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AUTOMATIC IRRIGATION SYSTEM USING FPGA

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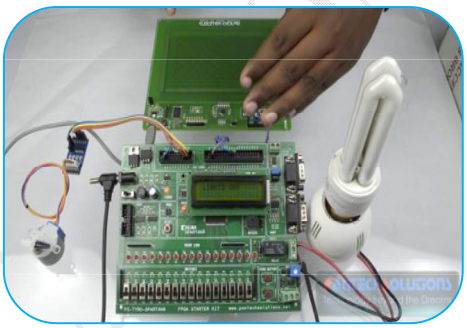
ABSTRACT:



Environmental factor monitoring is one of the most essential works for the farmer. The monitoring include temperature, moisture, and humidity as the main factor. In older days this factor are measured manually by the farmers but now a day's technology advances. For the best possible yield and for the best possible outcome we are using wireless system and we are implementing it using FPGA. The present need for any farmer is the cost. In this paper we are discussing about temperature and moisture sensor which can be placed in different location in the field which is connected to control mechanism which regulate the water supply timely by doing so we can reduced the cost and yield more product.

KEYWORDS: *FPGA (Field programmable gate array), Irrigation, Sensor, Soil moisture.*

INTRODUCTION

In developing countries irrigation is the basic problem. The farmer of this country uses more water because they are uneducated and they are not using smart technique to control the usage of water [1]. Soil moisture sensor is the one of the best sensor to determine the moisture content in soil and tells the farmer when it is required.

The current work aims is to develop a lowprice soil temperature and moisture observation system which will track the soil temperature and moisture at completely different locations of thefield in real time and thereby permit water to be wet on to the sphere if the soil temperature goes higher than and/or the soil wetness falls below a prescribed limitdepending in the nature of crop grown in the soil [2]. The sensors take the inputs like moisture, temperature and provide these inputs to the control unit. The control unit converts these inputs into its desired form with the program that is running on it and provides outputs within the mode of regulation of water flow consistent withthe current input conditions.

Now-a-days awareness about implementing technology for agricultural environment has increased into the industries [4]. The manual collection of data can cause difficulty in controlling environmental important factors. Wireless sensor can reduce time and effort required for monitoring the environment. Monitoring systems is the quicker for various conditions, better quality control of the production and cost effectively [3]. This new technology allows us for measurement of factors such as temperature, humidity, atmospheric pressure, soil moisture, water level and light detection. Different scientist tries to find out the reason for decrease in production and tried to invent the efficient system that will increase the yield to the great

extent.

2. METHODOLOGY

This system will monitor all these parameters through different sensors. Soil moisture sensor will measure the water content in the soil i.e. it will check whether the soil is dry or wet. Water level sensor senses the water in the water source

Temperature sensor and humidity sensor are used for forecasting the weather conditions. When any of the climatic parameters like temperature, humidity, water level, soil moisture etc. cross a safety threshold which has to be maintained to protect the crops the sensor senses the change and the FPGA reads this data at its input ports after being converted to a digital form by the ADC .The FPGA then performs the required actions [4]. In addition the system also employs memory in which all the sensor values are stored.

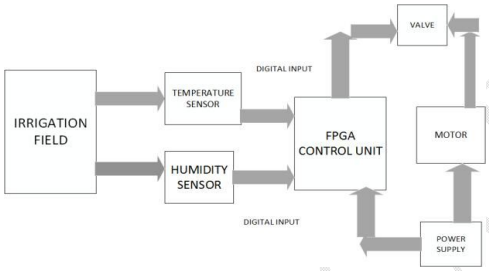


Fig1: Block Diagram of Basic Architecture

The system comprises of

- Sensors
- FPGA Control Unit
- Motor
- Power supply and valve

When any of the above mentioned climatic parameters cross a safety threshold thathas got to be maintained to guard the crops, the sensors sense the change and the fpga controllerreads this from the information at its input ports after being converted to a digital type by the ADC [1].The fpga then performs the required actions by using relays till the strayed-out parameter has been brought back to its optimum level.Since an fpga is used as the heart of the system, it makes the set-up low cost and effective [3]. As the system additionally employs anLCD display for endlessly alerting the user regarding the condition inside. Thus the entire set-up becomes user friendly.

Function of various modules:

As shown in fig 1. The basic setup for irrigation system is divided as follows:

2.1 Temperature sensor:

A temperature sensor is used to measure the temperature of the fields. This is most effective field parameter which has greater influence on other parameters. The sensor comprises of ADC converter that converts the analog input to digital one for FPGA controller.

2.2 Humidity sensor:

Humidity is the presence of water in air. In agriculture, measurement humidity is important for plantation protection and soil moisture monitoring [2]. The humidity sensor is also called a hygrometer. It continuously measures and reports the relative humidity in the air. The humidity sensor senses relative humidity. That means it measures both air temperature and moisture. Relative humidity is expressed as a percentage [3]. It is the ratio of actual moisture in the air to the highest amount of

moisture air that temperature can hold. The warmer the air is,a lot ofmoisture it will hold, thereforerelative humidity changes with fluctuations in temperature. Similar to Temperature sensor it also contains ADC converter.

2.3 FPGA Controller:

This is the main block which comprises of comparator and scaling unit. The output of sensors goes to scaling unit where they are scaled down to a particular value .This scaled values of sensors are given to a comparator where output of both sensors are compared and required output is given.

2.4 Valve:

Depending upon the output of comparator it goes to valve which is connected to motor and decides the percentage of water supply [2].

2.5 Motor:

It provide the water to the irrigation field when soil is dry it automatically on and takes the underground water and supply water to the whole field either by using sprinkler [1].

3. Simulation result and analysis

This project is divided into different sub-modules such as temperature sensor, soil moisture sensor, scaling of both temperature and soil sensor values, comparator and sprinkler unit .This sub-modules are being called in a module named as irrigation.

Temperature sub-modules contain an 8 bit input which is compared to a predefined threshold temperature which is set depending upon the crop demand. If the temperature measured is more than threshold output will be equals to temperature measured else it will be zero. After this, scaling is done on the basis of upper limit and lower limit of temperature as defined.

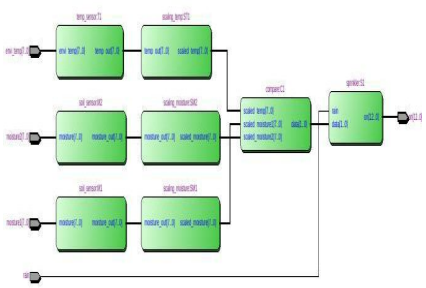
Similarly soil moisture sub-modules contain an 8 bit input which is compared to a predefined threshold moisture value which is set depending upon the crop demand. If the measured value is more than threshold, output will be equals to temperature measured else it will be zero. After this, scaling is done on the basis of upper limit and lower limit.

A comparator is needed to compare which scaled output is more effective .The comparison is between the outputs of temperature sensors and moisture sensor.If scaled temperature is very high then field is too dry. If it is in comparison with moisture content then field is supposed to be less dry vice versa if moisture is more. The comparator output is given as an input to the sprinkler unit which decides how much percentage of valve should be opened depending upon the condition.

All of the above sub-modules are instantiated in top block irrigation where work is done simultaneously.

The RTL view of the block is shown below..,

RTL VIEW:



From the RTL it is given that first column blocks are sensors whose output is given to scaling unit provided in second column. The outputs scaled_temp, scaled_moisture1, scaled_moisture2, is given

to comparator unit whose output i.e. data_0 is given to the sprinkler unit whose output is on which decides whether the sprinkler is switched on or not.It also depends on a reset signal i.e. rain.

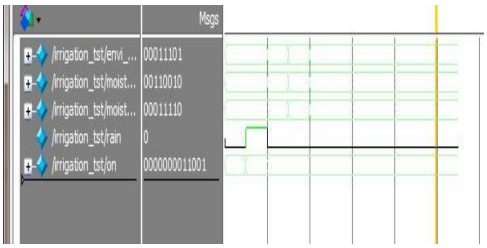
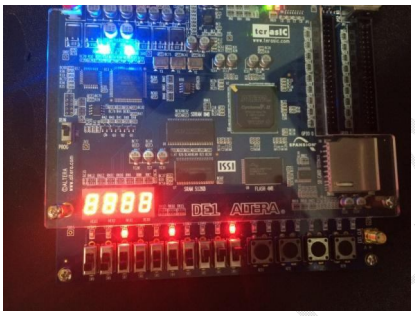


Fig 2. Output of top modules

From the above waveform it is clear that whenever the rain is '0' output 'on' is '1' means the valve is opened depending upon various sensors condition.



From above fig .LEDR0 is 'on', SW0'rain', led4 'temp is high', led7 is sprinkler output. When rain is '0' and temperature sensor output is high i.e. given to SW1 and moisture to SW2 led4 glows as temperature is high .Thus making on signal high and sprinkler is started . Which is shown by led0 and led7.

4. CONCLUSION

By monitoring the environmental condition sensor based system used to increase the yield thus providing the information to farmer. This is used for the upgrading farmer's condition. Wireless sensor used for robustness and flexibility. The FPGA based system used for measuring environmental condition effectively.

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