Monitoring of Water Level Variations in Rivers and Flood Alert System Using Wireless Sensor Networks

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Abstract: *A flood is an overflow of water that covers the land which is usually dry. The main objective of this project is effective monitoring of the water level variation in rivers. A wireless sensor network consists of set of nodes. The wireless sensor node consists of a micro-controller, sensors and wireless transceiver. Each node is responsible to collect the information, processing the data and transmission of the processed information. The wireless sensor node is programmed accordingly that reads the status of the sensors and for processing of the data. The sensor network is used to send the measured data to data base and server. The messages are given to the responsible persons in the case of flooding.*

Key words: ARM7,Temperature sensor, Flow sensor, Level sensor,Rainfall sensor,GSM

1. INTRODUCTION

Natural disasters happens everywhere in the world, and they can be completely disturbing for human life and the environments that they are living. The given model is very much utilized for monitoring of the water level variations in rivers and the observed values regularly that are put in storage in the server which is useful to send flood alerts to consistent authority for faster action. With the given conditions, the project proposes the use of wireless sensor networks along the river beds to monitor the web based information source for the people responding to the need for information on water condition and floods. The design of the system can be used to observe, record and send a message to the people before disaster hits level of the water. The developed system functions as. Since almost every common man is using mobile phone now a days, it makes best use to transmit alert to these devices using messages. The model is useful to monitor the water level variations in rivers and the monitored values are regularly stored in web server which is useful to send flood alerts to corresponding authority for proper action.

2. Proposed System

Wireless Sensor Network is used for monitoring of river and flood conditions. The design of a WSN consists of a set of nodes for sensing and a base station that communicate with each other and collects local information to make actual decisions about the environment. The wireless sensor node consists of a micro controller, sensors and wireless transceiver. Sensing unit senses the flow of water, temperature, and its level. These kind of files gathered and also transported with in real time on the complete river container location multiple times each other. Wireless sensor nodes are scattered in rivers so that fluctuations of the water level can be effectively observed. Each such sensor node has an electronic circuit for communicating with the sensors and a power supply. The sensor nodes are programmed accordingly so that it reads the status of the sensors. When the water level crosses the desired set point the signal will be transferred to the server. Now the server will provide information using GPRS to authorized/responsible people to allow the users to view real time water related data as well as historical data.
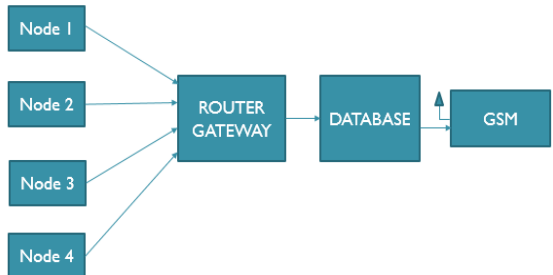
3. Block diagram

Figure 1: Block Diagram
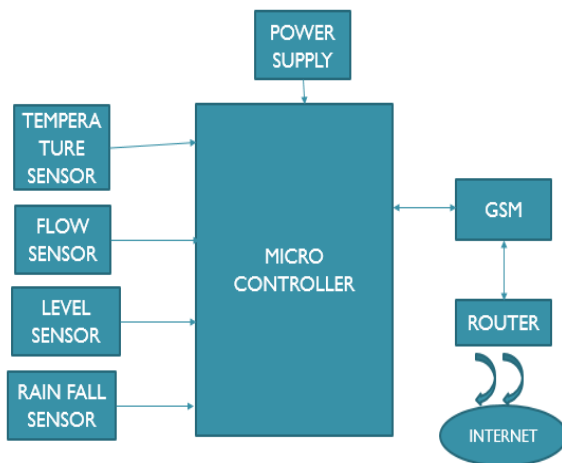
4. Block Diagram of Wireless Sensor Node:

Figure 2: Block Diagram of Wireless Sensor Node

5. Hardware Implementation

The main hardware components are:

1) ARM7 micro controller
2) Temperature Sensor
3) Flow Sensor
4) Level Sensor
5) Rainfall Sensor
6) GSM

5.1 ARM7 micro controller:

ARM is the full form of "Advanced RISC Machines". It is an extensive processor cores in the world. It is used in portable devices because of reasonable performance and consumption power is low. ARM is a family of Reduced Instruction Set Computing architectures The ASK 16/32-bit ARM7TDMI-S microcontroller trainer board is very specifically designed for the purpose of students to meet their requirements.

5.1.1 LPC2148 Chip Features:

- 16-bit/32-bit ARM7TDMI-S microcontroller in a tiny LQFP64 package.

- 8 kB to 40 kB of on-chip static RAM and 32 kB to 512 kB of on-chip flash memory.

- 128-bit wide interface/accelerator enables high-speed 60 MHz operation.

- In-System Programming/In-Application Programming (ISP/IAP) via on-chip boot loader software. Single flash sector or full chip erase in 400 ms and programming 256 bytes in 1 ms.

- Embedded ICE RT and Embedded Trace interfaces offer real-time debugging with the on-chip Real Monitor software and high-speed tracing of instruction execution.

- USB 2.0 Full-speed compliant device controller with 2 kB of endpoint RAM.

- Single 10-bit DAC provides variable analog output (LPC2142/44/46/48 only).

- Two 32-bit timers/external event counters (with four capture and four compare channels each), PWM unit (six outputs) and watchdog.

- Low power Real-Time Clock (RTC) with independent power and 32 kHz clock input.

- Multiple serial interfaces including two UARTs (16C550), two Fast I2C-bus (400 Kbit/s),

- SPI and SSP with buffering and variable data length capabilities.

5.2 Temperature Sensor:

A temperature sensor detect the hotness and the coldness of the environment. The sensing of the temperature can be done with the directly contact or an indirect contact. The temperature sensor LM35 is used to measure the temperature of the environment accurately. LM35 sensor is an integrated circuit in which the voltage output is directly proportional to the temperature Celsius.
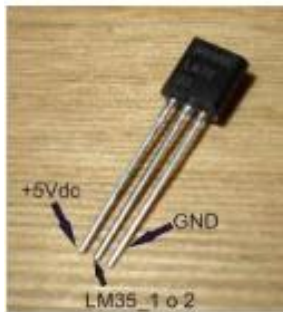

Figure 3: Temperature Sensor

VCC	GND	DO
5V	GND	P0.25

Table1: Temperature sensor pin configuration

5.3 Level Sensor:

Level sensors are used for the measurement of the level of the flowing elements. Such substances can be liquids like water, oil, slurries as well as solids which can flow. Level sensors measures the level above a pre-set reference. Ultrasonic level instruments depends on the basic time-of-flight principle which sends a sound wave from a piezo electric transducer to the matters of the vessel, which may contain liquid. This liquid level sensor has two elements such as an electronic transceiver and a transducer with a very high efficiency. When we consider a liquid level controller, the fluid level can be obtained by measuring the difference between a transmitted ultrasonic pulse and a reflected echo which may be called as a tripping time.
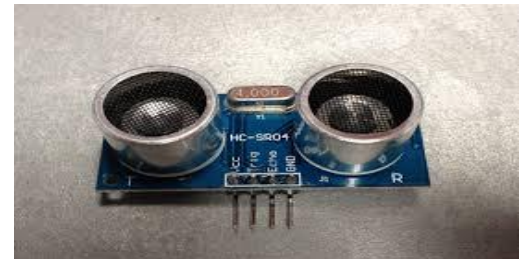

Figure 4 : Ultrasonic sensor

VCC	Trig	Echo	GND
5V	P0.4	P0.5	GND

Table 2: Level Sensor pin Configuration

5.4 Flow Sensor:

The flow sensor is a device for observing the rate of fluid flow. Usually a flow sensor is the sensing element used in a flow meter for the recording of the flow rare. It is true for all the sensing elements that exact accuracy of a measurement will require certain functionality for regulation. Water flow sensor has a plastic valve body, a hall-effect sensor and also a rotor. When water moves into the rotor, the rotor will be rolled. Its speed changes fluctuates with change of rate of flow. The hall-effect sensor output shows the pulse signal for output. It uses a simple rotating wheel that counts according to a Hall Effect sensor.

Figure 5: Flow Sensor

VCC	Signal	GND
5V	P0.3	GND

Table 3: Flow Sensor pin configuration

5.5 Rainfall Sensor:

Figure 6: Rainfall Sensor

The rainfall sensor detects the amount and intensity of rain in the environment. A rain sensor or rain switch is an exchanging gadget initiated by precipitation. There are two primary applications for rain sensors. The first is a water preservation gadget associated with a programmed watering system framework that causes the framework to close down in the occasion of precipitation. The second is a gadget used to shield the inside of a car from rain and to bolster the programmed method of windscreen wipers.

5.6 GSM:

GSM stands for Global System for Mobiles. It requires a SIM (Subscriber Identity Module) card just like mobile phones to activate communication with the network. The microcontroller will collect the information from the sensors. This data is analysed and will be sent to the authorized persons who are responsible through GSM. The GSM module will be having a RS232 interface for the serial correspondence. The transmitted stick of the microcontroller is attached to the receiving stick. The GPRS network acts in parallel with the GSM network, providing packet switched connections to the external networks. GPRS provides mobile users access to value-added WAP services and different external packet switched networks. GPRS also permits the network operators to execute an Internet Protocol (IP) based core architecture for integrated voice and data applications, which continues to be used and expanded for 3G services. The GPRS will signify the information and will send to the personal computers.
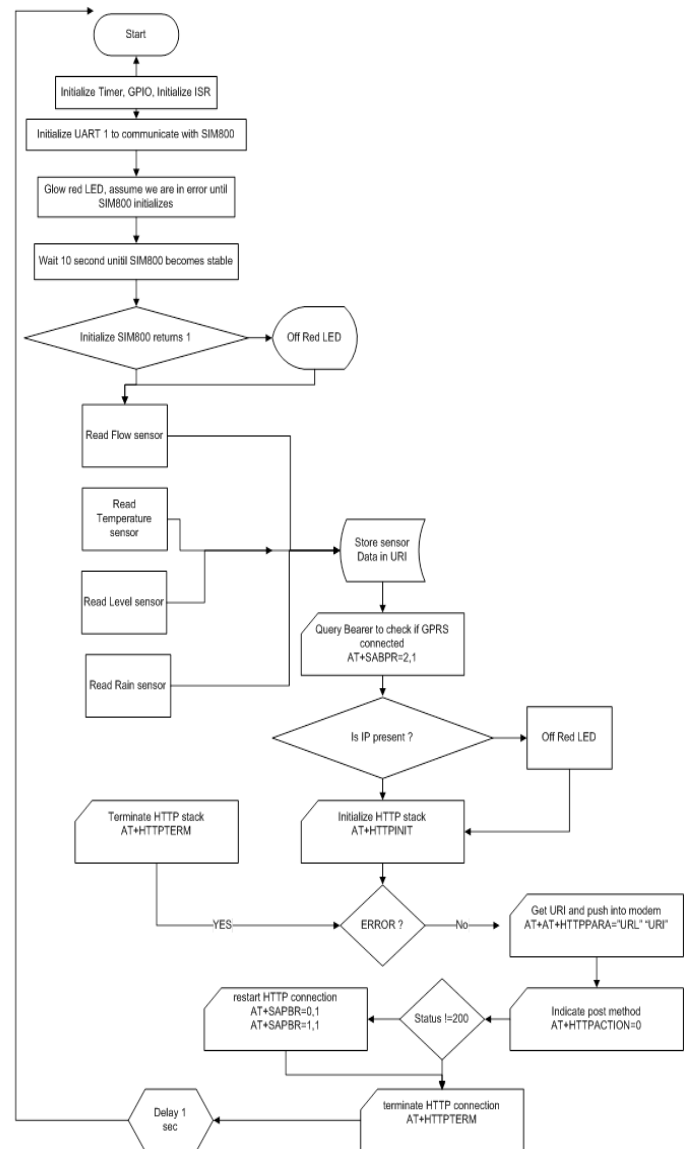
6. Software Implementation

The software tools used in this project are
1. Keil software
2. Proteus
3. Flash Magic

Keil software supports the ARM7 packages. Keil complier is a software that is used and the machine language code is written and complied. Keil compiler has many types of libraries. After the compilation of the machine code then it is converts into hex code. The hex file is again put into the microcontroller with the help of flash magic. The Flash magic is a PC tool for the use of programming purpose. It is based on the serial Ethernet protocol in the target hardware.

7. Flow Chart:
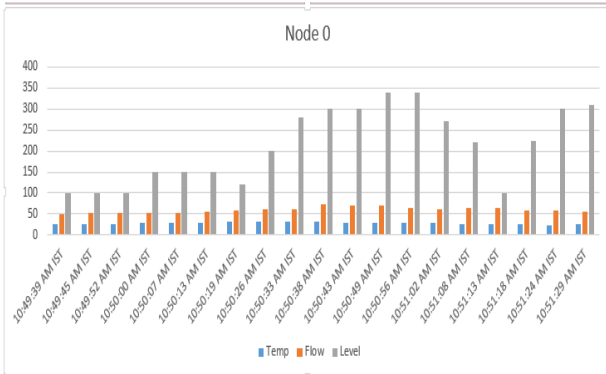
8. Results:

Output of Node 0:

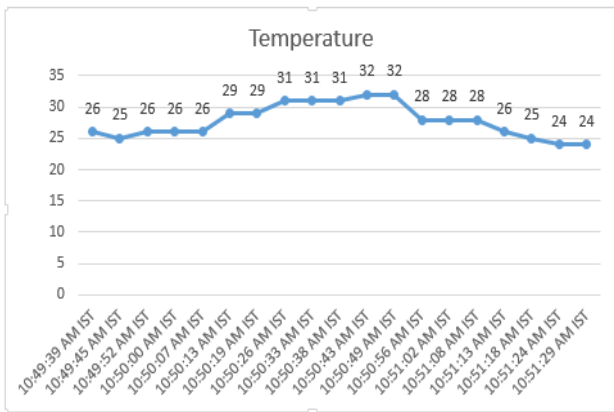Figure 7: Temperature, Flow and level observations

Output of Node 1:
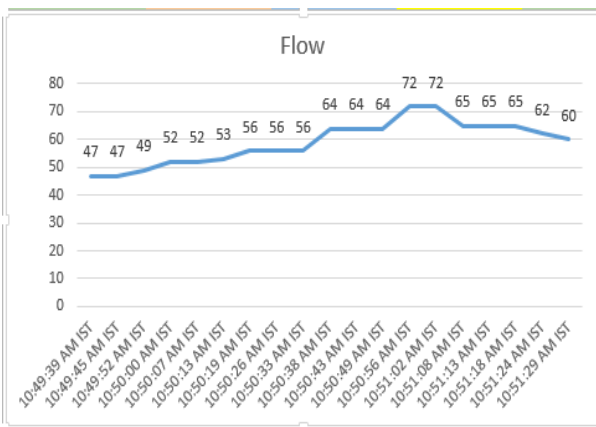

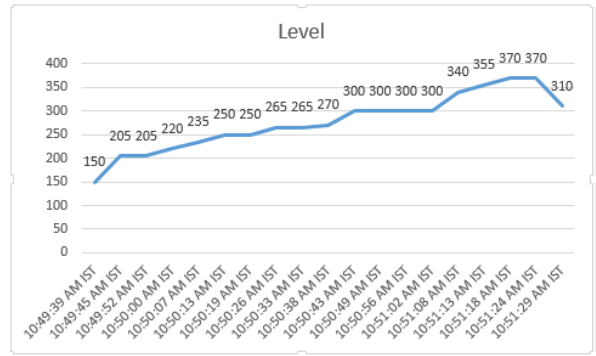Figure 8: Observations of Temperature in Node 1

Figure 9: Flow in Node 1

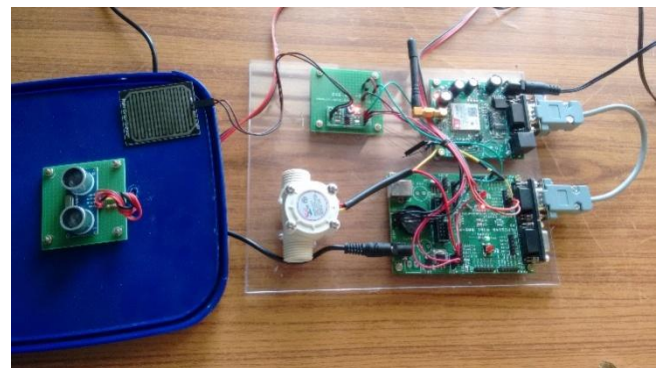Figure 10: Level in Node 1

9. Hardware Results:

Figure 11: Hardware of the project

10. Advantages:

The main advantages of this project it is real time measurement and monitoring system. It can be easily configurable. The size of the system is less and also more reliable. Water level in the rivers are monitored regularly.

The main limitation in this project is huge data should be utilized. As we are using the GSM module network the signals should be available regularly.

11. Conclusion:

In this project a model is developed to monitor the level and flow of water in rivers. Wireless Sensor Network is used for monitoring of river and flood conditions.Sensors and wireless communication protocols are used to create a database and the server.

12. References:

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