WIRELESS LANDSLIDE DETECTION AND MONITORING SYSTEM

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ABSTRACT

Wireless sensor networks are one of the emerging areas which are provides capability of developing real-time monitoring systems.This paper discusses the development of a wireless sensor network(WSN) to detect landslides, which includes the design, development and implementation of a WSN for real time monitoring by collecting data through the sensors and process on it for tracking and detection.

Keyword- *Wireless Sensor Network, Distributed Algorithms,Heterogeneous Networks, Landslide*

1. INTRODUCTION

Landslide are the natural phenomenon during which large amount of landmarks slide downwards from hilly areas, mainly owning to gravity , destroying everything lying in the path.The Himalayas and the western ghats are the two regions in India that are most vulnerable to landslides.The Himalayan mountain belt comprises of tectonically unstable,young geological formations that experience mild to severe seismic activity.Although ghats and the nilgiris are geologically stable;they have uplifted pleatue margins that are include by influenced by neotechtonic activity.The slides in the Himalayan regions are bigger and more massive than the one experienced by the western ghats,and in the most case,they are triggered by seismic factors .

CAUSES :-

Landslide may be caused by natural as well as anthropogenic factors.some of the causes are discussed in the following sections.

NATURAL CAUSES :-

The following are the natural causes of landslides:-
Earthquakes : Most of the landslides are induced by earthquakes and these landslides are the major contributors of casualties during such earthquakes.The heightened seismic activity during an earthquake reactivities old landslides and also leads to the formation of new ones.

Volcanic eruptions : landslides on volcanoes are common because of there massive heights on their cones.these cones are obtained weakend by the rise and eruption of magma,and the tremendous weight of the lava causes them to settle under the force of gravity leading to landslides.

Torrential rains and glaciers : Heavy rains and melting of glacierds increases the moisture contents,leads to saturation,and hence weaken the slopes,causing the wet earth to slide downwards.

Anthropogenic causes : In addition to natural causes ,human activities may also trigger of landslides in susceptible areas the following are some of the anthropogenic causes of landslides:-

- Constructions of dams,bridges,tunnels,roads etc.
- Use of explosives for breaking rocks during minings.
- Destruction of vegetation from the slopes leaving them vulnerable to run-offs.

2. Methodology used

The method is used for the detection of landslide can describe by the three step
1.collecting the data by using the sensor.
2.compare the collected data with the value that are stored in the pic using c programming.
3.Track the place where landslide is done with help of gps and gsm.

3. .BLOCK DIAGRAM OF THE SYSTEM

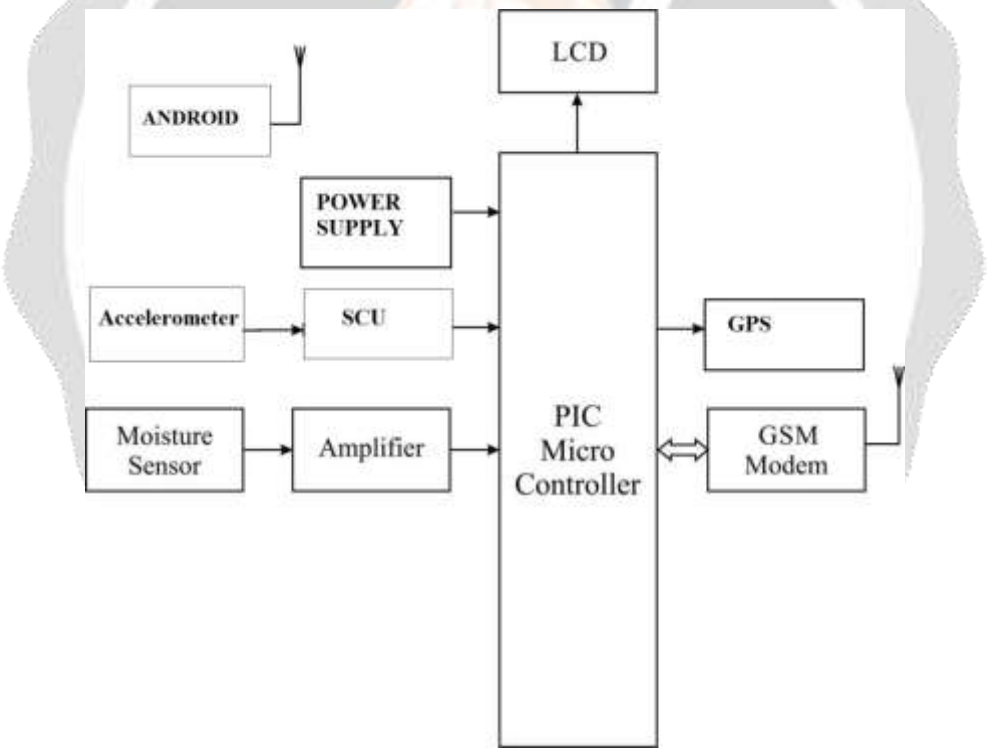


FIG 1: Block Diagram Of The System

The concept is as follows:
We designed a power supply unit to give 5V, +12V and -12V dc to microcontroller, relay and opamp.
When we turn ON the supply the ac voltage is step down using step down transformer and then rectified using bridge rectifier. The electrolytic capacitor is used to filter the dc voltage and then by using 7805 and 7812 then we get 5Vdc and 12V dc. GSM is connected to microcontroller which initializes using AT commands. Once the GSM is initiated, it sends message on android app that includes IP address of the GSM. Once android app receives IP address of the GSM, it sends message on the GSM and finally communication establishes between GSM and android app.

Whenever earthquake is detected by accelerometer we will get a message on our mobile indicating the values of accelerometer and GPS values.
Whenever land slide is detected by soil moisture we should get a message on our mobile indicating "landslide detected" and GPS values.

4. MOISTURE SENSOR

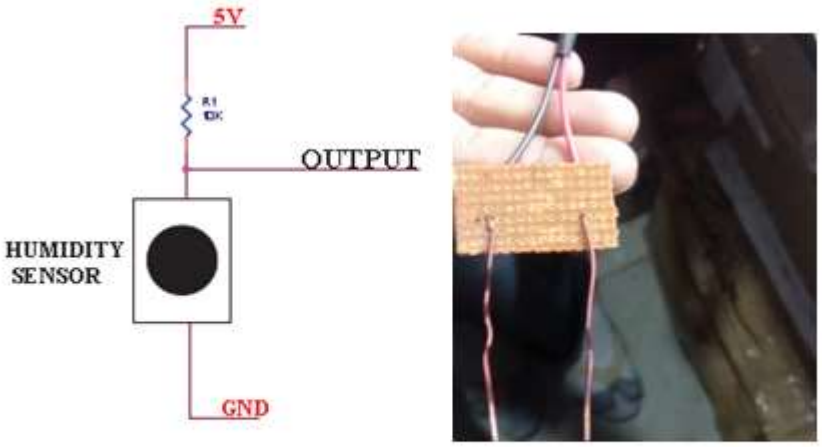


Fig 2 : moisture Sensor

Circuit description:-In this circuit the two conductors are used to measure the moister. moister is nothing but water particles in the sand.

Potential divider form:

$$V_{out} = V_{in} \frac{R_2}{(R_1 + R_2)}$$

If the R1 and R2 value is equal means the output is half of the Vcc supply. In this circuit output is a variable one. So the output is depending upon the R2 resistance value. Resistance value will be varied depend upon the Temperature level. Temperature varied means the resistance value also varied. If moister value increased means output also decreased. The moister value and output is a inversely proportional one. Then the final voltage is given to ADC for convert the analog signal to digital signal. Then the corresponding digital signal is taken to process in microcontroller. The ADC value will increase if the temperature increased. We can measure the moister only with the help of any controller or processor.

5. ACCELEROMETER

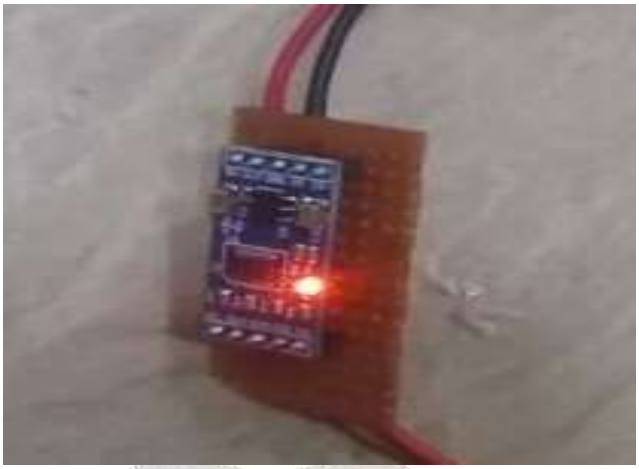


Fig 3 : accelerometer

Accelerometer is an electromechanical device that will measure acceleration forces. These forces may be static, like the constant force of gravity pulling at your feet, or they could be dynamic - caused by moving or vibrating the accelerometer.An accelerometer is a device that measures the vibration, or acceleration of motion of a structure. The force caused by vibration or a change in motion (acceleration) causes the mass to "squeeze" the piezoelectric material which produces an electrical charge that is proportional to the force exerted upon it. Since the charge is proportional to the force, and the mass is a constant, then the charge is also proportional to the acceleration.

6. PIC CONTROLLER(16F877)

The microcontroller that has been used for this project is from PIC series. PIC microcontroller is the first RISC based microcontroller fabricated in CMOS (complimentory metal oxide semiconductor) that uses separate bus for instruction and data allowing simultaneous access of program and data memory.

The main advantage of CMOS and RISC combination is low power consumption resulting in a very small chip size with a small pin count. The main advantage of CMOS is that it has immunity to noise than other fabrication techniques.PIC (16F877) :Various microcontrollers offer different kinds of memories. EEPROM, EPROM, FLASH etc. are some of the memories of which FLASH is the most recently developed. Technology that is used in pic16F877 is flash technology, so that data is retained even when the power is switched off. Easy Programming and Erasing are other features of PIC 16F877

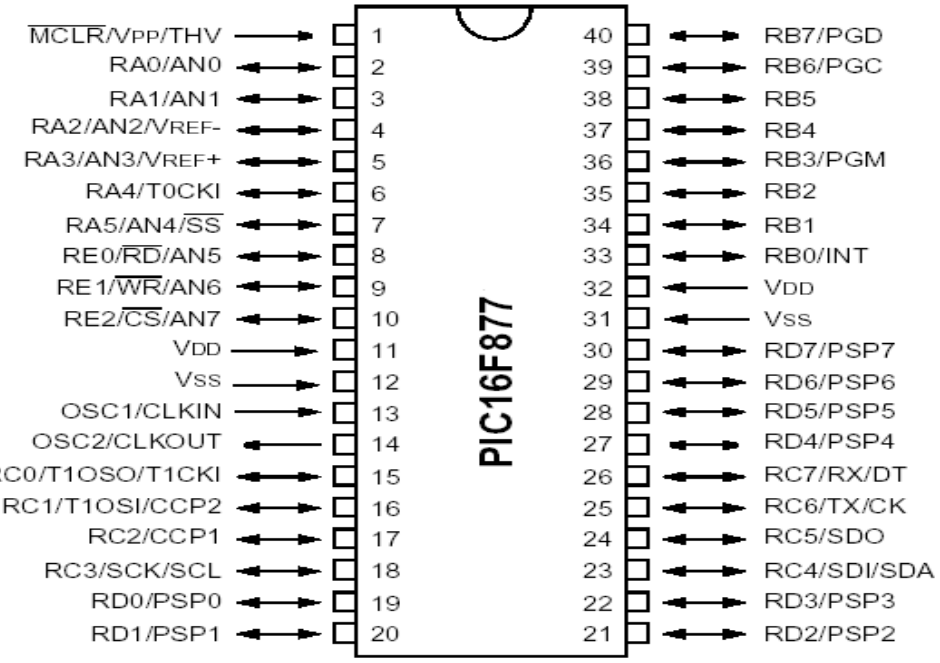


Fig4:diagram of PIC

7. ANROID SYSTEM (GPS AND GSM)

Fig 5 :gsm module

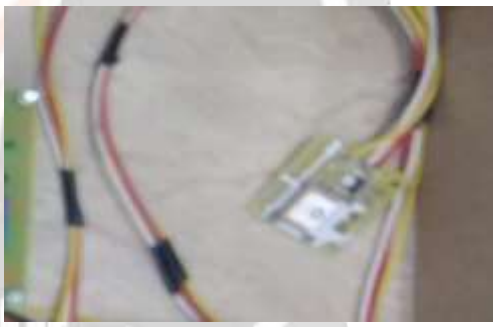
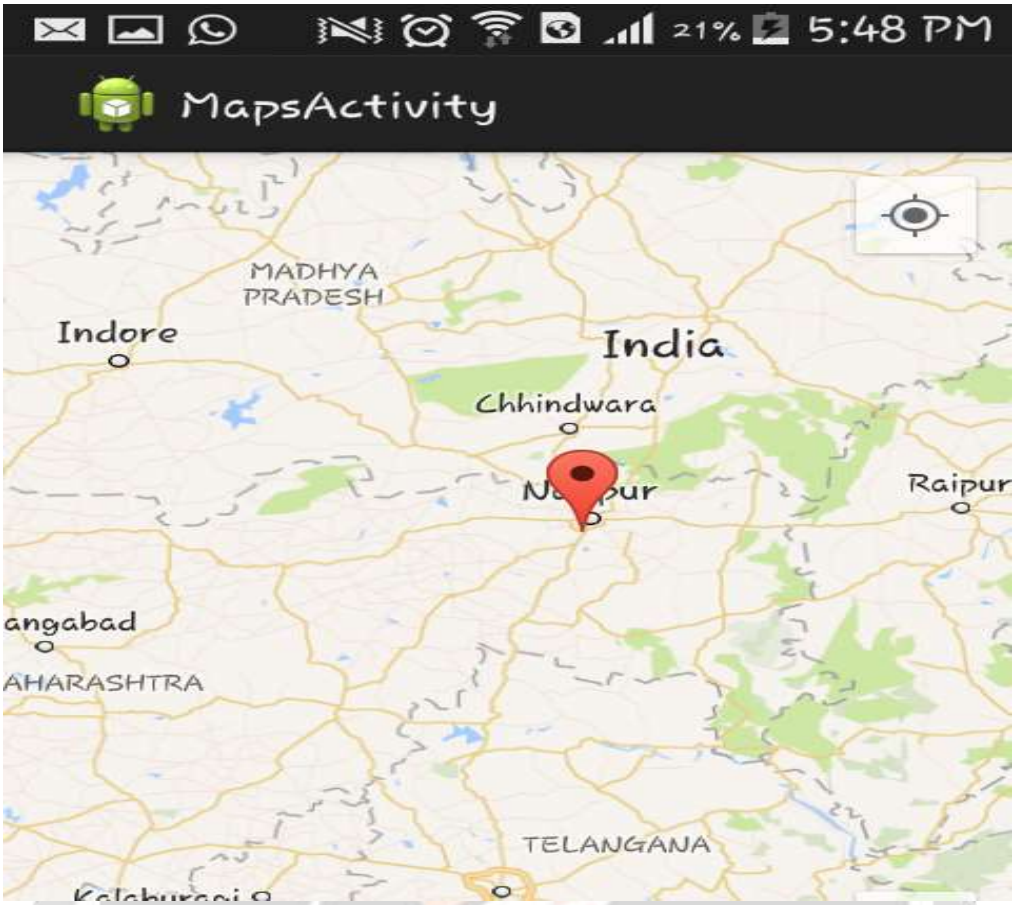


Fig 6.gps module

The sim 900 is complete quad- band GSM solution in a SMT module which can be embedded in the customer application.Featuring an industry standard interface the SIM delivers GSM/GPRS 850/900/1800/1900 mhz for voice ,sms,data,fax in a small form factor and with low power consumption . This is a third generation POT (Patch Antenna On Top) GPS module. This POT GPS receiver providing a solution that high position and speed accuracy performances as well as high sensitivity and tracking capabilities in urban conditions & provides standard NMEA0183 strings in “raw” mode for any microcontroller. The module provides current time, date, latitude, longitude, speed, altitude and travel direction / heading among other data, and can be used in a host of applications, including navigation, tracking systems, fleet management, mapping and robotics.This is a standalone GPS Module and requires no external components except power supply decoupling capacitors. It is built with internal RTC Back up battery. It can be directly connected to Microcontroller's USART. The module is having option for connecting external active antenna if necessary.

8.RESULT

Use concept of distributed detection,estimation and consensus for reliabledecisions at lower level sensor nodesLandslide causes significant changes in the Earth's natural environment. It is relatively local event; therefore,non-geodetic monitoring technique might help more significantly. WSN is also an emerging, reliable andinexpensive technology and is capable of presenting the real time monitoring over a long distance and inhospitableterrains. A multi functional IRIS mote interfaced to wireless module has been used to sample the heterogonous datawith digital sensors in the present paper. Analyzing the data produced by the system, one can monitor the landslidemovement, acceleration and subsequently remedial measure can be taken



9.CONCLUSION

Wireless sensor network for landslide detection is one of the challenging research areas available today in the field of geophysical research. This paper describes about an actual field deployment of a wireless sensor network for landslide detection. This system uses a heterogeneous network composed of wireless sensor nodes, Wi-Fi, and satellite terminals for efficient delivery of real time data tothe data management center. The data management center is equipped with software and hardware needed for sophisticated analysis of the data. The results of the analysis in the form of landslide warnings and risk assessments will be provided to the inhabitants of the region.The pilot deployment of this system is already in place at Anthoniar Colony, Munnar, Idukki, Kerala, India. In the future, this work will be extended to a full deployment with increased spatial variabilty, and the work in this regard is progressing. Field experiments will be conducted to determine the effects of density of the nodes, vegetation,location of sensor columns etc., for detecting rainfall inducedlandslides, that may help in the development of low costwireless sensor network for landslide detection.

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