Water-Saving Irrigation System Based on Automatic Control by Using GSM Technology

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Abstract: This project proposed an embedded system for automatic control of irrigation. This project has wireless sensor network for real-time sensing and control of an irrigation system. This system provides uniform and required level of water for the agricultural farm and it avoids water wastage. These paper have real time sensing and control of an irrigation system. When the condition of water in the agricultural farm is abnormal then the system automatically switches ON the motor. When the water level reaches normal level the motor automatically switch OFF. In this project we are interfacing microcontroller through temperature sensor, humidity sensor and also interfacing to GSM through MAX 232. In this we set specified values of temperature, humidity and the conditioned is uniformly monitored by VB.NET.

Key words: Embedded System • ARM 7 • LPC2129 Micro Controller • Irrigation • Wireless Communication

INTRODUCTION

As we know that India is a developing country and the major part of our GDP growth rate belongs to agriculture alone. So we can say that agriculture is the backbone of India and irrigation is called the lifeline. So, agriculture in India has been the most important priority in the economic development of country since the independence. Major part of our expenditure is spent on agriculture alone and inspire of that we not getting required output. In India, there is uneven biological diversity cause, some part experience droughts while some parts flood, so there is always scarcity of water available for the irrigation. Farmer in rural area severely affected by this condition. New technologies coming but they are too expensive for the common farmer. The project offers a cheaper and simpler solution to this problem by developing automated microclimate irrigation controllers with wireless capability assisted with low cost wireless sensor nodes. Like temperature sensor, humidity sensor which senses the level of moisture of the soil. The land or firm is divided into microclimatic regions equipped with smart specified sensors and integrated wirelessly into automated irrigation controller with wireless networking capability.

Proposed System: To overcome the drawbacks of existing system like high cost, difficult in maintenance and more wired connection. We introduce a new system which will have wireless connection between server and nodes. We introduce a new design of embedded web server making use of GSM network technology in the paper. Compared to the wired link web server system. This system is characterised by having no wires between the web server and terminal nodes. These systems have lower cost and having more flexibility of the network topology.

For every node we will use separate GSM trans-receiver to transmit the details to server nodes. Water irrigation control based on microcontroller and internet of things. By internet of things we mean that it has the ability to analyse and distribute data that can be used as information and knowledge. Internet of things improves distribution of world’s resources to those who need it the most. In agricultural farm we use water irrigation is monitored by using sensor like temperature, humidity. Then controller sends sensor to pc using GSM wireless technology and updated on the internet using VB.NET.

Functional Blocks Diagram: The functional block diagram consists of following steps:
• Functional requirements
• Non-functional requirements

**Functional Requirements:** The functional requirements consist of following parts:-

• Sensing elements like temperature sensor, humidity sensor.
• Irrigation control valve [if water level is very low.]
• Man-machine interaction requirements [automatic mode for irrigation].

**Non-Functional Requirements:** The non-functional requirements include performance of irrigation process, physical size of irrigation components and power consumption in the irrigation.

**Components Description**
**Temperature Sensor:** The LM35 series are precision integrated-circuit temperature sensor. The LM35 is rated to operate over a -55° to +150°C temperature range. The sensor senses the field temperature and it is interfaced with microcontroller.

**Humidity Sensor:** The humidity sensor is used to measure humidity of the field. This sensor senses the field humidity and is connected to the microcontroller. We have to set points of humidity as 54% to 80% for standard irrigation but it changeable according to the climate and the type of soil.

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Description</th>
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<tbody>
<tr>
<td>Name</td>
<td>Automatic irrigation system</td>
</tr>
<tr>
<td>Purpose</td>
<td>Monitors and control the water level in the tank and performs the irrigation according to the sensors.</td>
</tr>
<tr>
<td>Inputs</td>
<td>Temperature sensor, humidity sensor.</td>
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<tr>
<td>Outputs</td>
<td>LCD</td>
</tr>
<tr>
<td>Functions</td>
<td>Depending upon the temperature, humidity the automatic irrigation is performed and also checks the water level and switch on/off the motor.</td>
</tr>
<tr>
<td>Performance</td>
<td>Updates the sensor data to the base station.</td>
</tr>
<tr>
<td>Power</td>
<td>12v</td>
</tr>
</tbody>
</table>

**Software Description**
**Keil Compiler:** This is the embedded Compiler which is compatible for the ARM 7 to compile the code.

**Embedded C:** Embedded C is a set of language extensions for the C Programming language. C is often used for system programming, including implementing applications, due to the combination of desirable characteristics such as code portability and efficiency. The ability to access specific hardware addresses and low run-time demand on system resources. Some reasons for choosing Cover interpreted languages are its speed, stability and universal availability.

Flow chart of the Irrigation process
Start
Initialize MAX 232-serial port
End Device Connect request
Allow Connect
Assign Destination Address
Initialization of Set Points for Humidity, Temperature
Maximum = Max, Minimum = Min
NO
Yes
Get the data from sensors and send to base station
Send Irrigation ON from base station to field station
Min < Temperature < Max and
Humidity < Min
Relay ON
LCD Display
Data base
End
Max > Temperature
Max or
Humidity > Max
Water level < 10%
Motor ON
Else
Motor OFF
Water level > 90%
End

RESULTS AND DISCUSSION

Initial stage: Irrigation ON: In case 1 first of all we take the value from the field sensor i.e. temperature sensor and humidity sensor. And sent to user 1 and user 2 by the Trans receiver and then user 1 sends command if the temperature and humidity is abnormal. And then irrigation process starts.

Case 2: when the temperature is abnormal and humidity is abnormal.

When the temperature and humidity are abnormal then sensor sends the message to user 1 and after receiving command from user 1 then motor is automatically switch on the motor.

Case 3: when the temp is normal and humidity is abnormal.

In this case only humidity is abnormal so user 1 sends message about the humidity and after receiving command from user 1 then motor is automatically switch on the motor.

Case 4: when temperature is abnormal and humidity is normal.

Simulation Result: Simulation result is performed in Keil software. Simulation diagram of proposed water-saving irrigation system using GSM technology is shown in the figure 4.
CONCLUSION

Embedded system for automatic irrigation of an agriculture field offers a potential solution to support site-specific irrigation management that allows producers to maximize their productivity while saving the water. This project is designed using ARM 7 microcontroller. The temperature and humidity sensors detect the field temperature and field humidity and then sensor values are sent to the base station. The base station checks the conditions for irrigation and performs automatic irrigation. Field condition is specifically monitored by the base station. Each field station are wirelessly communicates with a base station by GSM technology.

REFERENCES