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Smart Drip Irrigation System Using Arm11 Processor and ARDUINO



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ABSTRACT:

This project proposes a design for plant irrigation automation system using ready-to-use, cost effective and energy efficient devices including raspberry pi, Arduino microcontrollers, Zigbee modules and relay boards. Use of these components results in overall cost effective, scalable and robust implementation of system. The commands from the user are processed at raspberry pi using web interface. Arduino microcontrollers are used to receive the on/off commands from the Rasperry pi using Zigbee protocol. Star zigbee topology serves as backbone for the communication between raspberry pi and end devices. Raspberry pi acts a central coordinator and end devices act as various routers. Low-cost and energy efficient drip irrigation system serves as a proof of concept. The design can be used in big agriculture fields as well as in small gardens via internet. The use of moisture sensors and solenoid valves make a smart drip irrigation system.

Index-Terms:

ARM11, Arduino, Moisture Sensor, Humidity Sensor, ZIGBEE.

I.INTRODUCTION:

The requirement of building an automation system for an office or home is increasing day-by-day. Industrialist and researchers are working to build efficient and economic automatic systems to control different machines like lights, fans, air conditioners based on the requirement. Automation makes an efficient use of the electricity and water and reduces much of the wastage. Drip irrigation system makes the efficient use of water and fertilizer. Water is slowly dripped to the roots of the plants through narrow tubes and valves.

Water is fed directly to the base of the plants which is a perfect way to water plants. There should be proper drainage in the fields or pot plants to avoid any water logging which in case may affect the productivity [1]. There already exist automatic drip irrigation systems which water plants based on soil humidity, pH value of soil, temperature and light. These parameters are required in big agricultural fields where productivity of the crop matters. In small areas like office premises, buildings, house gardens etc. where watering plants at regular interval matters, our proposed irrigation system will be very efficient. This paper presents an smart drip irrigation system to water plants with the use of devices like raspberry pi, Arduino microcontrollers. Xbee is used to control the system wirelessly while Python programming language is used for automation purpose. This paper contributes an efficient and fairly cheap automation irrigation system. System once installed has no maintenance cost and is easy to use.

II. IMPLEMENTATION OF PROJECT:

2.1 EXISTING METHOD

In the existing system the Lab monitoring system is design and controlled by using RF technology which can monitor and control the system inside the lab only in places where network availability is more. They are bit more costly because cost of components is increased. Not so easy to implement as you have to take great care of noise, Because of antennas it is bulkier.

2.2 PROPOSED METHOD:

The proposed method is used to overcome the drawbacks present in existing method. Here we are using ARM Intelligent Monitoring Center which uses Samsung's processor as its main controller.

The environmental conditions present inside the lab can be monitored using sensors like temperature, gas and LDR. All the sensors are connected to sensor board. From the sensor board we are sending monitored values to control room (ARM board) through RS232 serial cable. The serial cable is connected to one of UART port of ARM board. Whenever a person is entered inside the lab, the person's image can be captured by camera and send it to controller. The controller transmits the data to remote PC through Ethernet by using FTP. FTP is a protocol through which users can upload files from their systems to server. Once data is placed at server we can view the data at remote PC (with internet) on web page with unique IP address. We can view continuous streaming of video as well as senor's data. If we want to control the devices based on sensor's information we can control through web page from remote location using HTTP protocol. HTTP protocol continuously requests the server for control (turn on or turn off) the devices. In this way we can monitor and control the devices through remote PC.

2.3 BLOCK DIAGRAM:

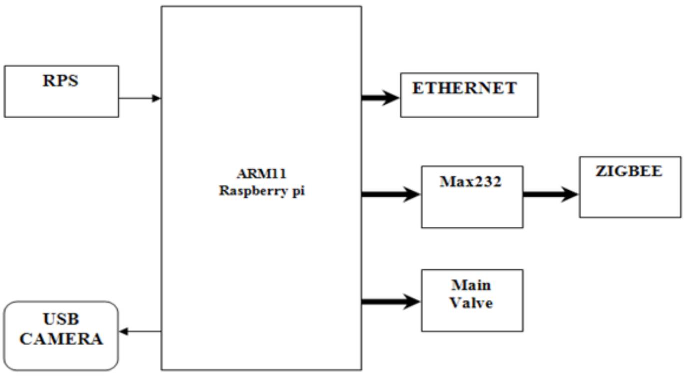

Figure-1: Block diagram

2.4 MONITORING CENTER:

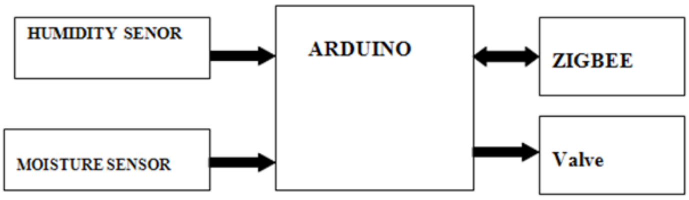

Figure-2: Monitoring system

III. HARDWARE COMPONENTS:

3.1 ARDUINO:

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip.

3.2 ETHERNET CABLE RJ45:

Since its commercial release, Ethernet has retained a good degree of compatibility. Features such as the 48-bit MAC address and Ethernet frame format have influenced other networking protocols. Ethernet initially competed with two largely proprietary systems, Token Ring and Token Bus. Because Ethernet was able to adapt to market realities and shift to inexpensive and ubiquitous twisted pair wiring, these proprietary protocols soon found them competing in a market inundated by Ethernet products and by the end of the 1980s, Ethernet was clearly the dominant network technology. In the process, 3Com became a major company. 3Com shipped its first 10 Mbit/s Ethernet 3C100 transceiver in March 1981, and that year started selling adapters for PDP-11s and VAXes, as well as Multibus-based Intel and Sun Microsystems computers. This was followed quickly by DEC's Unibus to Ethernet adapter, which DEC sold and used internally to build its own corporate network, which reached over.

3.3 Soil Moisture Sensor:

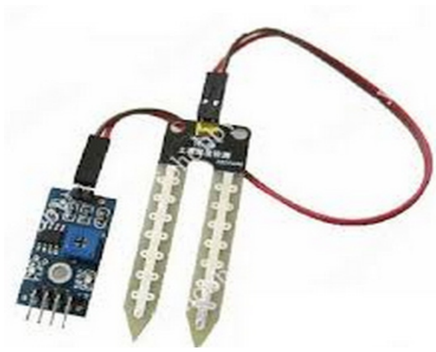

Figure-3: soil moisture sensor

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This is a simple to use water sensor, that can be used to detect soil moisture content. It has both digital and anlog outputs and can be directly connected to an Arduino (or similar development board). The sensor allows the user to set a predefined threshold using the onboard potentiometer. The digital output goes high when the measured soil moisture increases more than the threshold value. This digital ouput can be directly read from an Arduino or a similar microcontroller.

3.4.DHT11 HUMIDITY SENSOR MODULE:

Figure-4: Humidity sensor

This DHT11 Humidity Sensor features a temperature & humidity sensor complex with a calibrated digital signal output. By using the exclusive digital-signal-acquisition technique and temperature & humidity sensing technology, it ensures high reliability and excellent long-term stability.

This sensor includes a resistive-type humidity measurement component and an NTC temperature measurement component, and connects to a high-performance 8-bit microcontroller, offering excellent quality, fast response, anti-interference ability and cost-effectiveness.

Digital Output Single Wire Output Stable & long term accuracy Full range temperature compensated Relative humidity and temperature measurement Calibrated digital signal Outstanding long-term stability pins packaged and fully interchangeable DHT11 output calibrated digital signal.

IV. RESULTS:

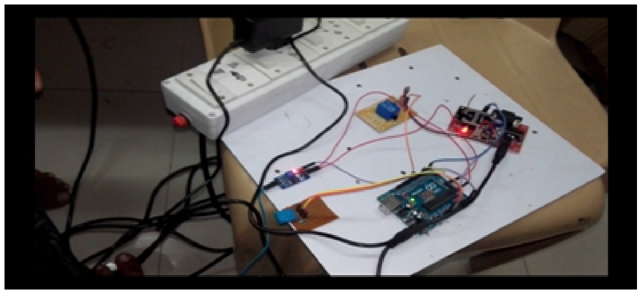

Figure-5: Monitoring system

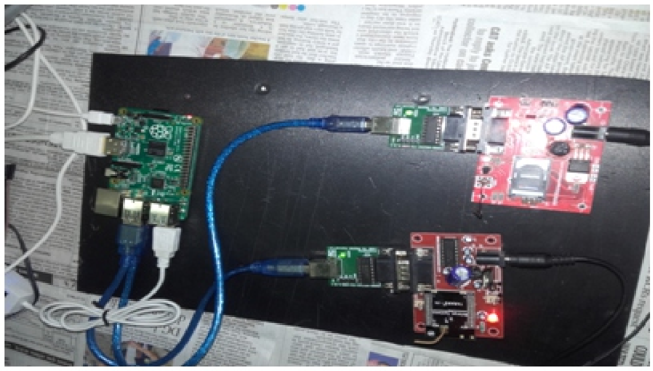

Figure-6: Hardware implementation

V. FUTURE SCOPE:

» The cost of ARM11 is more that's why in future we can implement this system using ARM CORTEX A8, Beagle bone etc as well as updated processors with high frequencies will work fine.
» As the storage space is also less in future we can also record these live streaming data by connecting external memory storage.
» We can complete our project using wireless technology.
» In future we can provide more security to data by using encryption, decryption techniques.

VI. CONCLUSION:

The project "Smart drip irrigation system using Raspberry Pi and Arduino" has been successfully designed and tested. It has been developed by integrating features of all the hardware components and software used and tested. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit.

Secondly, using highly advanced ARM 11 Processor board and with the help of growing technology the project has been successfully implemented.

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