International Journal of Modern Trends in Engineering and Research
www.ijmter.com
e-ISSN No.:2349-9745, Date: 2-4 July, 2015

On-line Interactive Data Acquisition and Control System for Agricultural Applications

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Abstract- Online Interactive Data Acquisition and Control system plays the major role in the rapid development of the fast popularization and control in the field of measurement and control systems. Design of on-line embedded web server is a challenging part of many embedded and real time data acquisition and control system applications. The World Wide Web is a global system of interconnected computer networks that use the standard Internet Protocol Suite (TCP/IP) to serve billion of users worldwide and allows the user to interface many real time embedded applications like data acquisition, Industrial automations and safety measures[1]. This system contains inbuilt Data Acquisition and Control system (DACS) with on-line interaction. Single chip IDACS method improves the processing capability of a system and overcome the problem of poor real time and reliability. ARM processor handles two modes at same time, DAC and web server. We control different sensors, pump and drips by using ARM processor and collected data is given to the server using Bluetooth controller.

Keywords: Embedded ARM Processor, Sensors and Embedded web Server, Interactive data acquisition system, android cell phone.

I. INTRODUCTION

Embedded technology and people's lives have been closely related, but traditional data acquisition system only responds to particular signals, which is quite limited. We present the principles of a low operational cost but flexible Internet-based data-acquisition system [3].This new system contains inbuilt Data Acquisition and Control system (DACS) with on-line interaction. It makes the system more reliable and avoids more complication [1]. We are designing a data acquisition system for monitoring and controlling agricultural field. It is important to optimize cultivation management to improve agriculture. Communication is very important because workplaces for farmers are often separated by distance. So mobile technology is increasingly being adopted in agricultural space as a measure to assist farmers in decision[4].The system is very useful for farmers to get information of field like temperature, humidity, moisture, level, light intensity, CO2 proportion .also they can monitor the field and controls the pump or drips. The main core of the system is an embedded hardware running, popular choice of operating system for embedded applications. This system contains inbuilt Data Acquisition and Control system (DACS) with on-line interaction. This system uses ARM processor portability with suitable operating system. Web server application is ported into an ARM processor using embedded 'C' language. ARM processor handles two modes at same time, DAC and web server. Web pages are written by hyper text markup language (HTML)[1]. We can use different types of sensors for collecting data into the Farm [5]. That data has been converted into digital form using ADC then it is processed by ARM processor also controls pumps, drips. After that data is display onto android phone in which android application is developed using JAVA language .The data from mobile in the form of graph, table etc., and Send towards server section.

II. BLOCK DIAGRAM

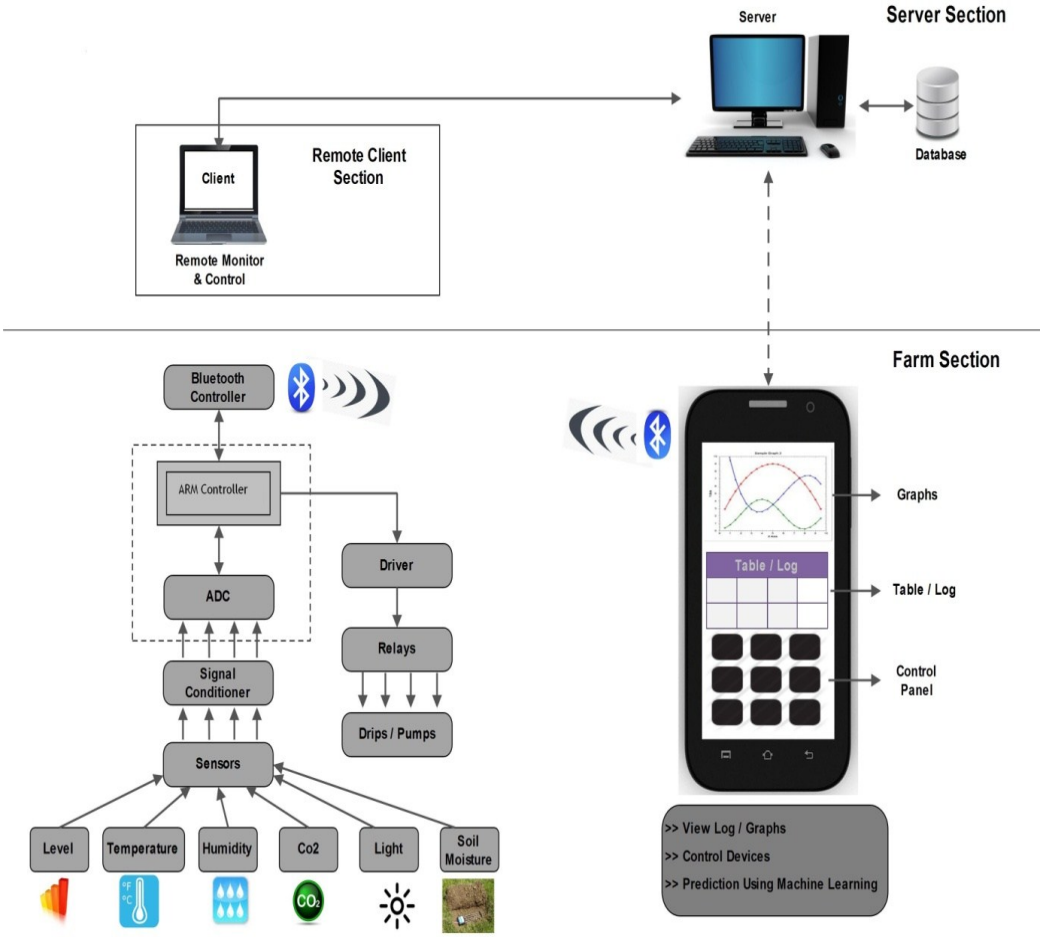

Figure 1.Online interactive data acquisition system for agricultural application

A. Farm Section

In Farm Section we used different types of sensors, signal conditioner, ADC, ARM Controller, Bluetooth Controller, Android Cell phone.

1. Sensors-Sensors are devices which sense the particular area and converts physical signal like temperature, humidity, light into electrical signal i.e voltage and current.

1.1 Humidity Sensor-It is a sensor which measures actual humidity of soil. We use SY-HS-220 humidity sensor in our system.

Figure 2. Humidity Sensor SY-HS-220

Specifications

Items	SY-HS-220
Rated voltage	DC 5.0V
Rated power	≤3.0mA
Operating temperature	0~60℃
Operating humidity	30~90%RH
Storage humidity	Within 95%RH
Storage temperature	-30~85℃
Standard output	DC 1,980mV(at 25℃ 60%RH)
Accuracy	±5%RH(at 25℃, 60%RH)
Remarks	PCB unit containing thermistor or diode for temperature compensation

1.1 Soil Moisture-This Moisture Sensor can read the amount of moisture present in the soil surrounding it. This Moisture Sensor can be used to detect the moisture of soil or judge if there is water around the sensor, let the plants in your garden reach out for human help. They can be very to use, just insert it into the soil and then read it. It is having low power consumption and high sensitivity.

1.2 Temperature Sensor-

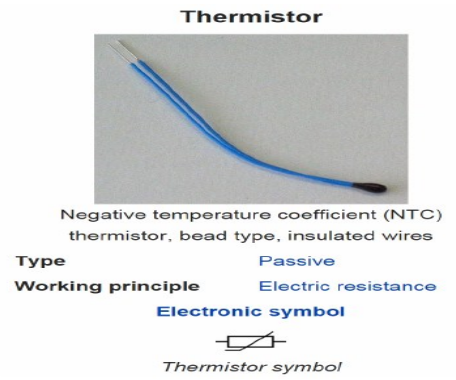

Figure 3. Thermistor

We use Thermistor with 10K resistance as a temperature sensor in our system. A thermistor is a type of resistor whose resistance varies significantly with temperature, more so than in standard resistors. The word is a portmanteau of thermal and resistor. Thermistors are widely used as inrush current limiters, temperature sensors, self-resetting over current protectors, and self-regulating heating elements. Thermistors typically achieve a higher precision within a limited temperature range, typically −90 °C to 130 °C.

1.3 Light Sensor-

LDR (Light Dependent Resistor) with 10K resistance is used as light sensor in this system. Two cadmium Sulphide (cds) photoconductive cells with spectral responses similar to that of the human eye are used. The cell resistance falls with increasing light intensity.

2. Signal Conditioner- In electronics, **signal conditioning** means manipulating an analog signal in such a way that it meets the requirements of the next stage for further processing. Most common use is in analog-to-digital converter. Signal conditioning can include amplification, filtering, converting, range matching, isolation and any other processes required to make sensor output suitable for processing after conditioning.

3. Analog To Digital Converter- An analog-to-digital converter is a device that converts a continuous physical quantity (usually voltage) to a digital number that represents the quantity's amplitude.

4. ARM Processor- This system uses ARM processor portability with suitable operating system. Web server application is ported into an ARM processor using embedded 'C' language. ARM processor handles two modes at same time, DAC and web server. Web pages are written by hyper text markup language (HTML). **ARM** is a family of instruction set architectures for computer processors based on a reduced instruction set computing (RISC) architecture. A RISC-based computer design approach means ARM processors require significantly fewer transistors than typical CISCx86 processors in most personal computers. This approach reduces costs, heat and power use. Such reductions are desirable traits for light, portable, battery-powered devices—including smart Phones, laptops, tablet and notepad computers, and other embedded systems. A simpler design facilitates more efficient multi-core CPUs and higher core counts at lower cost, providing improved energy efficiency for servers. We use LPC2148 processor for processing and controlling the whole DAS.

5. Bluetooth Controller-

HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup.

6. Relay and Relay Drivers-

Relay- A relay is an electrically operated switch. Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil

current can be on or off so relays have two switch positions and most have double throw (changeover) switch contacts. We use relay in our system for controlling motor and pump.

Relay Drivers-

ULN 2803 driver is use to drive the relay to On-Off the motor and pump.

7. Android cell phone-We develop android application using android software development kit into cell phone. For that we use ECLIPS and NETBEANS Software. We view Logs/Graphs, Control devices by developing android application in our phone. Generally applications are developed in JAVA Programming.

B. Server Section-

In server section server provide data as per the client request in the form of web pages.

C. Remote Client Section-

We can send a request from client section remotely. As per the client request server send data towards client. Data is stored in the database.

III CONCLUSION

The system helps many farmhouses to manage agricultural work to accomplish cost-effective precision agriculture. We plan to conduct experiments to evaluate how usable the system is and how well it performs. Moreover, it is expected that data collected with the system will comprise big data for precision agriculture. Analysis of big data will lead to improved precision agriculture and cultivation management in the Future [4]. This embedded ARM system can adapt to the strict requirements of the data acquisition and control system. This system operated by DACs mode to acquire the signals and control the devices remotely. Embedded web server mode is used to share the data with clients in online. Android application is developed into the android mobile using Java programming. Using this system we can control the farm remotely.

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