A REAL-TIME FLOOD ALERT SYSTEM

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Abstract: Floods are the most destructive and costly natural disaster in India, in terms of loss of life, and damage and destruction of property and infrastructure. Despite of various methods of alerts available; like the Emergency Telecasting System or sirens, none of these have proven to alert a user remotely in an efficient and timely manner. This paper presents a real- time system to monitor sudden floods in parking area, addressing the concern of water damage to vehicles. The automatic alarming system will be provided with this device for alerting during the increasing floods level with wireless network and also monitoring the network power management. The framework includes two kinds of hubs: Sensing and Sink. Each detecting hub utilizes a dimension sensor to screen the water levels; which will at that point speak with UART and the information achieves the sink hub. The sink hub is currently in charge of sending the got information from the sensors to a remote server by means of Wi-Fi Network. What's more, information's of the two clients and surge level are prepared and dealt with by the server, and will send clients an email caution and instant message (SMS).

Keywords: UART, Power management, Wireless, SMS

I.INTRODUCTION

A flood is an occurrence where water submerges land mass that is usually dry. Floods are natural phenomenon that can be due to a number of factors and affects human lives. These happen at irregular interval, not two floods occur at same time. A Sudden, heavy and intense precipitation can cause floods to rise quickly in minutes or hours followed by flash floods, and are typically associated with small catchment areas. In large sea areas, rain can build up over hours, days or weeks. Many factors are the reasons for floods however the main cause of floods is rainfall. When rain pours over a catchment, some rain water are captured by soil, vegetation and water storages such as farms and dams. The rest flows downhill into waterways. The amount and time of the rainwater reaching the waterway are based on the characteristics of the catchment, particularly its verdure, shape, size, the way the land is utilized and the preceding weather conditions.

Grust (2008) identifies the importance of Early surge cautioning frameworks as basic for the insurance of the populace against surge dangers by giving ample time for individuals to get readied. Perez et.al (2007) proved that a community based flood warning system can be used for disaster mitigation and disaster preparedness of the community as it provides an early flood monitoring and warning services. Based on its service, flood warnings should be exact, informative, timely manner, targeted to appropriate peoples, trustworthy and confidently to enhance flood forecasting and warnings.

Usually heavy downpour is the major cause of flash floods but it can also occur from a dam break, a embankment break, or even ice jams in rivers during the winter and spring months. Increase in urbanization is also one among many reasons of flash flooding. Impervious surfaces made of materials like concrete or compacted bare soils cause sudden contribution in runoff from heavy downpour leading to destruction of roads and buildings very quickly. So the intensity of the rainfall event and spatial distribution of land cover largely affect the hydrologic response of the watershed. Hence, flash floods is to be analysed at both spatial and temporal scales to calculate exact response time of the watershed (time of concentration). Many preventive measures such as the construction of dams, head works or dykes, are aimed at reducing the impact of floods. Though these measures may be successful in reducing the impact of floods level destructions, but it is unlikely ever to be totally stopped. Moreover, change in climate and precipitation patterns also pose serious problems leading to flash flooding. Global warming is the major reason of climate change and cause further alteration of the global water cycle with a consequent increase in flood risk. Nevertheless, the substantial natural variability and changes in stream flow makes the problem further complicated.

The Flood hazard that lead to flooding is defined as the possibility of the occurrence of a flood event of a certain degree in a given region within a specific period of time. In this study, variuos flood hazard indicators considered are flood duration, flood depth, flood velocity, flood peak, flood volume, the impulse of flood (product of water level multiplied by velocity), the rate of the rise of floodwater levels, and flood warning time. Flood vulnerability is defined as the amount of damage triggered by a hazard of a given magnitude for a specific element which is at risk (e.g. a stage - damage function). In general, the indicators of vulnerability are loss potentials derived from the susceptibility of an individual or a community. In this study it includes residential areas, buildings, farm - lands, infrastructure, social structure and environmental surroundings, human health. However, evaluation procedure for vulnerability (like, flood vulnerability index, social vulnerability index, and environmental vulnerability index) is beyond the scope of this paper. In this study, the hazard indicators are estimated using the hydrologic modeling of the floodplain.

The major technological infrastructure which is required for the flood warning system is the operating system and hardware (for forecast centre), an application program (for effectively collection, processing, analyses and display of earth observation data), an redundancy and maintenance program (to ensure the data availability and processing capability at all the time). A Flood alert application program usually has the following functions: 1) A stream flow forecasting using rainfall data, water level data and remotely sensed topographic data of the watershed; 2) The real time processing and storing of data; 3) Checking the data for exceedance of threshold value; 4) Determination of parameters using observed data; 5) Display of analysed and predicted water level information.

This is achieved by incorporating a new wireless network system, if there be any flood level increasing, for continuously updating the message to corresponding peoples through internet from Web-Server.

II. AN OVERVIEW ON SOME PREVIOUS ALERTING SYSTEM

1. Radar Based Flood Alert Systems
Systems like Flood monitoring systems have been around for some time with the use of radar based flood estimation. The city of Houston established a flood alert system for the Brays Bayou. It was commissioned by the Texas Medical Center in 1998, and gives the center real-time data on the predicted floods in the area. For this the system uses the National Weather Service's NEXTRAD installation near downtown Houston.

A flood forecasting model using autoregressive methods with stochastic parameters were disccussed in the paper. Data for these forecasts were obtained with two different types of radars for the Mayaguez Bay Drainage Basin Area. These radars (Off-the Grid and TropiNet) were able to detect rainfall events which were even missed by the NOAAs NEXRAD. A distributed hydrologic model was used to obtain flood depths.

2. Flood Forecasting Using Ultrasonic Sensors
Another system which is a Disaster flood alert system using GSM & ultrasonic frequency sensors is one of the important technology which is useful to make the people alert during disaster flood. In this project ultrasonic transducers were used to find out the water level of the flood. And then the information is given to the controller and GSM. This system then continuously send messages towards control room about the level of the flood when water level changes.

III. PROPOSED SYSTEM

The network will be used to continuously monitor the flood levels in the region of interest while the server will receive, analyse, store the data, and send alerts when threshold level is reached. The automatic alarming system will be provided along with this device which alerts the increasing floods level with wireless network and also for monitoring the network power management.. A database of clients and flood levels will be prepared and dealt with by the server, which will send clients information as an email and also will reach to any cell phone as an instant message (SMS).

IV. SYSTEM ARCHITECTURE
The actualized framework consists of a microcontroller (LPC2148) as a principle preparing unit for the whole framework; and all the sensor and gadgets are associated with the microcontroller. The sensors can be controlled by the microcontroller to recover the information and it examins with the sensor information and updates it to the web through Wi-Fi module connected to it.
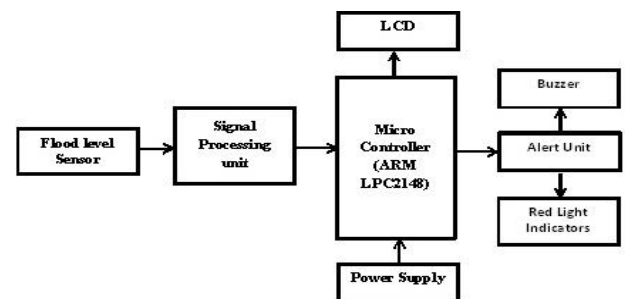
BLOCK DIAGRAM:

SENSING CONTROL UNIT:

Fig.1.Block diagram of sensing node
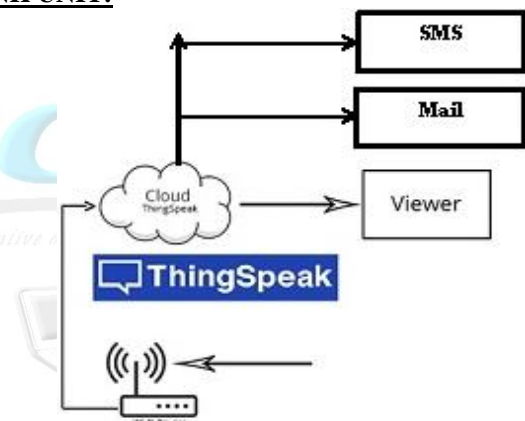
SINK UNIT:

Fig.2.Block diagram of sink node

LPC2148:
The microcontroller LPC2148, used in this framework is a right decision for the actualized framework. As this proposed framework is a low power consumable arrangement, the microcontroller should also be likewise of low power devouring. LPC2148 having 8 channels Analog to Digital converter will be a noteworthy favorable position with this microcontroller to get the information from the simple sensors attached with it. And this chip has significant number of highlights on it.

SENSOR NODES:
The ultrasonic sensor is an instrument for estimating the separation to a protest utilizing ultrasonic sound waves. This sensor uses a transducer to send and get ultrasonic heartbeats that hand-off back data around a question's closeness. The High-recurrence sound waves reflect from limits to deliver unmistakable resound designs. These Ultrasonic sound vibrates at a recurrence over the scope of human hearing. Transducers are the amplifiers used to receive and send the ultrasonic sound. A solitary transducer is used to send a

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heartbeat and to receive the reverberate. The sensor then decides the separation by estimating time between sending and accepting of the ultrasonic pulse.

ESP8266 WI-FI Module:

The ESP8266 WI-FI module is essentially, an entire WI-FI arrangement, which has an independent working framework and an incorporated TCP/IP convention stack that can efficiently interface with the microcontroller for selecting the entrance to any Wi-Fi network. This module has the ability to either to give or gain the applications and capacities from other module or processor. For interfacing this module to any WI-FI network, pre-programed program which is set in the module should be uploaded as firmware. This is an extremely practical module with a constantly developing and colossal correspondence network.

This module has great capacity and information preparing ability, accordingly it can without much difficulty coordinate with sensors and others handling units. This is high degree on chip reconciliation device which has a low PCB hardware region. It is supported with IPSD for yield applications and additionally interfaced with Bluetooth. The module does not require any outer RF flag since it has independent adjusted flag. The ESP 8266 WI-FI module is given in figure below:

GSM Modem

A GSM (Global System for Mobile Communication, initially from Group Special Mobile) modem is a type of remote modem that works with a GSM remote system. A remote modem transmits on like a dial-up modem, and the fundamental difference between these is that a dialup modem sends and receives information through a settled phone line, while a remote modem doesn't.

AT COMMANDS:

The Microcontroller, to control the GSM Modem uses the AT directions. GSM modems and ordinary Hayes modems augment a typical arrangement of AT directions. GSM modem supports an all-encompassing arrangement of AT directions which are considered in the GSM norms.
With these we can:
  i)   Send SMS messages and Monitor the signal strength.
  ii) Battery level and its charging status can be monitored.
  iii) Read, write and search phone book entries.

GENERAL SYNTAX:

AT commands are used to control a modem. AT is the acronym of ATtention. Every command line starts with "AT" or "at". This is the reason why modem commands are called AT commands. The starting of a command line is known by the modem with help of the prefix "AT" and is not a part of the AT command name. For instance, 'D' is the actual AT command name in 'ATD' and '+CMGS' is the actual AT command name in 'AT+CMGS'. Many of the commands like these, which are used to control wired dial-up modems, such

as ATA (Answer), ATH (Hook control), ATD (Dial) and ATO (Return to online data state), are also supported by GSM/GPRS modems and mobile phones.

Relay:

For performing switching actions in AC/DC devices Relay is used. In the proposed work, Relay is used to switch ON the cooling fan. If the room temperature is higher than the limit, through Relay the cooling fan will be ON automatically.

IV. SOFTWARE IMPLEMENTATION

In the proposed work, the implementation of the software plays a major role for retrieving the sensor data and updating it to the server. Here two software tools we mainly used. They are Keil uVision Ide and Flash Magic. The Keil uVision IDE is an embedded programming platform for supporting different microcontrollers and provides a complete programming environment for the microcontrollers.

This IDE is used for programming the LPC2148 which is a microcontroller with ARM7 TDMI processor. Another tool known as Flash magic is used for writing the machine language code into the microcontroller's flash memory. This tool also enables additional features like terminal window for the hardware devices.

The whole programming work is done in C language. Firstly, is to instate the ESP8266 by sending a couple AT directions. Common instatement process incorporates, checking the correspondence with ESP8266 to microcontroller, scanning for a Wi-Fi network inside its range and interfacing the Wi-Fi module to that network by getting verified with required certifications. After the introduction procedure is finished, a program for configuring the Wi-Fi module as a TCP/IP client is to be finished. When configuring the ESP8266, checking the acknowledgment is important so as to ensure that the module is configured correctly. After configuring the ESP8266 is finished, we have to program for reading the sensor data. The ADC (Analog to Digital Converter) unit must configure with all prerequisites like clock frequency, resolution and data format. Thereafter, the microcontroller will run the instruction continuously to get the updated data values from sensors. Next, the major task is plotting the sensor data in a graphical form. To deal with IP address communication, it is essential to go through networking environment. As mentioned before, one open source data logger web site is used to reduce the implementation cost. In a normal way, if its required to plot the data into web site, its required to own and pay for the domain space and design the web page as per ones requirements, which is difficult and costlier method. Hence, instead of paying for a own domain, a web site called "Thingspeak" is used. This website provides a free user space for forming the data channels. Each channel will be having 8 fields for writing various data and thereafter it automatically plots the given data in a graphical representation.

The correspondence with Thingspeak server should be possible by utilizing its IP address. It is important to program for ESP8266 to send the required AT directions and to build up an association between the framework and thingspeak server. In the wake of making one channel for entering the

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information into site, the channel will be relegated with one API key. So its required to compose the API key before composing the real information. At that point the information will be put away and showed in the required channel.

V. CONCLUSIONS

This paper aims to develop the flood alert application to shelter the property of the people living in Mushim stream watershed from flash flood. A flood alert application is a flood disaster mitigation measure and gives flood warning based on observation of river stage wise and rate of rise. It aims at giving early warning flood information for floods with lead-times upto 3 hour by relating deterministic and probabilistic weather information. And a bare bones ARM LPC2148 was used, removing unnecessary LEDs and unused pins, allowed to lower the overall power consumption. The system was improved by changing to an event trigger instead of a cyclic approach, which would keep the system in a shutdown state and turn it on in the case of rain or water being detected. The range of the nodes for effective performance, the radio's antenna should be located outside the building so as to improve the line of sight and reduce dropped packets.

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