FPGA BASED WIRELESS TEMPERATURE MONITORING SYSTEM WITH IRRIGATION CONTROL SYSTEM

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Abstract : ***This paper presents the FPGA based wireless temperature monitoring system with irrigation control system . This paper focus on the most important factors for the quality of plants growth are temperature , soil and humidity . Continuous monitoring of these environmental variables gives information to the grower to better understand of the variables which can increase the productivity and reduce the loss of crops due to environment and drought condition , then How much each factors affects growth and how to manage maximal crop productiveness and reduce the minimum loss of crop .firstly we can optimize greenhouse climate adjustment can enable us to improve productivity and to achieve remarkable energy savings . For the implementation of agricultural technologies, low cost and real time remote monitoring are needed to continue monitoring the field area .***

This project implements Temperature monitoring system for Agricultural field using FPGA KIT . The most important factors for the quality and productivity of plant growth are temperature and humidity. Continuous monitoring of these environmental variables gives information to the grower to better understand, how each factor affects growth and how to manage maximal crop productiveness .The optimal greenhouse climate adjustment can enable us to improve productivity and to achieve remarkable energy savings - especially during the winter in northern countries. The system itself was usually simple without opportunities to control locally heating,

IndexTerms - WSN; ZigBee; FPGA; Irrigation ; XILINX; ,Temperature sensors lm 35 , Humidity sensor (sy – hs 220) ,Soil moisture ,Level sensor(fsh 24) ,spartan 3 Family EP3C16F484C6

I. INTRODUCTION

Agriculture has played a very important key role in the development of human civilization. Agriculture is mostly dependent on climatic condition and climatic changes they affect climate in many ways like rainfall , draught and flood conditions , heat waves hailstorms in winter .Badly affects the agricultural field due to this causes loss in production quality and quantity of crops production. That is in drought deficiency of water cause loss in yield and damage the crops and on other hand in over-irrigated area like in flood situation loss in yield is due to access of water and damage completely all over the production of crops. To avoid such loss in production proper water management and monitoring of water supply must be needed. Thus efficiently designed drip irrigation system is required to properly distribute the water in field and roots of the crops. This system must be environmental friendly and helping for farmers to reduce the loss of crops and distributed water in irrigation field in smart way to supply water for crops in a well manner that is water is provided to those areas of field where it is needed and control the wastage of water can avoided and provide proper water into the field .

A field programmable gate array (fpga) is an integrated circuit (ic) that can be programmed in the field ad the ic designed to configured by a customer or design after manufacturing.

An FPGA is a device that contains a thousands of matrix of reconfigurable gate array logic circuitry. When a FPGA is configured, the internal circuitry is connected in a way that creates a hardware implementation of the software application which is designed and reconfigurable all the blocks of FPGA. Not at all like processors, FPGAs utilize committed equipment for handling rationale and don't have an operating system .

II. METHODOLOGY

After the examination in the rural field, specialists found that the yield of agribusiness continues diminishing step by step. Utilization of innovation in the field of agribusiness assumes critical part in expanding the generation and additionally in diminishing the additional labor endeavors, water prerequisite and manure necessity. A portion of the specialists strove for better states of ranchers and gives the frameworks that utilizations new and unique and tedious advances which are useful for expanding the horticultural yield and productivitiness.

The most critical elements for the quality and profitability of plant development are temperature, moistness, light a. Consistent checking of these ecological factors gives a data to the cultivator to better comprehension of harvests , how each factor influences the development and how to deal with the maximal yield productiveness. The ideal nursery atmosphere modification can empower us to enhance efficiency and to accomplish wonderful vitality reserve funds - particularly amid the winter in northern nations. In past of the numerous decades, there is prompt development in the field of horticultural innovation. Usage of appropriate strategy for water system by trickle is exceptionally sensible and capable.

Farming has assumed a key part in the advancement of human development however we know horticulture is generally subject to climatic condition and subsequently climatic condition, for example, dry spell, surge, and so on severely influences the agrarian field consequently cause misfortune underway. That is in dry season lack of water cause misfortune in yield and on other turn in finished inundated zone misfortune in yield is because of access of water. To stay away from such misfortune underway legitimate water administration must be required. In this way proficiently composed water system framework is required to legitimately circulate the water in field. This framework must be ecological well disposed and conveyed water in water system field in savvy way that is water is given to those regions of field where

it is required with the goal that wastage of water can maintained a strategic distance from and give appropriate administration of water in field.

The current situation and flow work expects to build up a FPGAs based ease soil temperature, dampness and dampness checking framework that can track the dirt dampness at various areas of the field progressively and in this way enable water to be sprinkled on to the field if the dirt temperature goes above as well as the dirt dampness falls underneath an endorsed constrain depending in the idea of yield developed in the dirt. The sensors take the information sources like dampness, temperature and give these contributions to the microcontroller. The ADC changes over these contributions to its coveted frame with the program that is running on it and gives yields in the method of direction of water stream as indicated by the present information conditions. The product or a little working Framework that is running on the Xilinx and fpga gives an extremely easy to utilize UI..

The compelling root zone profundity is the profundity of soil utilized by the fundamental body of the plant roots to get a large portion of the put away dampness and plant sustenance under appropriate water system. It isn't the same as the most extreme root zone profundity of alternate yields .

Vegetables crops

Truck /vegetables crops	Effective Root Zone Depth (Inches)
Broccoli	18
Okra / lady finger	18
Cabbage	18
Carrots	18
Onions	12
Cauliflower	18
Eggplant	18
Pumpkins	24
Cucumbers	18
Spinach	6
Radish	6
Tomatoes	24

Figure 2.1 Crop Rooting Depth

III. System Diagram

This system will monitor all these parameters through different sensors. Soil moisture sensor will measure the water content in the soil , it will check whether the soil is dry or wet. Water level sensor senses the water in the water source like well or lake. Temperature sensor and humidity sensor are used for forecasting the weather conditions. and memory unit store information send to the main module.

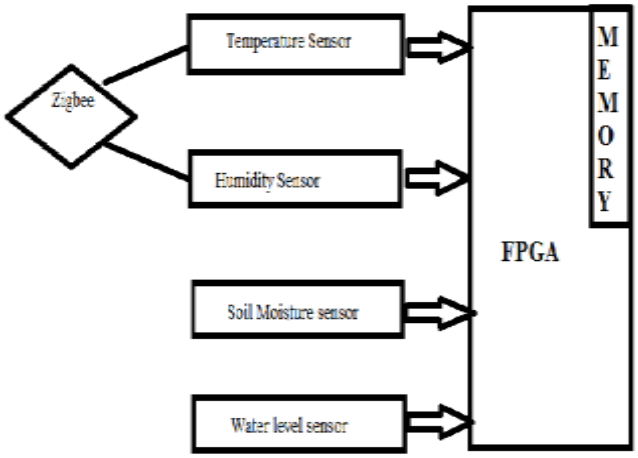


Figure 3 System Architecture

3.1 Zigbee network

Zigbee is designed to be simpler and less expensive than other personal area network Zigbee communication network is wireless personal area network provides low cost, low power and high range network of nodes which is a remote control and sensor applications The first step for forming Zigbee network is the configuration of Zigbee using X-CTU software. The serial interfacing of Zigbee module with Spartan 3A board is required to send and receive data to/from Spartan 3A FPGA board respectively by connecting the RS232 port.

3.2 Soil moisture sensor

The field module is sensor-based system distributed over the agricultural field. Here the moisture sensor interfaced with FPGA board to collect information of moisture of agricultural field. This sensor gives output in two formats digital as well as analog, In both mode in case of absence of moisture in soil output of the sensor is highest i.e. 3.4V, but in analog mode moisture of soil determined accurately. This is a simple water sensor can be used to detect soil moisture module due to the fact that the dielectric soil moisture determine the soil moisture by the dielectric constant of water is 80 much larger than the other soil components, including air. Thus, measurement of the amount of water in a known amount of soil .the change in the value of dielectric constant and subsequent increase in the moisture content gives For more information on soil moisture sensors see, Field Devices for Monitoring Soil Water Content.

2.2.3 Water level sensor

Severe drought and population growth are prompting unprecedented investment in the automation of irrigation distribution systems. Automated irrigation management systems use water level sensor and ultrasonic sensors are used to accurately measure and transmit water level and flow from the well or lake or from where we can take water for our crops .the data send through the wireless method to FPGA and the result show via advanced computer networks. That data drives irrigation gates, pumps, valves and other infrastructure to precisely manage water distribution

2.2.4 LM35

The LM35 series are precision integrated-circuit temperature sensors, the temperature sensor is a thermocouple or a resistance temperature detector (RTD) that gathers the temperature from a specific source and alters the collected information into understandable type for an apparatus or an observer whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ° Kelvin, This sensor generates a high output voltage than thermocouples and may not need that the The LM35 has an output voltage that is proportional to the Celsius temperature. as the user is not required to subtract a large constant voltage from its output

2.2.5 Environmental parameters:

a) Temperature

The temperature for plant (flowers or vegetables) growth required is Day temperature around 26°C to 30°C Night temperature around 15°C to 18 ° C This temperature can be controlled using ventilation or fan pad cooling systems.

b) Humidity

Humidity is the presence of water in the air. In agriculture, measurement of humidity is important for plantation protection and soil moisture monitoring. The humidity sensor is also called a hygrometer. It continuously measures and reports the relative humidity in the airFor floriculture, 70% to 80% humidity should be maintained and for vegetables, 60% to 70% humidity is required.

4. General Description

The Extended Spartan®-3A family of Field-Programmable Gate Arrays (FPGAs) solves the design challenges in many high volume, cost-sensitive electronic applications. With 12 devices ranging from 50,000 to 3.4 million system gates (as shown in Table 1), the Extended Spartan-3A family provides a broad range of densities and package options, integrated DSP MACs, and low total system cost while increasing functionality. The Xilinx® Vivado® High-Level Synthesis (HLS) compiler provides a programming environment similar to those available for application development on both standard and specialized processors. HLS shares key technology with processor compilers for the interpretation, analysis, and optimization of C/C++ programs. The main difference is in the execution target of the application. By targeting an FPGA as the execution fabric, HLS enables a software engineer to optimize code for throughout, power, and latency without the need to address the performance bottleneck of a single memory space and limited computational resources. This allows the implementation of computationally intensive software algorithms into actual products, not just functionality demonstrators. This chapter introduces how the HLS compiler works and how it differs from a traditional software compiler. Application code targeting the HLS compiler uses the same categories as any processor compiler.

HLS analyzes all programs in terms of

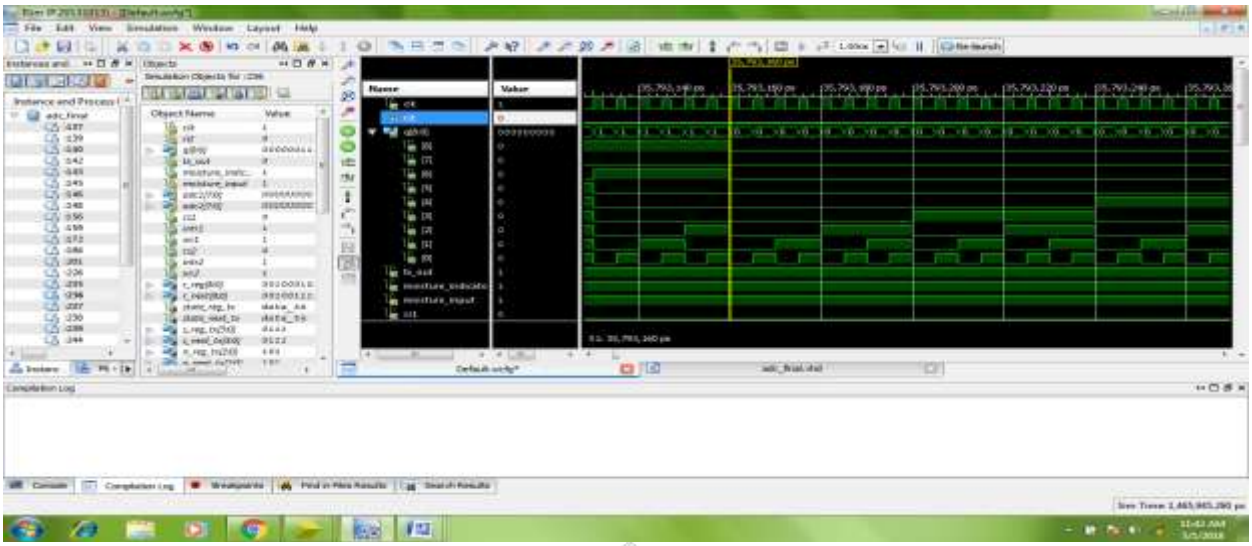
: • Operations

• Conditional statements

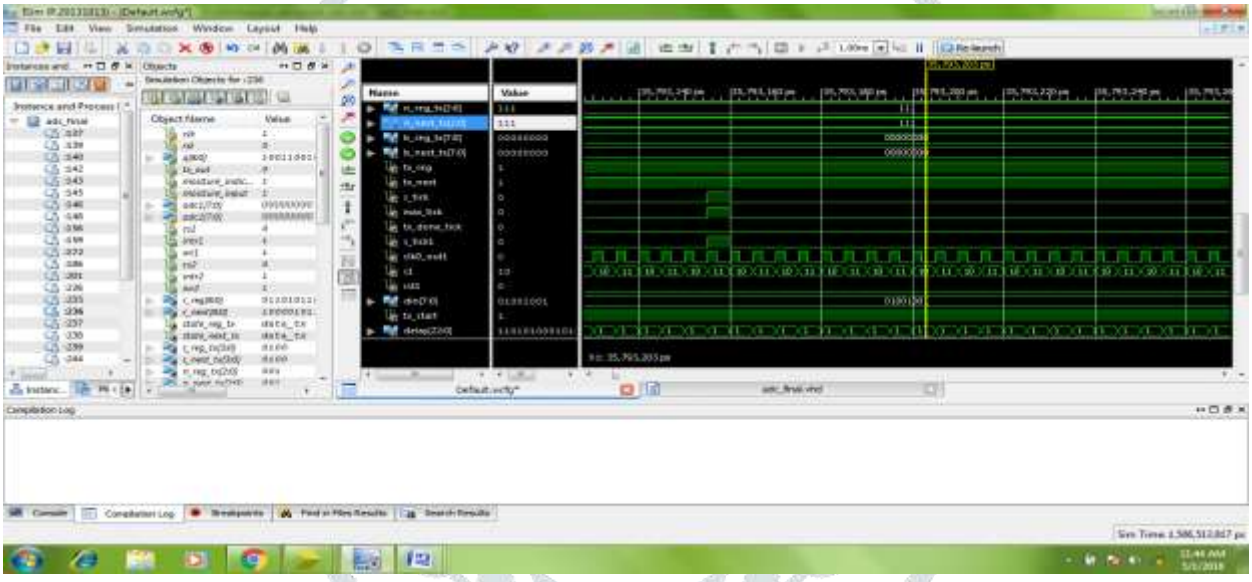
• Loops

• Functions

SIMULATION RESULT



SIMULATION 1



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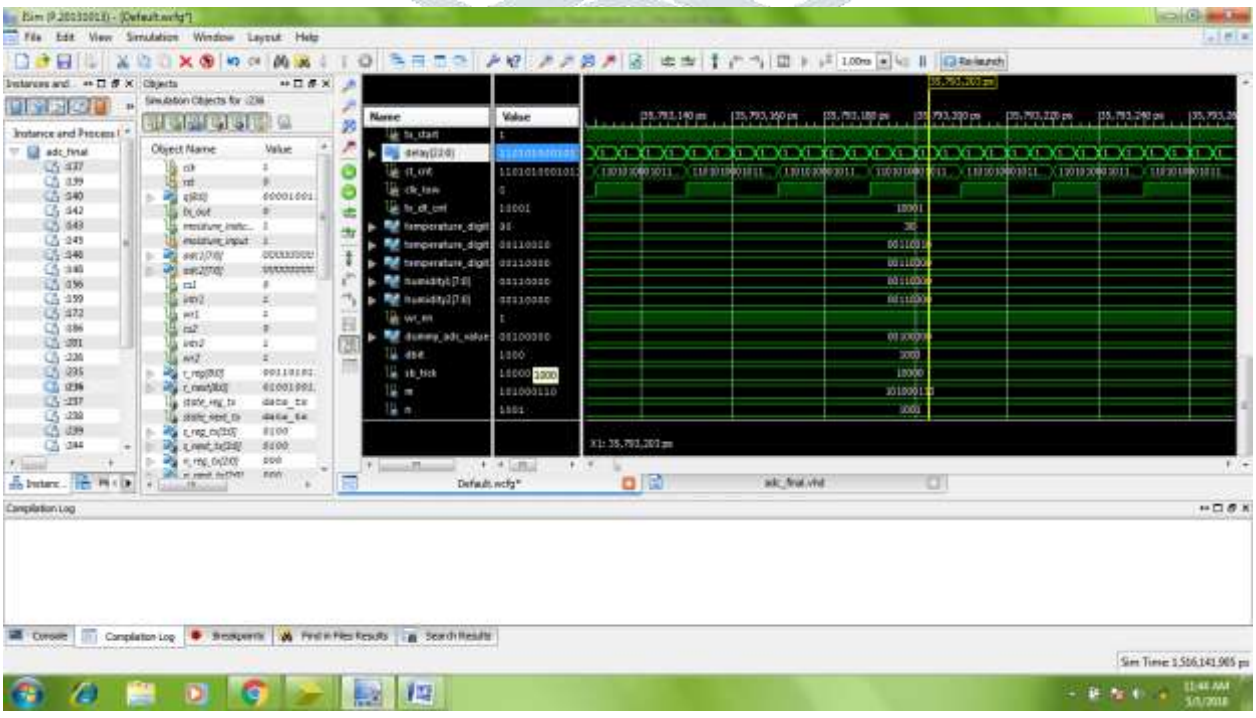

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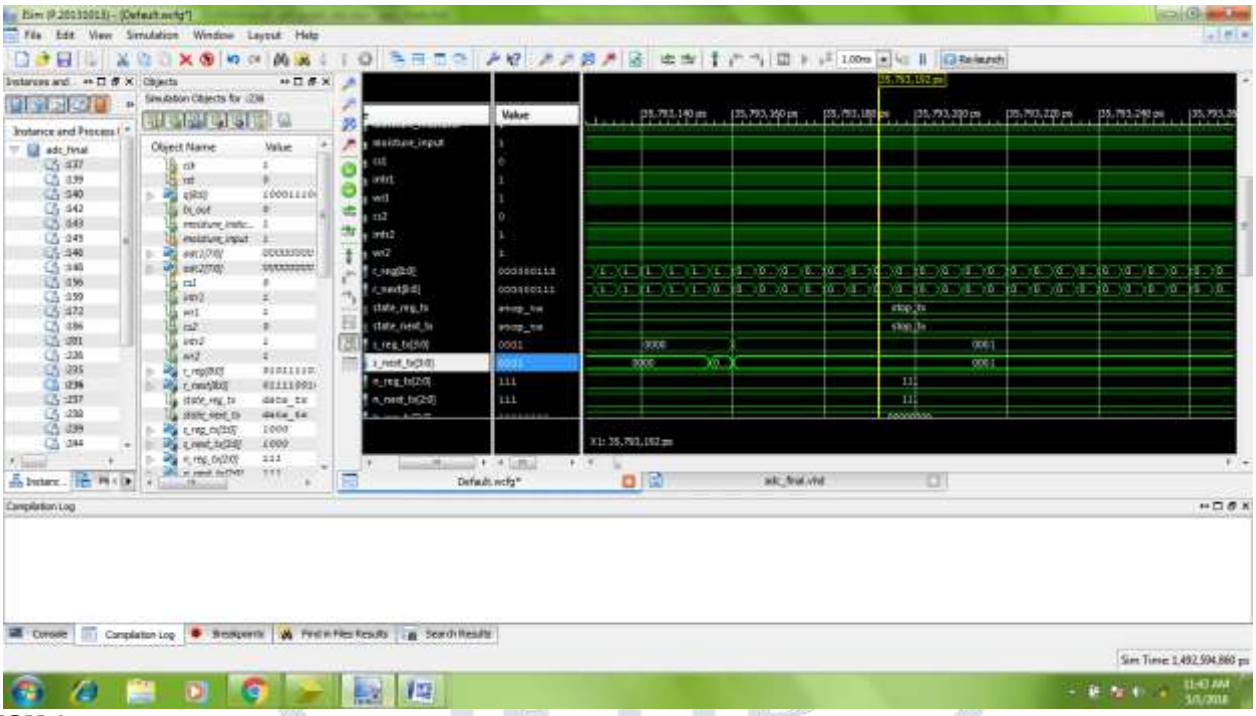

SIMULATION 4

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