The International Journal Of Engineering And Science (IJES)
||Volume||3 ||Issue|| 3||Pages|| 13-18||2014||
ISSN(e): 2319 – 1813 ISSN(p): 2319 – 1805

Wireless Sensor Network for Building Monitoring

Renjan Raj V.C
PG Scholar, Electronics & Communication Dept. Hindusthan Institute of Technology, Coimbatore,

----------ABSTRACT----------

This project mainly used to monitoring the building to access the earthquake damage and evaluate the structural behaviour of the building. Strain sensor and acceleration sensors are mainly used for this purpose. Additionally we are adding fire sensor, smoke sensor, co_2sensor, temperature sensor are adding the roof of the building to evaluate any damages that occurring the building. If any critical condition occurs then alarm will on and inform the people. The GSM protocol is used as the communication medium between the transmitter and receiving base station. Here in this project the receiving base station which consist of mobile phone. Inside the mobile phone the GSM SIM 300 is inserted. One of the main advantage by using GSM is the communication path which is wide by using this method more detailed information could be obtained from the structural behaviour as well as the actual condition of the building structure. This will enable engineers use more precisely information for the structure analysis and repair as well as life time prediction.The main aim of this project is to evaluate earthquake damage and also we can get structural behaviour as well as the actual condition of the building structure. If any critical condition that occurring the building roof such as smoke, Fire, temperature. In this project work detailed study of installing various equipments, sensoring the information and which helps to minimise the damages for huge structures and loss human lives.

KEYWORDS: *GSM, GSM SIM 300*

Date of Submission: 27 February 2014 Date of Acceptance: 10 March-2014

I. INTRODUCTION

In the modern world high cost buildings and high rising buildings are constructing all over the world. At the same time due to various reasons damages are occurred frequently to those high tower buildings and large number of human lives is also lost. Those natural calamities are forecasting by the weather forecasters every day. But it is done for a wider area such as district level, state level, and regional level. But for a particular building separate equipments are needed and they must be installed at micro level which helps us to get information's regarding the possibilities of changes in the seismic activities, changes in temperature, possibilities out breaking of fires. in this project work detailed study of installing various equipments, sensoring the information and which helps to minimise the damages for huge structures and loss human lives. Now days they are so many technologies are implemented to evaluate the natural calamities. Currently Richter scales are using to detect the earthquake monitoring. By using this only monitoring the earthquake level in a country level, state level or district level. but there was no any method to evaluateearthquake in a particular building In this project mainly aims to monitoring building to access the earthquake damage and also we can evaluate structural and actual condition of buidingStructure. Here strain sensor and accelerometer sensor which is mainly used for this purpose. The strain sensor are mounted the base of the buidingfloor, it can measure the settlement and plastic hinge activation after an earth quake. Accelerometer sensor which have placed each floor of the building to measure the seismic response of the movement during the earthquake. Here the smoke and fire sensor which is placed in each floor to measure the smoke and fire that affecting the building roof. If smoke and fire which is rises then through the LCD module which kept top of the building to show the warning message. Here the vibration and temperature sensor also placed. In the building to measure the seismic vibration and temperature that effecting the building roof..Here these sensor readings are wirelessly transmit to the base station (mobile phone) through GSM.

II. PROPOSED SYSTEM

Fig.1,Fig 2, shows the complete structure of the proposed system. It mainly consists of following sections and features.

A. Building Management System

The building management system mainly consists of two types of sensor modules strain sensing modules and acceleration sensing modules. They placed in the building as shown in Figure.1. The strain sensor modules are mounted the lowest level of the building, to estimate the vertical column loads and Measure the settlement and plastic hinge activation of the building after an earth quake communication signals and transmit/receive the required information. In the transmitting unit mainly consist of PICmicrontroller 16F877A,GSM ,vibration sensor,co_2 sensor, strain sensor, acceleration sensor,buzzers,power supply,lcd display are used. In the building roof . The strain sensor are mounted the base of the buidingfloor, it can measure the settlement and plastic hinge activation after an earth quake. Accelerometer sensor which have placed each floor of the building to measure the seismic response of the movement during the earthquake. Here the smoke and fire sensor which is placed in each floor to measure of the building to show the warning message. Here the vibration and temperature sensor also place in the building to measure the smoke and fire that affecting the building roof. If smoke and fire which is rises then through the LCD module which kept top seismic vibration and temperature that effecting the building roof. Here these sensor readings are wirelessly transmit to the base station (mobile phone) through GSM.In the receiving base station which consists of mobile phone. Inside the mobile phone the GSM SIM 300 which is inserted. One of the main advantage by using GSM is the communication path which is wide by using this method more detailed information could be obtained from the structural behaviour as well as the actual condition of the building structure. This will enable engineers use more precisely information for the structure analysis and repair as well as life time prediction The strain sensor are mounted the base of the buidingfloor, it can measure the settlement and plastic hinge activation after an earth quake. Accelerometer sensor which have placed each floor of the building to measure the seismic response of the movement during the earthquake. Here the smoke and fire sensor which is placed in each floor to measure the smoke and fire that affecting the building roof. If smoke and fire which is rises then through the LCD module which kept top of the building to show the warning message.

B. MEMS Sensors

The strain sensor and accelelerometer sensor are combinely called as MEMS sensors. MEMS strain sensor is a longitudinal comb finger capacitor. This finger is protected with borosilicate class cap. The accelerometer sensor consist of two transverse comb finger for X and Y axis. and a Z axis is perpendicular to it. strain sensor is mounted on base of the building and accelerometer sensor is mounted each floor of the building.

C. Security system

The security system is effectively done. if any critical condition occur that temperature, fire, smoke is rises. then the alarm is on and alert the people. The LCD module kept top of the building to provide warning messages. This will help the people to escape from the building. The receiver base station consists of mobile phone. Through the GSM module we have obtain the sensoring information. Here the data's are highly secured.

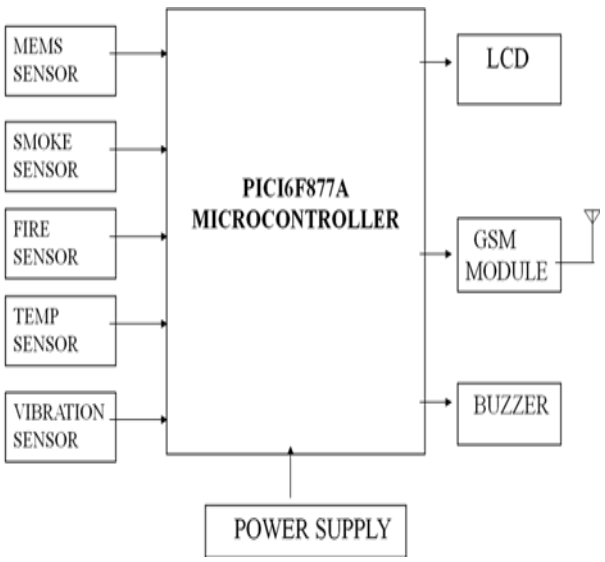

Fig.1 Block Diagram-Transmitting unit

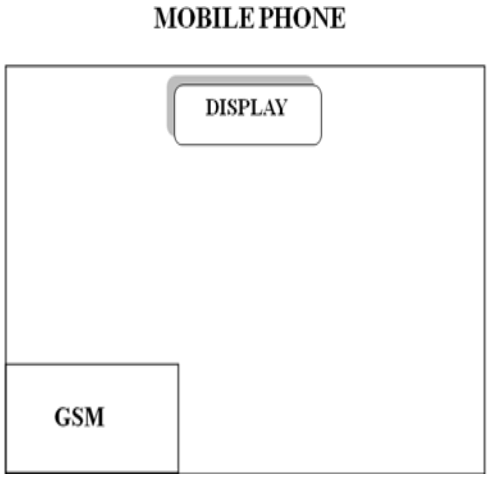

Fig.2 Block Diagram-Receiving unit

D. HARDWARE DESIGNING UNIT

The hardware designed kit of building management system is shown below Fig 3 .Transmitting unit mainly consist of MEMS sensor, Fire sensor, smoke sensor, temperature sensor and vibration sensor. Here the sensor data's are analog in nature and signal strength is relatively low. So before loaded the sensoring data's into the microcontroller. The OPAMP is placed in between the sensors and microntrioller.Hence the resultant signals are loaded into the microcontroller. Inside the micro controller there is an ADC ,which is inbuilt. By using this ADC analog signals are converted digital signals and loaded int the microcontoller.we cant interface microcontroller to GSM. So UART is placed. Here half duplex UART is used.

Fig.3 Hardware desinged kit

III. SOFTWARE DESIGN

The Software designed kit of building management system is shown below .

A. Simulation of Building Monitoring System

All the simulation of the building monitoring system was successfully done.vibration,smoke, fire, strain, acceleration sensor results screen shots was shown in below Figure3-8.

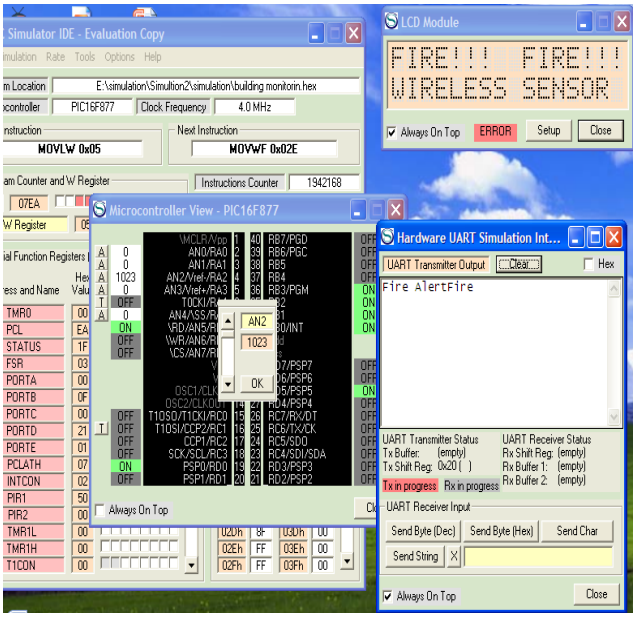

Fig.4 Fire sensor reading

Here in the top of the building we are mounted LCD module. the warning messages are get through this. the GSM receivers is used as the mobile phone. we can get the building status continuously through the mobile phone.

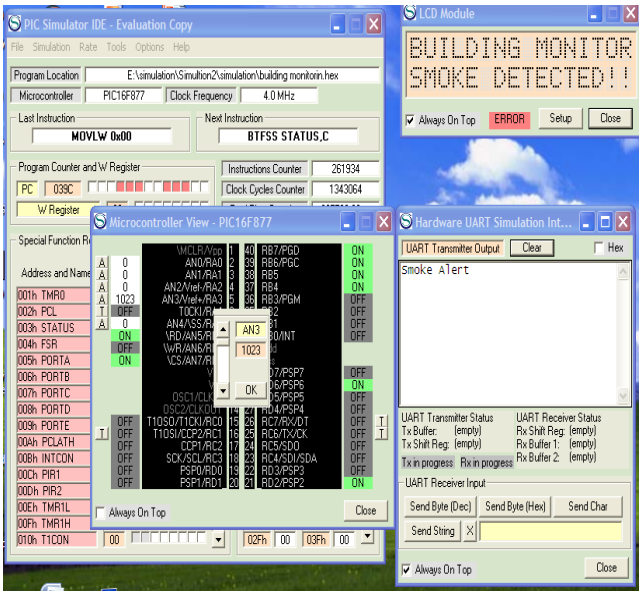

Fig.5 smoke sensor reading

B. SOFTWARE OVERVIEW

Here MPLAB IDE is used. MPLAB IDE is a Windows-based Integrated Development Environment (IDE) for the MCU families. MPLAB IDE allows you to write, debug, and optimize PICmicro MCU applications for firmware product designs. Here High-tech C cross compiler is used to convert the user defined language into the microcontroller. And also we cant dump the program directly into the IC.So here Wind PIC programmer is using for this purpose.

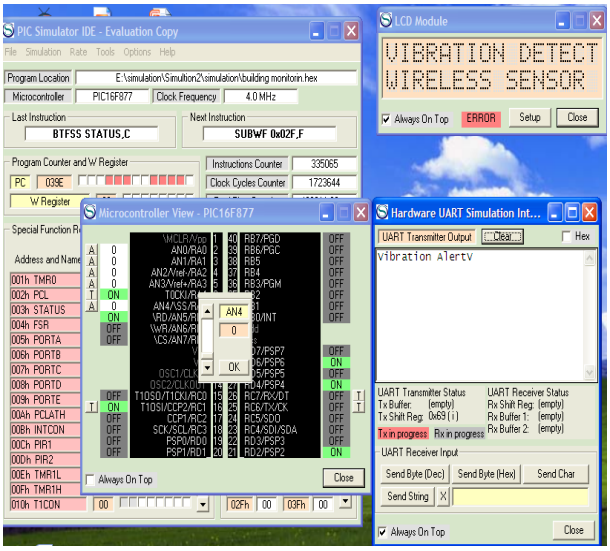

Fig.6 Vibration sensor reading

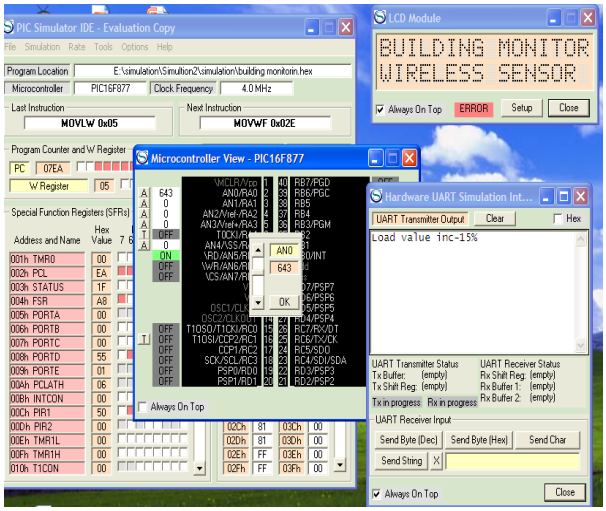

Fig.7. Strain sensor reading

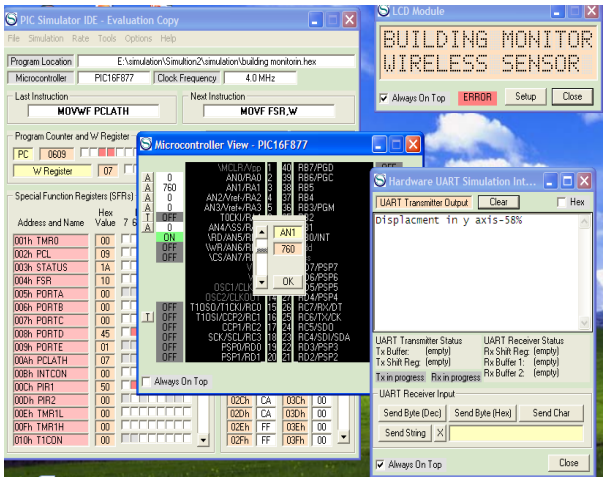

Fig.8.Accelerometer sensor reading

IV. RESULT

All the part of building management system is successfully done and verified by the simulation. Here we can evaluate the structural and actual condition of building and we can analyses the current status of the building.

ACKNOWLEDGMENT

The authors would like to thank the Department of Electronics and Communication Engineering, HIT, Coimbatore for providing laboratory facilities and opportunity for experimental setup.

REFERENCES

[1] Tom Torfs, Tom Sterken, Steven Brebels, Juan Santana, Richard van den Hoven,Vincent Spiering, Nicolas Bertsch, Davide Trapani, and Daniele Zonta."low powerWireless sensor network for building monitoring"-IEEE March 2013

[2] D.Trapani,D.Zonta,F.Larcher,A.Amditis,N.Bertsch,M.Bimpas,A.Garetso,Saillen, J. Santana, T. Sterken, Y. Stratakos, T. Torfs, and Ulieru. "Laboratory validation of MEMSbased sensors for post earth quakdamage assessment," in Proc. 8th Int. Workshop Struct. H September. 2011

[3] The Torre Aquila DeploymentMatteo Ceriottila,Luca Mottola,Gian Pietro Picco,Amy L.Murphy,Stefan Guna1,Michele,Matteo,Danieleta.Paolo Zano."Monitoring Heritage Buildings Wireless Sensor Networks"-IEEE October 2011.

[4] Santana, R. van den Hoven, C. van Liempd, M. Colin, N. Saillen, and C. Van Hoof, "A 3-axis accelerometer and strain sensor system for building integrity monitoring," in Proc. 16th Int. Conf. Solid-State Sensors, Actuat., Microsyst., Beijing, China, Jun. 2011.

[5] A. Amditis, Y. Stratakos, D. Bairaktaris, M. Bimpas, S. Camarinopolos, and S. Frondistou-Yannas, "Wireless sensor network for seismic evaluation of concrete buildings". in Proc. 5th Eur. Workshop Struct. Health onitor., Sorrento, Italy, Jun.–Jul. 2010.

[6] M. Pozzi, D. Zonta, W.Wang, and G. Chen, "A framework for evaluatingthe impact of structural health monitoring on bridge management". in Proc. 5th Int. Conf. Bridge Maintenance, Safety Manage., Philadelphia,PA, Jul. 2010, p. 161.

[7] D. Zonta, M. Pozzi, and P. Zanon, "Managing the historical heritage using distributed technologies"October 2009

[8] Murat Demirbas Wireless Sensor Networks for Monitoring ofLarge Public Buildings, SUNY buffalo,2009

[9] A .Arora, P. Dutta, S. Bapat, V. Kulathumani, H. Zhang, V. Naik, VMittal, H. Cao,M. Demirbas, M. Gouda, Y-R. Choi, T. Herman, S. S. Kulkarni, U. Arumugam, M. Nesterenko,A. Vora, and M ashita."wireless sensor network for target detection,classification, and tracking. Computer Networks (Elsevier)", 46(5):605–634, 2009.

[10] J. Beutel, O. Kasten, F. Mattern, K. R¨omer, F. Siegemund, and L. Thiele. Prototypingwireless sensor network applications with btnodes. In 1st European Workshop on WirelessSensor Networks (EWSN), number 2920 in LNCS, pages 323–338, Berlin, Germany, January2008

[11] P.K. Lee, L. L. Lai, "A Practical Approach to Wireless GPRS On-Line Power Quality Monitoring System," Proc. of the IEEE PES General Meeting, June 2007.

[12] J. Burrell, T. Brooke, and R. Beckwith. Vineyard computing: Sensor networks in agriculturalproduction. IEEE Pervasive computing, 3:38–45, 2008.

[13] D. Estrin, R. Govindan, J. S. Heidemann, and S. Kumar. Next century challenges: Scalablecoordination in sensor networks. In Mobile Computing and Networking, pages 263–270, 2006.

[14] S. Goel and T. Imielinski. "Prediction-based monitoring inensornetworks: taking lessonsrom mpeg. SIGCOMM Comput. n. 8, 2005.

[15] T. He, C. Huang, B. Blum, J. Stankovic, and T. Abdelzaher. Range-free localization schemesin large scale sensor networks. Mobicom, 2005.

[16] W. B. Heinzelman, A. P. Chandrakasan, and H. Balakrishnan. "Application specific protocolarchitecture for wireless microsensor networks. IEEE Transactions on Wireless Networking".2005.

Renjan RAJ V.C. pursuing M.E. in VLSI Design and Embedded Systems, from Hindusthan Institute of Technology, Coimbatore under Anna University, Chennai. He Received B.E degree from Anna university in Electronics and Instrumentation Engineering in 2012 with 'Honours' certificate.