Web Controlled Irrigation System for Farmers

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***Abstract*: This paper presents research work to develop a low cost and flexible system to facilitate remote control of irrigation. Main motivation behind this project is to automate irrigation system that can improve water usage efficiency since agriculture is one of the primary water consumer in the world. Web controlled Irrigation system is an open-source Internet controller system based on the Arduino platform which emulates a process found in many industries. Farmers can monitor sensor level and control sprinklers in their land from anywhere in the world using a web page. In this work two sensors have been used that provides information about the environment with the help of a Arduino microcontroller and watering cycles can be adjusted from server side to suit the weather condition. Arduino board is connected directly to the internet using an Ethernet shield. A serial interface in between the microcontroller and a PC for uploading of programs and retrieving data logged on the controller for reporting purposes. The PC was to perform all of the user input as well as gathering, processing and displaying the data, performing these tasks locally via a webpage to enable remote access of the system. Web control irrigation system reduces water usage and improves crop yield.**

***Keywords*- Embedded internet; Irrigation system; Arduino; Temperature; Humidity; Soil moisture;**

I. INTRODUCTION

In the today's competitive environment where everyone is running out of time for making more and more money but our farmers spend so much of time only on watching the condition of their field whether all the parameters required for better crop are O.K. or not. Even if they want to utilize this time they can't do this due to the restriction made upon them and which ultimately limits their income. If the work of analyzing or monitoring the farm land for the suitability of corps can be automated then farmers can engage themselves in some other constructive work in order to increase their income. With the popularity of internet increasing among the every section of the society, we can utilize this embedded internet technology [1-3] for solving the problem of farmers while they are away from their farms. With the help of a webpage they could be able to visualize the condition of soil moisture, air moisture and the temperature while sitting anywhere in the world and even can control the water pump while sitting there only. This enables them to utilize their time better rather than watching the pump to fill the field.

An internet based irrigation system based on the Embedded Internet technology is being discussed in detail in this paper. In this system a server enable the embedded device to be connected to the internet and also enable users to access, control and manage the embedded devices using a standard web browser over the internet from any place in the world without the restriction of distance and time.

A lot of work had been done related to this embedded internet technology in the other aspects of daily life like internet based control of home appliances, SCADA using internet etc. [4-15]. In this paper we have designed and developed and tested an internet based irrigation system for Farmers.

II. SYSTEM MODEL

Microcontroller is the core or the heart of the embedded system in order to control and monitor the various other sensors and devices connected in the system. The microcontroller based embedded system takes all the sensor readings established in the field and also sends the command to actuators in order to perform desired task. Figure 1 shows the system model of proposed irrigation system based on embedded internet technology [2-3].

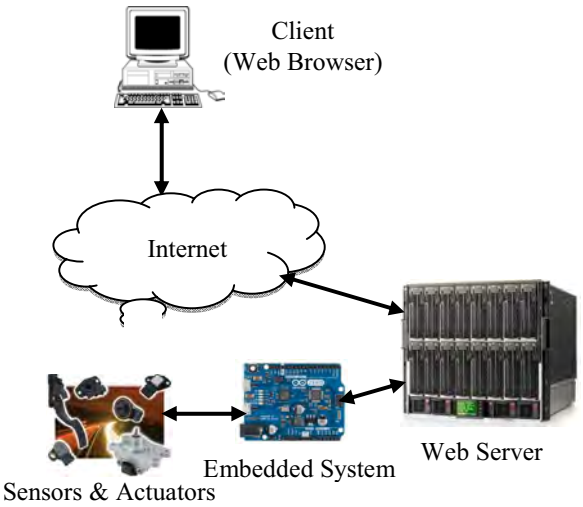

Figure 1: Irrigation System Model Based on Embedded Internet

The embedded system connects to the web server (computer) via RS232 communication protocol. On the other hand web server is nothing but a normal computer which host the website for the entire system and a data base in order to store the information of sensors sent by the embedded system and control commands issued by the client, in order to perform some action. One more application also runs on this server in order to provide necessary link between the database and the embedded

system. This application can be termed as the driver program for our embedded system. Hence the overall flow of information is described as follows:

i. Embedded system reads the sensor reading and sends this information to the server.

ii. Driver application running on the server store this information into the database.

iii. Web page designed in JSP reads this database and displays the sensor data to the client.

iv. After checking the readings of the sensors client issued certain commands, JSP page store these commands back into the database.

v. Driver application reads the database and sends the command to the embedded system.

vi. After receiving the command from server embedded system perform the task as desired by the client.

III. Design of the System

A real time system consisting of hardware and software which when connected together interacts with the actual environment. It shows an interface between hardware and software which helps to know the environment of the field. Figure 2 shows the block diagram of the system. This also describes the elements we have used in our project and its purpose of using it.

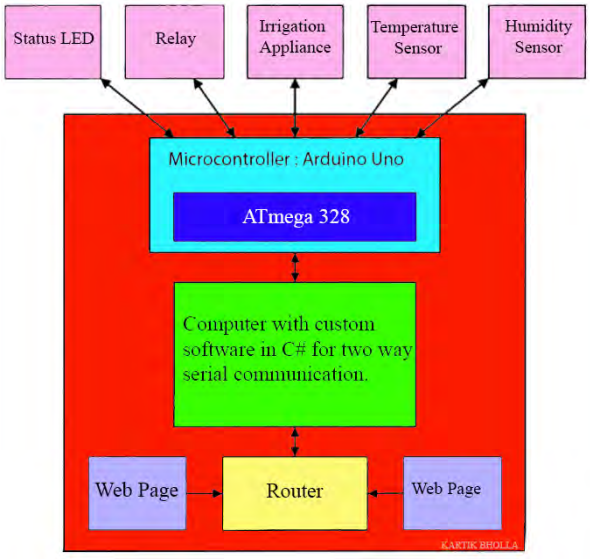

Figure 2: Block Diagram of the System

Microcontroller forms the embedded system part in this design, it is the most important and the central part of our system is being connected to a computer via an USB or serial RS232 cable. It's the central part because it acts as a pathway between sensors and web page. All the sensors which we have used are all connected to arduino Uno Board on a PCB (Printed Circuit Board). All the data of sensors are fetched into a computer via C# coding. Sensors which shows us the environment condition helps us to decide to turn on or off the water source or pump. And similarly command is given to arduino Uno in C# code and then further task is performed. Through the web page user can control and interact with the land via arduino Uno.

The elements of our system are described below:-

i. Microcontroller- Arduino is a tool for making computers that can sense the physical world more than your desktop computers. It's an open source physical computing platform based on a simple microcontroller board and a development environment for writing software for the board.

ii. Water Pump- It forms the Irrigation appliance in the system. It will turn ON or OFF as per the control commands given by the user and depending on its requirement.

iii. Web server- The web page designed is user friendly. This page can be accessed from anywhere in the world and is user interactive. User can easily watch the condition of field in the form of data sent by the sensors.

iv. Temperature and Humidity sensor- These are the two sensors used in the project. The sensors are used to exploit all the available resources efficiently. It provides information about the environment.

IV. Implementation

This describes the work of our paper and the steps followed by us to successfully run our system in real world.

A. Hardware implementation

It is very important to have standardized technology to increase its reliability and safety. For the very same reason we have choose Arduino Uno R3, the simpler microcontroller to use. Arduino Uno is based on Atmega328 which has 14digital input/output pins and 6 analog inputs. It simply connects it to a computer with a USB cable. Two sensors are connected to arduino with the help of their respective sketches. These are used to provide information about the environment with the help of a microcontroller and watering cycles could be adjusted to suit the current weather condition.

i. Temperature sensor- a 3 pin LM35 temperature sensor is used to give the current temperature of the field.

ii. Humidity sensor- HIH3605A humidity sensor is used which has 3pins in it (5V, GND, signal).

Water requirement in different seasons can now be decided with the help of sensor data. On rainy days it can detect rain and shut down the cycles, which utilizes the natural water. And in dryer days system would detect high temperature and low humidity which would help to start the cycle and water can be used as much as it's required. This in turn will reduce the usage of water and will help the current generation where water is the major issue.

B. Software implementation

As it is already being mentioned that this project is real time, so it's necessary to interact with the real world. Therefore, after interfacing and testing the hardware, here comes the software implementation which includes a web

server. First an arduino code is burned in Arduino Uno Board and then the sensor data was observed on serial monitor.

Figure 3: Hardware setup

Web page was then interfaced for gathering information and displays status of the field. Two way communications was implemented. The incoming communication from arduino Uno board to web page was done via C# without a user request. The outgoing communication from web page to arduino Uno was done in C#. Microsoft Visual Studio was selected over others because of its simplicity. It is a tool that connects our project in an easier way. And C# is suitable for writing applications in embedded system. Both the way communication was handled from anywhere in the world and was made easy for the user. Therefore it helps the farmer to control their field in a better way.

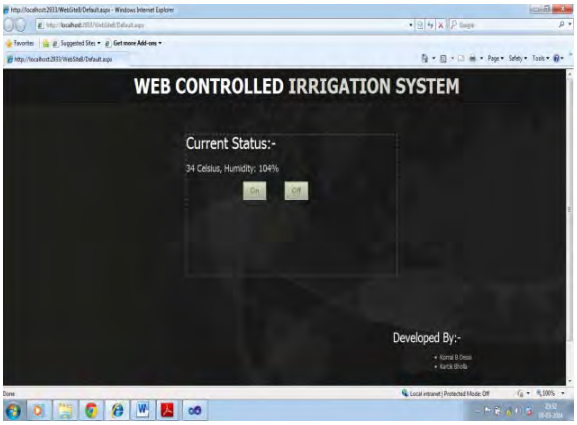

Figure 4: Web Page

V. RESULTS

Tests were conducted and successful sensor data was received in the web page which is figure 4. The temperature of the field was received successfully. Similarly humidity readings were recorded and displayed on the web page. The user was able to send message to arduino and sprinkler was made ON or OFF accordingly. This is done by simply clicking ON and OFF button displayed on the web page. Everything was handled from a web page and we were successful in achieving the required output.

VI. CONCLUSIONS

In this paper the web controlled irrigation system was implemented for controlling and monitoring irrigation using a web server. To demonstrate the performance, the prototype was tested and water was given as needed by the crops. Finally our aim to reduce water usage was achieved successfully.

There were many practical application problem related to farming which we encountered while testing are system in real time. Those were related to single sensor data and non-uniform of ground plane which can restrict the water to reach the sensor. We will try to solve out these practical problems in future work with the use of sensor networks for getting the various data from different places in the field

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