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An Appropriate Flash Flood and Landslide Warning System for Developing Countries: A Review

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Abstract— The system that is proposed is an early warning system that can provide valuable minutes that would help in mitigation of disasters like landslide and flash floods. The system comprises of a wireless sensor network established on slopes of a mountainside which are prone to landslides and flash floods. The network established is based on a zig bee tree topology. For purpose of demonstration, a two node system has been proposed. The nodes will measure precipitation using a tipping rain gauge and landslides using buried microphones or peizo elements that measure pressure changes. These nodes would report to a base station which would have a zig bee coordinator as a receiver. This unit, called the base unit will communicate with a master unit using a long range RF transmitter. This unit will be suitably located at a location, say, for example at the district collector. When rain detected by the nodes is larger in a given time period, so as to produce a flash flood, this information is sent to the base unit which in turn sends it to the master unit. The master unit sounds an alarm and sends SMS to related officials via a GSM module interfaced with it.

Keywords—GSM modem, flood alarm ,water level sensor, accelarometer.

I. INTRODUCTION

Natural disasters such as floods are a worldwide phenomenon, they are occurring more frequently and lead to devastating loses. In developing countries, the effects of flood are more harmful than in developed countries. Because of that, there is a need to make a system which can provide advance warning of flooding[1]

Fig.1 Flash flood due to heavy rain fall

European countries have also had large floods, but with less
property and life loss. flood impact can be reduced by effective flood risk management and timely dissemination of flood warnings to citizens. [2]. However, flood impact can be reduced by effective flood risk management and timely dissemination of flood warnings to citizens. This paper explores the existing flood warning systems in developing countries, describes issues associated with disaster warnings, and proposes an appropriate flood warning system for developing countries.

II. EARLY WARNING SYSTEM

The early flood alerts system itself divided into three main
parts: sensor node ,coordinator section and base unit .Solar panels are used as a voltage source for the entire electronic circuit by utilizing sunlight, so the system can be easily placed on the riverside.[1] The system that I am proposing is an early warning system that can detect landslides and flash floods in advance and send a real time warning of the same. The system can be hugely useful in hilly terrains and areas which are prone to such disasters. The system consists of three main parts.

Fig. 2.Landslide

The first segment which actually measures the parameters are the sensor nodes. These are multiple in number and are wirelessly connected to the second part of the system called the co ordinator node. This is the part that collects the data from multiple sensor nodes, processes this information in terms of verifying whether the threat is real or not and then sends the warning to the third part called the base unit. The Co ordinator unit and the base unit are connected to each other by a dedicated wireless link. The base unit has a GSM modem interfaced to it, through which it sends the warning to one or multiple numbers regarding the approaching catastrophe. The Intergovernmental Panel on Climate Change (IPCC) identified a number of extreme climate phenomenon with high level of likelihood to occur [6];

(i). heat waves;
(ii) floods;
(iii). landslides;
(iv.) avalanche;
(v.) soil erosion;
(vi.) tropical cyclones,
(vii.) drought and
(viii.) storms. [7]

The effects of the global climate change are clearly felt by many around the globe.

III. RELATED WORK

The detailed All the parts of the system are explained in brief below.

A. *The sensor node*:

It consists of mainly 3 main section they are illustrated as follows.

1) The Landslide detector : this section has been realized by the use of an accelerometer. The device is capable of measuring acceleration or deceleration along all three X, Y and Z axes. The maximum range of the sensor is ±3g which is enough for the small scale prototype. The actual system would need to have a sensor with much higher maximum range. The sensor is capable of measuring dynamic acceleration resulting due to shock, vibration or sudden motion. It also provides static acceleration output resulting from earth's gravitational pull. The MEMS sensor on the module is capable of producing outputs corresponding to vibrations ranging from 0.5 Hz to 1500 Hz. The lower limit has been set to 50 Hz by the on module filter capacitors of 0.1 uF. The operating power supply range of the module is 1.8V dc to 3.6V. The output from all three axis are signal conditioned. The output bandwidths on all three axis of the module can be selected by the user from 0.5 Hz to 1600 Hz. The output of the axis desired is given to a comparator . the reference voltage to which the accelerometer output is compared is taken. The output of the op amp is given directly to the digital in of an Xbee module.

2) The xbee module: Zigbee is the main hardware module used in this paper for communication purpose[5]. XBee Series 1 comes standard with 802.15.4 firmware for point-point or star topology. This mature firmware offers ADC (analog-to-digital conversion) inputs, and digital and analog I/O line passing. The 802.15.4 XBee is significantly faster than ZigBee. The ZigBee excels in very low-power scenarios, when configured as an End Device, this module has the lowest current draw of any Digital RF product. However, the infrastructure of a XBee network is more complex and requires more configuration to fully implement. The indoor range of the Xbee is about 133feet or 40m whereas the outdoor RF line of sight range is about 400 feet or 120m. The RF data rate is 250kbps and the receiver has sensitivity of -98dbm.

3)Tipping rain gauge: This sensor is actually a rain collector. The unit contains two metal buckets suspended by a pivot at the centre. sensor is perfect for any number of applicationsthat requires performing measurements between moving or stationary objects The mechanical arrangement is done such that when the first compartment is in a position to collect rain, the second is in position to empty itself. Each bucket is designed to tip at 0.5 mm of rain. When the first basket tips, the second comes into collecting position and the first one empties itself and vice versa. Every tip of the buckets swipes a small permanent magnet attached to the tipping buckets past a reed switch attached to the stationary support on which the entire assembly of bucket rests. Thus the reed switch generates a pulse for every 0.5 mm of rainfall or 2 pulses per 1mm of rainfall. These pulses are directly connected to the digital input of the Xbee module.

B. *Coordinator unit*:

Coordinator unit cosists of main controller section ,lcd section power supply and a encoder.

1) The main controller section: This section is the heart of the system. This controller is also in-system programmable thus reducing the development time even further. The chip has 3 16 bit timers/ counters and 8 interrupt sources. The maximum frequency supported by the chip if we take 89s52 is 33MHz. Here the microcontroller has been connected in a standard fashion. When the power to the circuit is switched on,

the capacitor which initially has zero charge on it will take a high charging current. This charging current will flow to ground via the resistor thus generating a positive going short pulse across it. The time duration of this pulse is equal to the time constant of the RC network. Port 1 of the micro has been configured as the input port and port 0 has been configured as the output port for driving the LCD. The controller controls an encoder which drives the transmitter.

2) The encoder : the encoder is activated when the co ordinator controller senses a real threat- a condition when multiple accelerometers indicate ground motion (in case of landslide warning) or multiple rain gauges indicate heavy rain. The heart of this section is an encoder chip HT12E from Holtek. The chip has four data inputs and eight address inputs. The address inputs are to be perfectly matched to that on the hand held receiver section decoder. The chip also has to be connected its frequency determining resistor externally. To match the frequency of the internal oscillator of the encoder, a resistor of 1.1M is connected between its oscillator pins (15 and 16). As in the case of the decoder, this value is not standard and a series combination of 1M and 100k has been used. The address is also set identical to that on the address lines of the decoder. To initiate the transmission of the data packet from the encoder the TE pin (transmit enable) has to be grounded momentarily. As the transmission of data is continuously required in our application, this pin is hardwired to ground. The output of the encoder is available at pin 17 which is a serial pulse train with start and stop bits added. This output will contain the status of the DIP switch which has been connected to the data lines of the encoder. This DIP switch setting is what corresponds to the actual unique address of the vehicle. The output of the encoder is fed as input to the RF transmitter module. The transmitter used here is the 433MHz ASK module operating in the ISM band.

3) The lcd section: an LCD display has been interfaced to the controller for display of various status of the entire system. The display used is a 16X2 standard back lit LCD display. In all the display has 16 pins of which 8 pins are data pins, 3 are power and contrast control pins, 3 are handshaking pins and remaining 2 pins are for power supply to the back light LED. The data lines (pins 7 through 14) are connected to port 0 of the controller. Port 0 being an open collector port, is also pulled up to Vdd by a 10k 9 pin pull up resistor network. The handshaking pins (4, 5 and 6) are connected to three lines on port 2. Pin 1 and 16 respectively are LCD ground and back light LED cathode and are thus directly grounded. Pin 2 is Vcc and pin 3 is contrast control for characters displayed.

4) The power supply section: The power supply section used here is quite different from other projects. As the system would be mounted in non populated regions it has to be self sufficient as far as power is concerned. This is done by using a solar panel and a rechargeable storage battery. The solar panel powers the unit by day time as well as charges the battery, and the battery takes up the duty of powering the unit when the solar panel ceases to produce any electricity. The battery used is an rechargeable battery. The battery is connected to the solar panel using a series type charge controller. The function of the charge controller is to charge the battery to a proper level at the same time ensure that the battery is not discharged by the panel during night time.

C. *The base unit*

The base unit consists of The gsm module and power supply .

1) The gsm module : The modem used here is SIM900 GSM module. This module accepts a single sim card and can send and receive messages (text messages). It can be controlled by sending AT commands from any general purpose microcontroller UART. Here it has been connected to the microcontroller TxD and RxD pins. The is powered by +5V dc which is obtained from the motherboard. The modem works on a single supply voltage range of 3.5 to 4.5V with a sleep current of only 2.5 mA. The transmitting power of the modem is 2W on GSM900 band and 1W on 1800 and 1900 band. The modem also supports GPRS data transfers of uplink data @ 85.6 kbps max. and downlink transfers @ 42.8 kbps max. the modem is also capable of sending and receiving SMSs but received SMSs are stored on the SIM card. The modem supports both 1.8V and 3V SIM cards in its SIM adaptor. Apart from this the modem sports speech and audio support, phone book support, AT command activated timer, an RTC, two serial interfaces, upgradable firmware etc.

2) The power supply section: As this unit is situated in the city, it is powered by ac mains. A power supply furnishes the dc requirements of the circuit. The

system contains an on board bridge rectifier that actually works as a polarity corrector which gives independence from concern regarding pin configuration of the power supply. A 1000uF pre-regulation and 100uF post regulation filter capacitors are also connected on board. The +5V is provided by a three terminal fixed voltage regulator.

IV. CONCLUSION

Floods and landslide are natural phenomenon, affecting people around the world. Floods and landslide are occurring more often more property damage and loss of life. Many countries have introduced alert systems to minimize this impact. However, it seems the systems are not always effective due to poor flood warning strategies and procedures.This paper has proposed an appropriate automatic flood and landslide warning system using SMS to directly warn and save people in remote flood areas in different countries, where mobile phone networks are available and there is a high level of mobile phone penetration.

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REFERENCES

[1] Endrowednes Kuantama, Pono Mardjoko,ade Anggrecia Saraswati" Design and Construction of Early Flood Warning System Through SMS based on SIM300C GSM modem"

[2] Saysoth Keoduangsine and Robert GoodwinM "An Appropriate Flood Warning System in the Context of Developing Countries" ,2013 3rd International Conference on Instrumentation, Communications, Information Technology, and Biomedical Engineering (ICICI-BME)115Bandung, November 7-8, 2013

[3] (2008)TheStar.Online]Available:http://thestar.com.my /news/story.asp?file=/2008/12/6/nation/20081206081039&sec=nation

[4] International Journal of Advance Research in Computer Science and Management StudiesVolume 2, Issue 12, December 2014 pg. 297-302V.

[5] Y.Srinivas, K. Raghava Rao," Landslide Warning System Using ZigbeeAnd GPS" IOSR Journal of Engineering (IOSRJEN) ww.iosrjen.org ,ISSN (e): 2250-3021, ISSN (p): 2278-8719Vol. 04, Issue 07 (July. 2014), ‖V4‖ PP 01-06

[6] Nor Azlina Ab. Aziz *, Kamarulzaman Ab. Aziz**,"Managing Disaster with Wireless Sensor Networks", ISBN 978-89-5519-155-4 Feb. 13~16, 2011 ICACT2011

[7] IPCC "'Summary for Policymakers'. Climate Change 2001: Synthesis Report. Contribution of Working Groups l, ll and lll to the Third

[8] Assessment Report of the Intergovernmental Panel on Climate Change." Cambridge University Press, Cambridge, 2001, pp. 1 – 34

[9] Dr. Patrick Parrish, Matt Kelsch, and Jennifer,"FLASH FLOOD EARLY WARNING SYSTEM REFERENCE GUIDE" ,the National Oceanic and Atmospheric Administration, U.S. Department of Commerce.