makes 32-bit and 64-bit RISC multi-core processors. RISC processors are designed to perform a smaller number of types of computer instructions so that they can operate at a higher speed, performing more millions of instructions per second (MIPS). By stripping out unneeded instructions and optimizing pathways, RISC processors provide outstanding performance at a fraction of the power demand of CISC (complex instruction set computing) devices.

ARM processors used in electronic devices such as smartphones, tablets, multimedia players and other mobile devices. Because of their reduced instruction set, they require fewer transistors, which enables a smaller die size for the integrated circuitry (IC). The ARM processor's reduced size, reduced complexity and lesser power consumption marks them appropriate for gradually miniaturized devices.

ARM processor features include:

i. Load/store architecture.
ii. An orthogonal instruction set.
iii. Mostly single-cycle execution.
iv. Enhanced power-saving design.
v. 64 and 32-bit execution states for scalable high performance.
vi. Hardware virtualization support.

- Water level sensor –

Water level sensors detect the level of liquids. The substance to be measured can be inside a container or can be in its natural form (e.g., a river or a lake). The level dimension can be either nonstop or point values. Continuous level sensors measure level within a specified range and determine the exact amount of substance in a certain place, while point-level sensors only indicate whether the substance is above or below the sensing point. Generally the latter detect levels that are excessively high or low.

- PH sensor –

PH Sensors are used to measure the nutrient content in the soil required for irrigation. The pH of soil is an important factor in determining which plants will grow because it controls which nutrients are available for the plants to use. Soils with pH upstairs 7 are basic or sweet. Soils with pH under 7 are acidic or sour.

- Soil / Moisture sensor –

Soil moisture sensor sense the soil volumetric of water content based on the dielectric constant (soil bulk permittivity). The soil dielectric constant and water content are directly proportional. So dielectric constant increase the water content is also increased. This process is due to the dielectric constant of water that has larger soil component than the other soil components, including air. It consists of a pair of electrodes that used to measure the resistance of the soil. Higher the resistance and lower the moisture content of soil.

- Temperature sensor –

LM35 is the temperature sensors used to measures the ambient temperature. Output voltage of LM35 is directly proportional to the centigrade/Celsius of temperature. The LM35 does not need external calibration or trimming to provide accurate temperature range.

Its operating temperature is -55^0c to $+150^0$c. It is low cost and gives low impedance output. The mechanical damage of sensor is protects by using sensor enclosure and membrane that filter to protect the sensor from dust, dirt, and water spray.

- Water flow sensor –

Water flow sensor contains of plastic valve frame, a water rotor, and a hall-effect sensor. When water flows through the rotor, rotor rolls. Its speed changes with different rate of flow. The hall-effect sensor outputs the corresponding pulse signal. This one is suitable to detect water flow.

- LCD (16 x 2) –

Here the LCD screen is used to display the values of soil moisture and temperature of surroundings so that the farmer is updated about the status of soil. It is also used to display the status of the motor. It works at both transmitter side and receiver side. In this design, we are using a 16×2 display which requires only 11 connections – eight bits for data and three control lines (we have only used two here). It operates at 5V DC supply and only needs about 1mA of current.

IV. LABVIEW ARM INTERFACE

The LabVIEW Embedded Module for ARM Microcontrollers is a comprehensive graphical development environment for embedded design. Jointly developed by Keil. An ARM Company and National Instruments, this module seamlessly integrates the LabVIEW graphical development environment and ARM microcontrollers. You can lower development costs and achieve faster development times by using the Embedded Module for ARM Microcontrollers to program ARM targets.

This module builds on NI LabVIEW Embedded technology, which facilitates dataflow graphical programming for embedded systems and includes hundreds of analysis and signal processing functions, integrated I/O, and an interactive debugging interface. With the Embedded Module for ARM Microcontrollers, you can optimize linking and view live front panel updates using JTAG, serial, or TCP/IP. The Embedded Module for ARM Microcontrollers includes the LabVIEW C Code Generator, which generates C code from the LabVIEW block diagram.

V. SOFTWARE IMPLEMENTATION

The software module that is integrated in developing the graphical program structure is Lab-VIEW 2013. It include the block diagram which is the sequence of icons that are connected with wires in the manner of flow of operation. The front panel is in which the acquired and generated parameters are shown in numerical, graphical waveform or as a control. The required block code is as shown in figure.

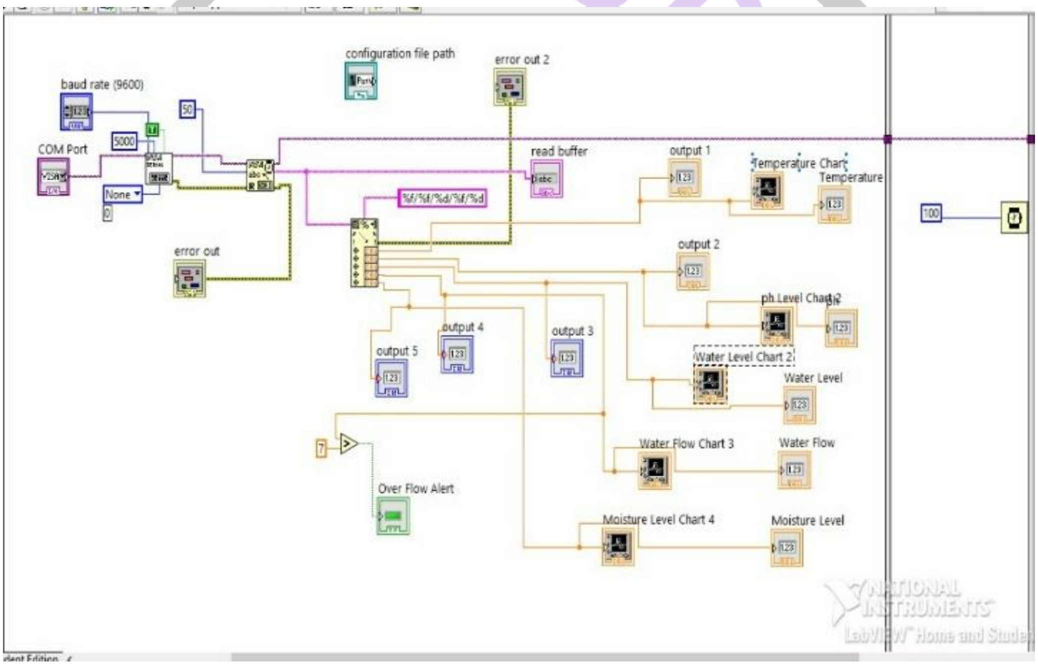

Fig 3. VI in LabVIEW

VI. RESULT AND CONCLUSION

The below Fig show the Front panel in Lab-VIEW. In which different values of the sensors are shown i. e. temperature, PH, water level, water flow and moisture sensor.

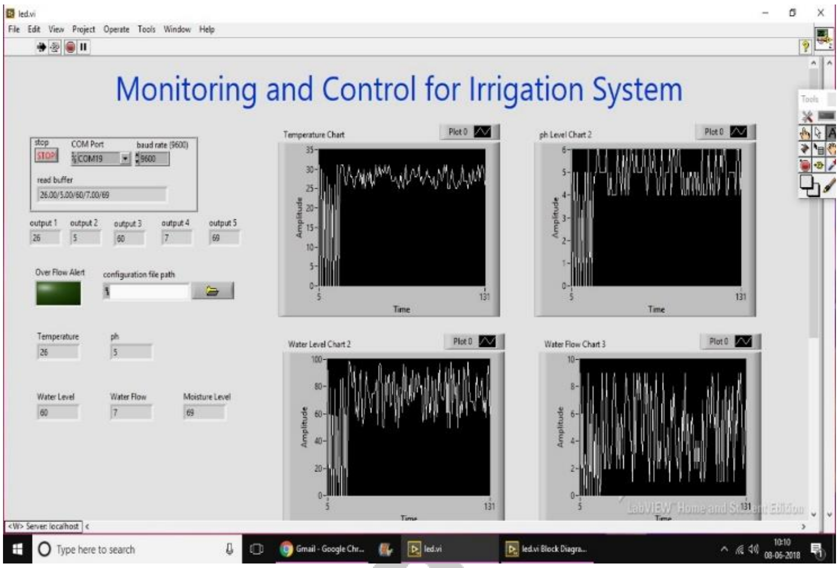

Fig 4. GUI in LabVIEW

Fig 5. LCD display shows values of temperature, Moisture, flow and set point

This paper involves how to control the motor by using Lab-VIEW and ARM interface. It provide every- thing that is needed to build any monitor or control application in significantly in less time, The automatic irrigation system was developed and successfully implemented along with sensors. The system reduces human effort and wastage of water and increase electricity consumption.

LabVIEW is best for any measurement and control system, with GUI that assist to build a wide range of applications in less time. In this code we have store all input and output data over a long period which is useful to study pattern of water usage due to which we can improve the reduction in water consumption. In future revision, we can also implement wireless system to avoid the long runs of cables in the field.

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