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Soil Area Network Landslide Prediction and Prevention

P.Banupriya , P.Suganya

Abstract— Landslide is one of the natural disaster . Approximately 15% of total area of India is susceptible to landslides. A large number of different monitoring techniques for landslide monitoring have been made available to geoscientists in recent years such as remote sensing, ground space techniques etc. The main disadvantages of these techniques include their high costs, their coarse ground resolution, and their discontinuity in data acquisition making it difficult to obtain real time data.

In this project landslide can be predicted by using low cost wireless sensor network(WSN). The WSN sensor is deployed on the hills to sense the soil moisture and the slope stability. Sensor nodes transport this information to host system through the wireless network.

Detection is performed by the host node after receiving data from all the sensor nodes. Soil moisture increases the possibility of the land and mudslides. If it detects an increase in soil moisture or an occurring one, the host system immediately transmit an emergency SMS to the governing authority at long distance by means of GSM unit interfaced with it. By connecting it with warning traffic lights on the road the vehicle in the region can be alerted before a landslide.

Keyword:WSN- wireless sensornetwork, soil moisture, GPS.

I. INTRODUCTION

Wireless sensor networks (WSN) is one of the major technology that can be used for real-time monitoring.WSN has the capability of large scale deployment, low maintenance, scalability, adaptability for different scenarios etc. WSN has its own limitation such as low memory, power, bandwidth etc, but its capability to be deployed in hostile environment, and low maintenance requirement made it one of the best suited technologies for real-time monitoring.

The sensor network has sensing component and computing component. The sensing component consists of a MEMS acceleration sensor and a soil moisture sensor, a low power data processing unit and wireless communication unit based on IEEE 802.15.4 RF transceiver. The computing component contains the processor and radio module.

MEMS acceleration sensor is used to assess the slope stability. The slope stability is a measure of tilt of the land. Any suggestive movement of land changes the orientation measurement of the MEMS sensor. Sensor component transport this information to host system through the wireless network, from which the data received is made available to the concerned authority with the help of GSM unit for rescue purpose.

Sensor networks, by exploiting multihop communications, can be distributed also on wide areas at limited wiring costs. For landslides, which can extend over several square kilometers, this is a very important feature.

Wireless sensor networks can be integrated to existing instruments, acting as an infrastructure to collect, process, and transmit their data to a remote base station, and thus helping alleviating the identified limitations of existing ground-based techniques.

II. EASE OF USE

The soil moisture sensor uses capacitance to measure the water content of the soil (by measuring the dielectric permittivity of the soil, which is the function of water content).By inserting the sensor in to the soil to be tested, and the volumetric content of the soil is reported in percent.

The horizontal orientation of the sensor ensures the measurement is made at a particular soil depth. The entire sensor can be placed vertically, but because soil moisture often varies by depth, this is not usually the desired orientation. To position the sensor, use a thin implement such as a trenching shovel to make a pilot hole in the soil. Place the sensor into the hole, making sure the entire length of the sensor is covered. Press down on the soil along either side of the sensor with your fingers. Continue to compact the soil around the sensor by pressing down on the soil with your fingers until you have made at least five passes along the sensor.

P.Banupriya , Assistant Professor, Department of Electronics and Communication Engineering, Syed Ammal Engineering college, Ramanathapuram, Tamil Nadu, India (Email : harshikabanu@gmail.com)
P.Suganya ,Assistant Professor, Department of Electronics and Communication Engineering, Syed Ammal Engineering college, Ramanathapuram, Tamil Nadu, India (Email : sugansuganp@gmail.com)

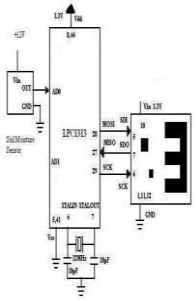

Fig.2. Interfacing with LPC1313F

III. RF TRANSCEIVER

There are two ways to transmit a message: broadcast and unicast. Broadcast packets have all devices in the radio range as their destination. IEEE 802.15.4 defines a specific short address as the broadcast address, but has no definition for the long address. As a result, broadcasting is the only situation when the MiWi P2P stack uses a short address. There is no Acknowledgement for broadcasting messages.

Unicast transmissions have only one destination and use the long address as the destination address. The MiWi P2P stack requires Acknowledgement for all unicast messages. If the transmitting device has at least one device that turns off its radio when Idle, the transmitting device will save the message in RAM and wait for the sleeping device to wake-up and request the message. This kind of data transmitting is called indirect messaging. If the sleeping device fails to acquire the indirect message, it will expire and be discarded. Usually, the indirect message time-out needs to be longer than the pulling interval for the sleeping device.

In the MiWi P2P stack, only the messaged device will be notified by the radio. If the messaged device turns off its radio when Idle, it can only receive a message from the device to which it is connected. For the idling device with the turned off radio to receive the message, the device must send a data request command to its connection peer. Then, itwill acquire the indirect message if there is one.

The Printed Circuit Board (PCB) antenna was designed and simulated using Ansoft Designer and HFSS 3D full-wave solver software by Ansoft Corporation . The design goal was to create a compact, low-cost antenna with the best radiation pattern. The performance of the antenna is dependent upon the orientation of the module.

IV. NETWORK TYPE

The MiWi P2P stack supports only nonbeacon networks. In a non-beacon network, any device can transmit data at any time, as long as the energy level (noise) is below the predefined level. Non-beacon networks increase the power consumption by FFD devices because they must have their radios on all the time. These networks reduce the power consumption of RFD devices, however, because the RFDs do not have to perform the frequent synchronizations.

V. MESSAGE FORMAT

The message format of the MiWi P2P stack is a subset of the IEEE 802.15.4 specification‟s message format.

FIGURE 3: MIWI™ P2P WIRELESS PROTOCOL STACK PACKET FORMAT

Bytes	2	1	2	2/8	0/2	8	Variable	2
	Frame Control	Sequence Number	Destination PAN ID	Destination Address	Source PAN ID	Source Address	Pay Load	Frame Check Sequence
			Addressing Fields					

Figure 3 shows the stacks packet format and its fields.

FIGURE 4: FRAME CONTROL

Bits	3	1	1	1	1	3	2	2	2
	Frame Type	Security Enabled	Frame Pending	Acknowledgement Request	Intra PAN	(Reserved)	Destination Address Mode	(Reserved)	Source Address Mode

Fig 4 : Frame Control

The three-bit frame type field defines the type of packet. The values can be:

- Data frame = 001
- Acknowledgement = 010
- Command frame = 011

In the stack, however, the Acknowledgement frame is not used, since all Acknowledgement packets are handled by hardware in the MRF24J40 radio. The security enabled bit indicates if the current packet is encrypted. If encryption is used, there will be an additional security header which will be detailed in later sections on the security feature. The frame pending bit is used only in the Acknowledgement packet handled by the MRF24J40MA radio hardware. The bit indicates if an additional packet will follow the Acknowledgement after a data request packet is received from a RFD end device.

The intra PAN bit indicates if the message is within the current PAN. If this bit is set to „1‟, the source PAN ID field in the addressing fields will be omitted. In the stack, this bit is always set to „1‟, but it could be set to „0‟ to enable inter-PAN communication. Resetting the bit to „0‟ can be done in the application layer, if necessary.

The Destination Address mode can be either:

•16-Bit Short Address mode = 10

In the MiWi P2P stack, the Destination Address mode is usually set to the Long Address mode. The Short Address mode is used only for a broadcast message. For broadcast messages, the destination address field in the addressing fields

will be fixed to 0xFFFF. The Source Address mode for the MiWi P2P stack can only be the 64-Bit Long Address mode.

VI.RESULTS

Figure shown below is of alerting system for landslide detection which consists of sensors.

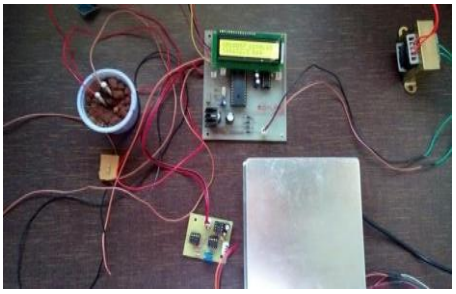

Fig.5.1 system setup

Figure shown below is a graph of soil moisture sensor output versus moisture content in the soil.

VII. CONCLUSION

Thus it is experimentally observed by operating the MEMS Accelerometer and Soil moisture Sensor. Since we can‟t display the occurrence of landslide, here in our project by tilting the mote and by measuring moisture content of our body from which the basic function of the project is demonstrated. The output will be displayed as "Warning - There is a Possibility of Landslide at WPAN 0x1212" and at great extent of landslide, the output will be "High alert - Landslidedetected at WPAN0x1212". The projectwork has been completed successfully. The project work functions satisfactory as per design.It was satisfying to see so many theoretical aspects work before us in life practice of which we have heard through lectures and which we have studied in the books.Though we cannot prevent the occurrence of the landslide, since it is a natural disaster, we can predict and take preventive measures to a satisfactory level.

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