Advances in Computational Sciences and Technology
ISSN 0973-6107 Volume 10, Number 11 (2017) pp. 3197-3204

http://www.ripublication.com

Wireless Mems-Based Accelerometer Sensor System for Structure Vibration and Post Defamation Monitoring

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Abstract

In the Remote Monitoring of Building Structural Integrity by a Smart Wireless Sensor Network we are using ZigBee as a wireless network and Accelerometer as a sensor to monitoring the building structural health. The accelerometer is use to get the information for the building the information is in the analog form so this information is given to the ADC. ADC converts to the analog information to the digital information and is given to the microcontroller for the microcontroller it given to ZigBee. ZigBee is use to transmit the gathered information to the receiver section in the receiver section another ZigBee receives the information and transmits the data to the microcontroller. The microcontroller it is connected to the pc in the pc we will develop a DSP application by using that application we can see the observation.

Keywords: Gesture recognition, Interactive controller, MEMS accelerometer

I. INTRODUCTION

Millions of landmines are still buried under the ground surface all over the world causing threats to the lives and economy of mine affected nations. Humanitarian landmine detection and removal has become a serious global issue. In order to make this mission successful, landmine detection and removal rate should be nearly 100%. The manual landmine detection and removal is still carried out for reasons of the reliability, however it is very slow method. In addition, the detection rate is very poor and at the same time, it is very dangerous for the life of the operating personnel. Metal detectors are considered as the most reliable sensors for mine detection work. However, landmine detection performance of the metal detectors is highly dependent on the distance between the sensor heads and the buried landmines Therefore, the landmine detection performance of the metal detectors could be substantially improved if the gap and attitude of the sensor heads can be controlled. In case of robots assisted land mine detection, this function can be performed in a convenient manner where the sensor heads should accurately follow the ground surface maintaining almost uniform gap between the ground surface and the sensor heads by controlling the gap and attitude of the sensor heads. In recent years, the significance of low cost and sustainable technologies for mine detection and mine neutralization has been increasingly recognized by many organizations and universities in different countries. The current solution for removing landmines from civilian areas is the use of trained technicians who manually search for buried objects using a prodder and a metal detector. When the mines are located, neutralization may become a less hazardous procedure. Mine neutralization is outside the scope of this research. There are two methods for detecting hidden landmines: prodding and remote sensing. In prodding, a probe is gently inserted into soil to examine the existence of a buried object. Although there have been several attempts to mechanize prodding, a practical solution is still unavailable. Recent advances in the development of accurate and reliable sensors for mine detection are so promising that researchers have become interested in the development of unmanned ground vehicles and robotic systems that can carry the sensors with the minimum interaction of human operators. There are different system configurations available for both handheld and vehicle mounted sensors. These are usually used in military missions to provide a safe route through minefields. On the other hand, robots are more suitable for off-road missions and antipersonnel unexploded ordnance (UXO) detection. Since most landmines are made of metal or at least have a piece 3 of metal (e.g., a detonator), metal detectors are commonly used to detect landmines. A metal detector is essentially a coil that generates a pulsing electromagnetic field and measures the eddy currents induced by a metal object moving in the field. The performance and reliability of a metal detector, determined by signal to noise ratio, largely depends on the distance, orientation, size, and scanning speed of the sensor. Although other types of sensors may adopt different sensing methods, they all have common requirements, as far as the robotic manipulation is concerned.

Manipulation in an unstructured environment can be a difficult task for a mobile robot. This research has focused on the development of a generic algorithm for terrain modeling and path planning of a terrain scanning robot to carry out such manipulation autonomously and in real time. The result of the research has been implemented into a mine detector robot capable of autonomously scanning unstructured terrain using a typical mine detector in a manner similar to a human operator. The mine detector closely follows terrain undulations using an articulated robotic arm mounted on a mobile robot platform. The autonomous motion may be synthesized based on a 3D model of the terrain that is developed in real time using rangefinders carried by another articulated arm, also mounted on the platform of the robot.

II. PROPOSED SYSTEM

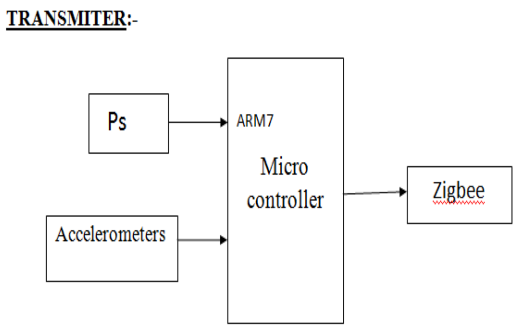

Fig. 1: Transmitter Section

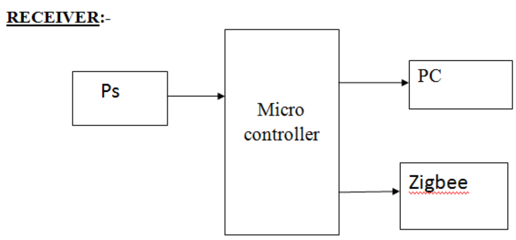

Fig. 2: Robot Section

III. METHEDOLOGY

ARM7TDMI: ARM architecture is based on *Reduced Instruction Set Computer* (RISC) Principles. The RISC instruction set, and related decode mechanism are much simpler than those of Complex Instruction Set Computer (CISC) designs. This simplicity gives:

• A high instruction throughput

• An excellent real-time interrupt response

• A small, cost-effective, processor macro cell.

Microcontroller: A Micro controller consists of a powerful CPU tightly coupled with memory RAM, ROM or EPROM), various I / O features such as Serial ports, Parallel Ports, Timer/Counters, Interrupt Controller, Data Acquisition interfaces-Analog to Digital Converter (ADC), Digital to Analog Converter (ADC), everything integrated onto a single Silicon Chip.

Liquid-crystal display (**LCD**) is a flat panel display, electronic visual display that uses the light modulation properties of liquid crystals. Liquid crystals do not emit light directly. LCDs are available to display arbitrary images or fixed images which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements.

ZIGBEE Technology

ZIGBEE is a new wireless technology guided by the IEEE 802.15.4 Personal Area Networks standard. It is primarily designed for the wide ranging automation applications and to replace the existing non-standard technologies. It currently operates in the 868MHz band at a data rate of 20Kbps in Europe, 914MHz band at 40Kbps in the USA, and the 2.4GHz ISM bands Worldwide at a maximum data-rate of 250Kbps.The ZIGBEE specification is a combination of Home RF Late and the 802.15.4 specification. The specification operates in the 2.4GHz (ISM) radio band - the same band as 802.11b standard, Bluetooth, microwaves and some other devices. It is capable of connecting 255 devices per network. The specification supports data transmission rates of up to 250 Kbps at a range of up to 30 meters. ZIGBEE's technology is slower than 802.11b (11 Mbps) and Bluetooth (1 Mbps) but it consumes significantly less power. 802.15.4 (ZIGBEE) is a new standard uniquely designed for low rate wireless personal area networks. It targets low data rate, low power consumption and low cost wireless networking, and its goal is to provide a physical-layer and MAC-layer standard for such networks.

Wireless networks provide advantages in deployment, cost, size and distributed intelligence when compared with wired networks. Wireless networks are more cost-efficient than wired networks in general. Bluetooth (802.15.1) was the first well-known wireless standard facing low data rate applications. The effort of Bluetooth to cover more applications and provide quality of service has led to its deviation from the design goal of simplicity, which makes it expensive and inappropriate for some simple applications requiring low cost and low power consumption. These are the kind of applications this new standard is focused on. It's relevant to compare here Bluetooth and ZIGBEE, as they are sometimes seen as competitors, to show their differences and to clarify for which applications suits each of them. The data transfer capabilities are much higher in Bluetooth, which is capable of transmitting audio, graphics and pictures over small networks, and also appropriate for file transfers.

ZIGBEE, on the other hand, is better suited for transmitting smaller packets over large networks; mostly static networks with many, infrequently used devices, like home automation, toys, remote controls, etc. While the performance of a Bluetooth network drops when more that devices are present, ZIGBEE networks can handle 65000+ devices.

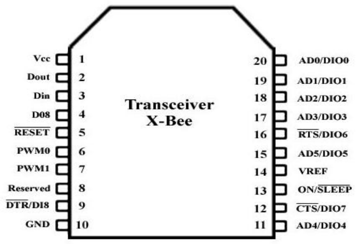

Fig. 3: Pin diagram of X-Bee Transceiver

Accelerometer:

Micro-Electro-Mechanical Systems (MEMS) is the integration of mechanical elements, sensors, actuators, and electronics on a common silicon substrate through micro fabrication technology. MEMS promises to revolutionize nearly every product category by bringing together silicon-based microelectronics with micromachining technology, making possible the realization of complete systems-on-a-chip. MEMS is an enabling technology allowing the development of smart products, augmenting the computational ability of microelectronics with the perception and control capabilities of micro sensors and micro actuators and expanding the space of possible designs and applications. Sensors gather information from the environment through measuring mechanical, thermal, biological, chemical, optical, and magnetic phenomena. The electronics then process the information derived from the sensors and through some decision making capability direct the actuators to respond by moving, positioning, regulating, pumping, and filtering, thereby controlling the environment for some desired outcome or purpose. Because MEMS devices are manufactured using batch fabrication techniques similar to those used for integrated circuits, unprecedented levels of functionality, reliability, and sophistication can be placed on a small silicon chip at a relatively low cost.

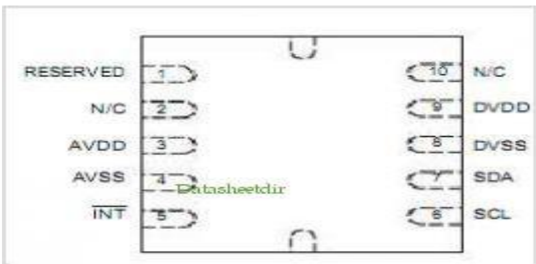

Fig. 4: Accelerometer IC

IV. HARDWARE CIRCUIT IMPLIMENTATION

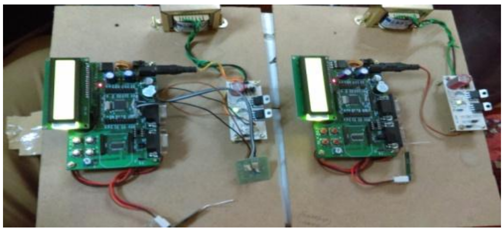

Fig. 5: Hardware project module

The project work is carried out using ARM-7,microcontroller LPC2148.To know the vibrations a MEMS sesor is used. The microcontroller ARM-7 has a built in ADC which converts the analog input signals in to digitals. This data is calibrated to show the vibration of structure. this information is used to find the earthquicks and save the pepole.

V. EXPERIMENTAL RESULTS AND OBSERVATIONS

Fig.6: Display during the MEMS intialisation

Fig 7: Display when building is vibrate

Fig.8: Display when building bend front side

Fig. 9: Display when building bend back side

Fig.10: Display when building bend right side

Fig.11: Display when building bend left side

VI. CONCLUSION

The project on "Design of prototypic army bot for Landmine detection and control using hand gesture" has been successfully done and tested for efficient performance of the vehicle. The Prototypic design modules are being presented and every unit of the device is elaborately explained. The robot is equipped with ARM interfaced with 8051 in the vehicle section, controlled through MEMS accelerometer, detect through camera and metal detector and done through an advanced robotic arm. Equipped with such high end technological ancillaries, this type of EOD vehicle is about to occupy a special place in the field of ordnance robots.

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