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ZIGBEE Based Prototype Implementation of Water Level Monitoring and Control in Canal and Sub Canals

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Abstract: *This paper represents the design and implementation of prototype of water level monitoring and controlling in canal and subcanal. This paper probes into the design of the automatic gate controlling system based on AVR microcontroller. This design aims to develop a low cost and efficient prototype model which is based on embedded platform for water level monitoring and controlling system. At present, manpower saving and water-saving technology is a key issue in irrigation system, when the water level in the canal exceeds certain level, the subcanal starts over flowing to particular subcanal and its trenches . To avoid this, we need to monitor and control the canal and subcanal water level. This can be done by controlling the canal and subcanal gates simply by applying automatic gate control system and using zigbee transmitting data from local site to remote site and vice versa, sensor nodes at both on canal and subcanal.*

Keywords: *AVR microcontroller, ZIGBEE system, embedded system, sensors.*

I. Introduction

In India today a major challenge in agricultural and industrial water system is water scarcity and water wastage. The irrigation land areas nearby dam receive abnormal water supply as dam usually releases water during night time, as the farmers are not available during night time to manually regulate this incoming water through canal and sub canal, this results in water overflow in sub canals and trenches causing water wastage and disturbance in economic water balance cycle. Also due to crop variation and absence of storage tanks within the system this improper canal water released create unnecessary outflow losses in water transportation system.

The traditional irrigation area system mostly uses the wireline medium to control the water-level, divert the rain water during rainfall and adjust the gate position based on sensors data and uses the data acquisition to transmit the graphic information. It brings the complex wiring, and the line can be easily damaged. In this proposed work, the wireless sensor network is used in the irrigation area automatic system, which reduces the system's cost by use of zigbee routers, enhance the system's extension, improve the system's performance, avoid water wastage, helps in balancing the natural water flow cycle. And also will overcome the overflow of water in sub canal and canal and will preserve the water for future use.

Atmega16 microcontroller, is used at both the local site and remote site for monitoring and control, the information required for controlling water level will be sensed by the sensor and will be transferred to remote site by zigbee wireless system. The power required for the sensors will be provided with the help of solar panel. Based on the preset water level conditions based on software the remote site will command through wireless medium by zigbee to local site thereby water level will be controlled through opening and closing of canal gates.

II. Literature Review

Ms. Aparna M. at all [1] in their research paper has implemented a system using PLC to control the dam gates. They had used real time monitoring system to control mechanism of the dam gates .But there were lots of errors in manually operating method also the PLC based system was huge and hence suitable for major dams due to its cost.

S.A.M. Matiur Rahman at all [2] in their paper has implemented automatic system to control tap water. They had discussed the procedure of the water level sensing system to control the misuse of water in tap.The advantage of this paper that it is low power consumption, and the disadvantage that it is not used for the WSN network.

P. Komeswarakul at all [6] in their paper has proposed water monitoring system using microcontroller for dam. This system also provides the real-time information via reliable fiber-optic communication. The four sensors installed into dam structure and in reservoir to measure physical quantities of interests such as seepage flow, water level, pressure and temperature parameters.

Zhang Zhi at all [7] in their research paper elaborate the control and monitoring of water level in nuclear power plant. In this paper they had used PID and fuzzy logic. It was developed for generating nuclear energy and also a class of SG water level control system used to increase the performance of this technology.

Nuno Brito at all [9]] in their paper they had used teaching /learning methodology for controlling the water level in two tanks. In this paper PID algorithms was used for controlling amd monitoring of water in tanks.They also used remote collaborative method. The disadvantage of this system ,it is not available with local or remote control configuration for demo purposes.

Zulhani rasin at all [10 In their paper they had used wireless network system for water irrigation control monitoring system. They had used a various sensor node to detect the water level in the reservoir.The disadvantage of this paper was the battery needed in this paper was operated only for 12 hours and require more human effort and advantages of this paper is cost effective and allows easy customization.

Zhou Yiming at all [11] in their research paper has implemented the Wireless system for monitor and control of water level in greenhouse. They had used ZigBee wireless network system and several sensors nodes. The advantage is low cost and high network capacity.

III. Objectives

- To detect and monitor water level in prototype model of sub canal and canal at local site and transmit this monitored data from local site to the remote site GUI through wireless medium by ZIGBEE.
- To control the water level by opening and closing the canal and sub-canal gates, based on preset values.
- Based on the preset water level conditions based on software the remote site will command through wireless medium by ZIGBEE to local site thereby water level will be controlled through opening and closing of canal and subcanal gates.

IV. Hardware Design

1) Hardware Design at Local Site:

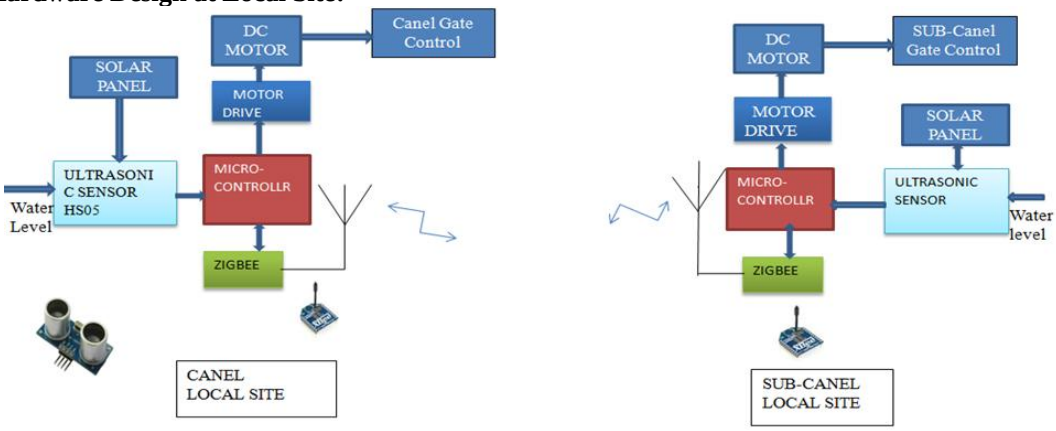

Fig1. Block diagram of local site hardware

2) Implementation at remote monitoring site:

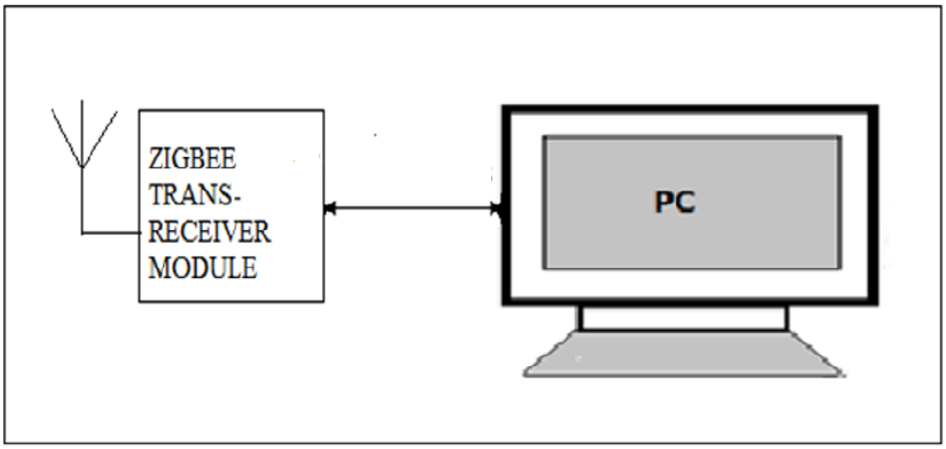

Fig.2: Block diagram of Hardware at remote monitoring site

V. Software Used

1) PCB artist Software: For schematic circuit design, PCB design and simulation.

2) Embedded-C: C is the most widely used programming language for embedded processors/controllers. Assembly is also used but mainly to implement those portions of the code where very high timing accuracy, code size efficiency, etc. are prime requirements.

3) AVR Studio Software: It is often believed that without target hardware it is difficult, if not impossible, to develop and test software for a microcontroller project.), AVR Studio, provide the framework for compiling programs and downloading them to the microcontroller, but it also comes with the ability to simulate programs for most of their AVR microcontrollers. This simulator has the ability to not only execute AVR instructions but also to simulate limited digital I/O (input/output)

VI. Description of the System

This paper introduce the design and implementation of water level monitoring and controlling in canal and subcanal. This implemented prototype model is used for reducing the water wastage in canal and subcanal by using embedded system and WSN system. Here different components and parameters are used such as ultrasonic sensors for sensing the water level in the canal and subcanal, AVR MICROCONTROLLER is used to control the gate operating ,ZIGBEE is used for transmitting data from local site and receiving data from remote site and vice versa.

Fig 1.shows the block diagram of remote site and local site, as the fig1. shows that the two sections in it 1]remote site and 2]local site .

In the local site both canal and subcanal consists of AVR MICROCONTROLLER, ultrasonic sensors, ZIGBEE, LCD, motor driver IC etc. The ultrasonic sensor senses the water level in canal and subcanal, this data will be transmitted through ZIGBEE to the remote site. Remote site will receive the data from local site and then gives the command to the local site to control the water level using opening and closing of canal and subcanal. When the command is received by the local site it adjust the gates of canal and subcanal so that the level of water will be controlled and which reduces the overflow of water in subcanal and its trenches.

The remote site consists of pc with software programmed GUI wherein the water level values (set point) can be given, based on this set values the gate at local site will open and close allowing water level as per requirement.

VII. Hardware Snap

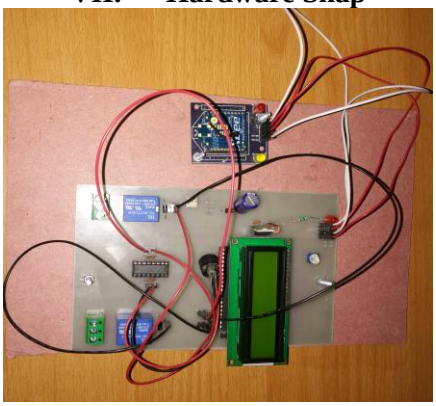

Fig.3. sensor node.

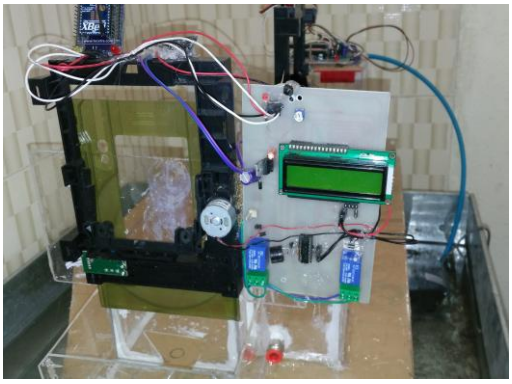

Fig.4. Front view of local site canal and subcanal

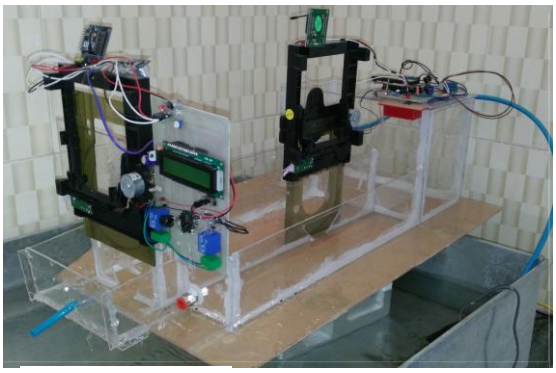

Fig.5. Side view of local site canal and subcanal

VIII. Software Implementation At Remote Site Gui Screen

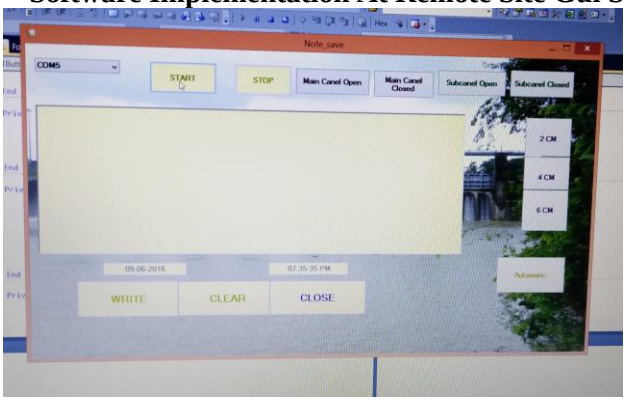

Fig.6. Remote site GUI

IX. Future Scope

- This design with modification can be used in industrial application, domestic water supply and hydropower generation and environmental management .
- To cover longer distance for transmitting and receiving data from local site and remote site ZIGBEE routers can be used.

X. Conclusion

It can be concluded that in the field of water level monitoring and controlling different techniques are widely used for prevent the wastage of water. The water level can be controlled and monitored in various field where large amount water is misused. The system proposed here is an effective way to overcome the water wastage in irrigation system and other applications. It is expected to give the exact output of water level controlling in real time and save the water in canal and subcanal ,which reduces the water overflow in canal and subcanal .In real time applications, floods can be controlled by redirecting excess water to purpose built canals which in turn divert the water to temporary holding ponds or other bodies of water where there is lower risk or impact to flooding, thus protecting people and property.

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