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MEMS BASED SMART & SECURE HOME AUTOMATION SYSTEM WITH MULTI-WAY CONTROL & MONITORING FACILITY USING SMART PHONE

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ABSTRACT

Home security and control is one of the basic needs of mankind from early days. But today it has to be updated with the rapidly changing technology to ensure vast Coverage, Remote control, Reliability & Real time operation. Deploying Wireless technologies for Security and Control in Home Automation systems offers attractive benefits along with user friendly interface.This paper is to design a highly secured Multi-way Home Automation system that allows the user to control all the Electric and Electronic devices from any Android Smart phone using Voice Recognition technology. The system also allows the user to control the Home appliances using SMS commands from any GSM phone or from a PC/Laptop with USB connectivity.

Key Words: Embedded Systems, MEMS, Home Automation, Android, GSM

INTRODUCTION

Embedded systems are computing systems with tightly coupled hardware and software integration, which are designed to perform a dedicated function. In some cases, embedded systems can function as standalone systems. One class of embedded processors focuses on size, power consumption, and price. Real-time systems are defined as those systems in which the overall correctness of the system depends on both the functional correctness and the timing correctness. The timing correctness is at least as important as the functional correctness.

When a Visitor presses the calling bell button, the system would announce that information on the home owner Android smart phone and simultaneously a Digital camera on the door will take a snapshot of the person in front of it and stores it in a memory card for future reviews. When security mode is ON, the system would constantly scan the area within the field of view of the Camera and if it finds any intrusion, it immediately sends an alert SMS to the owner's Mobile phone and as well as take a snapshot of the intruder and save it in memory card.

The system allows the user to turn the Light, Fan and other Home appliance ON or OFF using a Voice command from his Android smart phone if the user is available within Home. When the user is out of Home, he could simply send the same command using SMS from any GSM Mobile. A Fire sensor monitor the temperature of the Home and if it crosses a certain threshold, the system would interpret this as fire occurred and alerts the place using Alarm buzzer and send SMS to the user Mobile phone as well as to the fire station.

MEMS based Motion sensor is used to monitor window movements and if it detects a forceful entry such as a window smash action the system immediately triggers alarm buzzer and sends SMS to the user mobile phone. Garden Motor can be turned ON or OFF using either voice or SMS depending on the user location .When out of town, the user need not worry about feeding their pet animal. Simply send an SMS from their mobile phone and the system has a small Servo motor mechanism that would automatically rotate and pushes the restored food item on the plate below. The Servo then returns back to its original position. The system acts as a USB device when connected to a PC/Laptop. The user could use this connection to transfer the stored data such as the visitor/intruder snapshots to their PC/Laptop and to be saved there. This feature also assists the user to control the entire system from the PC.

MEMS-DUAL AXIS ACCELEROMATER

An Accelerometer is a device for measuring acceleration and gravity induced reaction forces. Single-axis & Multi-axis models are available to detect magnitude and direction of the acceleration as a vector quantity. Accelerometers can be used to sense inclination, vibration, and shock. They are increasingly present in portable electronic devices. Modern Accelerometers are often small micro electro-mechanical systems (MEMS), and are indeed the simplest MEMS devices possible, consisting of little more than a cantilever beam with a proof mass (also known as seismic mass). Mechanically the accelerometer behaves as a mass-damper-spring system; the damping results from the residual gas sealed in the device. As long as the Q-factor is not too low, damping does not result in a lower sensitivity.

Most micromechanical accelerometers operate in-plane, that is, they are designed to be sensitive only to a direction in the plane of the die. By integrating two devices perpendicularly on a single die a two-axis accelerometer can be made. By adding an additional out-of-plane device three axes can be measured. Such a combination always has a much lower misalignment error than three discrete models combined after packaging.

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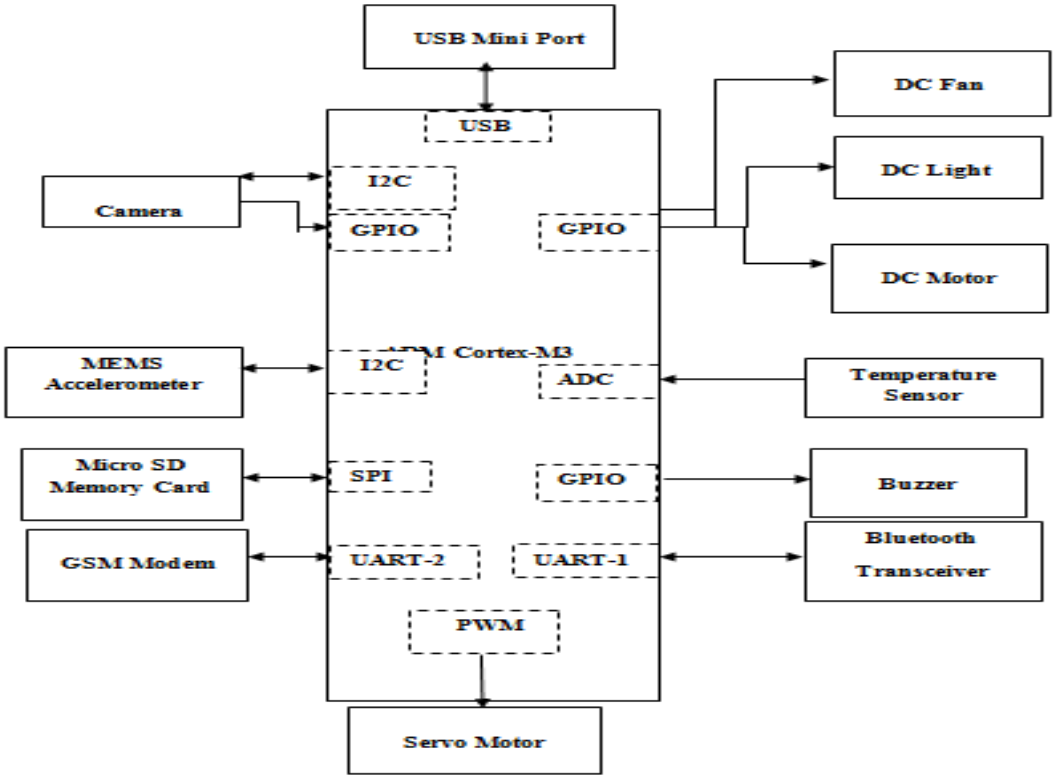

Figure.1.MEMS Based Home Automation Block Diagram

MEMS ACCELEROMETER LIS302DL

The LIS302DL is an ultra-compact low-power three axes linear accelerometer. It includes a sensing element and an IC interface able to provide the measured acceleration to the external world through I2C/SPI serial interface. The sensing element, capable of detecting the acceleration, is manufactured using a dedicated process developed by ST to produce inertial sensors and actuators in silicon. The IC interface is manufactured using a CMOS process that allows designing a dedicated circuit which is trimmed to better match the sensing element characteristics. The LIS302DL has dynamically user selectable full scales of ±2g/±8g and it is capable of measuring accelerations with an output data rate of 100Hz or 400Hz. A self-test capability allows the user to check the functioning of the sensor in the final application. The device may be configured to generate inertial wake-up/free-fall interrupt signals when a programmable acceleration threshold is crossed at least in one of the three axes. Thresholds and timing of interrupt generators are completely programmable by the end user on the fly.

RESULTS & DISCUSSIONS

Figure 2 shows the ARM Cortex 3 processor. Figure 3 shows the working model .Figure 4 shows the Flash magic Input method .This model will help the people in handling their house hold machines by using PC, Android Mobile through voice and also using text message of a GSM service from outside as well as staying in home. The advantages of the model are as

- Camera based security is lower cost adds more functionality and takes much less space than the older passive infrared sensors.
- Two modes of control according to the user location, Bluetooth for Indoor and GSM for Outdoor.
- The system allows one unique mobile phone to control all the home devices.
- A high speed USB interface to connect with PC or Laptop.
- Onboard 2-GB memory card allows storing huge number of photos taken by the camera.
- Low power, high performance 32-bit ARM Cortex-M3 microcontroller enables highly deterministic operation**.**
- Voice recognition helps hands free operation by the user.

In future the model can be upgraded by considering the following factors (i) increasing the speed of processing and also the distance & (ii) Resolution of the camera may be improved.

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Figure.2.ARM Cortex M3 processor

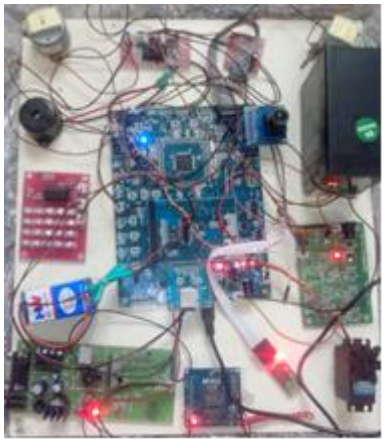

Figure.3.Snapshot of Working Model

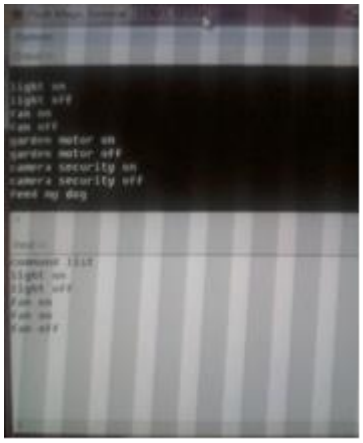

Fig.4.Flashmagic Input Method

REFERENCES

Arbab Waheed Ahmad, Research Assistant & Chankil Lee, Professor Hanyang University, Ansan, Korea, Naeem Jan, Research Assistant, UET Peshawar, Pakistan, "Implementation of ZigBee-GSM based Home Security Monitoring and Remote Control system", IEEE 2011.

D.Vijendra Babu, Dr.N.R.Alamelu, P.Subramanian, N.Ravikannan,"EBCOT using Energy Efficient Wavelet Transform", Proceedings of IEEE International Conference on Computing, Communication & Networking,2008,pp 1-6

D.Vijendra Babu, P.Subramanian, C.Karthikeyan, "Performance analysis of Block matching algorithms for Highly scalable Video Compression", Proceedings of IEEE International Symposium on Ad Hoc & Ubiquitous Computing, Communication & Networking,2006,pp 179-182

Hojin Park, Moonok Choi, Eui-HyunPaik, and Nam Kim, "Interoperability Model for Devices over Heterogeneous Home Networks", IEEE Transactions on Consumer Electronics, Vol. 55, No. 3, AUGUST 2009.

Jonathan M. McCune, Adrian Perrig, Michael K.Reiter, Carnegie Mellon University, "Seeing-Is-Believing: Using Camera Phones for Human-Verifiable Authentication", Proceedings of the 2005 IEEE Symposium on Security and Privacy.

Laisa C. P. Costa, Member, IEEE, Nicholas S. Almeida, Ana G. D. Correa, Roseli D. Lopes and Marcelo K. Zuffo, Member, IEEE, "Accessible Display Design to Control Home Area Networks", IEEE Transactions on Consumer Electronics, Vol. 59, No. 2, May 2013.

Lili Yang, Shuang-Hua Yang (SMIEEE), and Fang Yao, "Safety and Security of Remote Monitoring and Control of intelligent Home Environments", 2006 IEEE International Conference on Systems, Man, and Cybernetics October 8-11, 2006, Taipei, Taiwan.

Mansour H. Assaf, Ronald Mootoo, Sunil R. Das, Emil M. Petriu, Voicu Groza, and Satyendra Biswas, "Sensor Based Home Automation and Security System", IEEE 2012.

Min Chen, Senior Member, IEEE, Jiafu Wan, Member, IEEE, Sergio Gonza´lez, Member, IEEE, Xiaofei Liao, Member, IEEE, and Victor C.M. Leung, Fellow, IEEE, "A Survey of Recent Developments in Home M2M Networks", COMMUNICATIONS SURVEYS & TUTORIALS, VOL. 16, NO. 1, FIRST QUARTER 2014.

Ren C. Luo, Fellow, IEEE, and Chun Chi Lai, "Multisensor Fusion-Based Concurrent Environment Mapping and Moving Object Detection for Intelligent Service Robotics", IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS, VOL. 61, NO. 8, AUGUST 2014.

Shervin Shirmohammadi and Alessandro Ferrero, "Camera as the Instrument: The Rising Trend of Vision Based Measurement", IEEE Instrumentation & Measurement Magazine June 2014.

Taewan Kim, Hyungsoo Park, Sang Hoon Hong, and Yunmo Chung, "Integrated System of Face Recognition and Sound Localization for a Smart Door Phone", IEEE Transactions on Consumer Electronics, Vol. 59, No. 3, August 2013.