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Smart Security System Using Embedded System Technology

K.S.Tamilselvan & T.Balakumaran

***Abstract-* The paper aims to develop next generation wireless sensor networks called as Smart dust networks. Smartdust is a hypothetical system of many tiny Micro Electro Mechanical Systems (MEMS) such as sensors, robots, or other devices, that can detect, for example, light, temperature, vibration, magnetism or chemicals; are usually networked wirelessly; and are distributed over some area to perform tasks for defense industry and homeland security applications. It has a wide range of intruder detection system that can be deployed at critical locations on land, to enable quick, accurate and secure localization of a threat. Smartdust wireless sensor mote is a small size; rapidly deployable node used for intrusion detection purposes specifically in border, battlefield and industrial perimeter surveillance systems. The smart dust wireless sensor mote detects and classifies into vehicles, individuals and groups.**

***Index Terms*—** Battlefield, Intruder,. **MEMS,** Smartdust, Surveillance.

I. INTRODUCTION

In today's geopolitical climate, ensuring the protection of secure facilities or key locations against resourceful and determined intruders is of paramount importance to the defiance of a national border as well as industries of national importance. The greatest threat to national security is "Terrorism" and it cannot be defeated by conventional military force alone. In critical border areas such as Kashmir and Bangladesh, regular forces or even satellites cannot monitor these intruding terrorists as the area monitored is quite large and quite complex. To assist the army and security forces operating in these areas, smart dust like micro-sensors with wireless interfaces could be utilized to study and monitor these environments from a certain distance for military purposes[1].

These motes have a variety of sensors i.e. vibration/seismic, magnetic, acoustic and thermal, a microcontroller for processing these sensor values and a radio transceiver for communication over a wireless network. The sensor readings are processed to classify detected target and the result is transferred to the central unit via wireless network using special protocol. A network of this type can be deployed within an area as large as 4,000m² in a few minutes by one or two men.

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K.S.Tamilselvan, *Department of ECE, Anna University/ Velalar College of Engineering and Technology, Erode, India.*
T.Balakumaran, *Department of ECE, Anna University/ Coimbatore Institute of Technology, Coimbatore, India.*

The central monitoring node acts as the parent node in a peer to peer wireless network model. The dust motes communicate with central parent node using LR-WPAN. Microchip PIC microcontroller and MiWi P2P wireless protocol is used in all dust motes and they are typically battery powered. Microchip's MRF24J40MA, the RF transceiver used in this implementation, is a 2.4 GHz wireless transceiver module which offers low-data rate, low-power consumption and has an integrated PCB antenna with matching circuitry[2].

MiWi P2P protocol is selected for this purpose since many developers using WPAN technologies have observed that ZigBee seems undesirably complex and increases system cost. MiWi P2P protocol is lightweight WPAN stack, small foot-print alternatives (3K-17K) to ZigBee (40K-100K); they are useful for cost-sensitive applications with limited memory such as the dust mote in this paper.

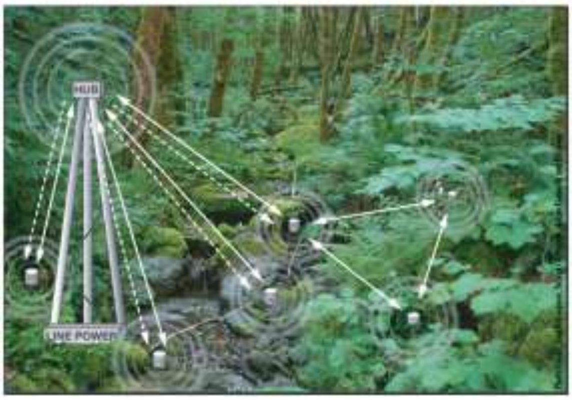

Fig.1. Smart dust network

II. RELATED WORK

A. An effective Surveillance System using Thermal Camera:

Thermography, or thermal visualization is a type of infrared visualization. Thermo graphic cameras are used in many heavy factories like metal recycling factories, wafer production factories and etc for monitoring the temperature conditions of the machines[8]. Besides, thermo graphic camera can be used to detect trespassers in environment with poor lighting condition, whereby, the conventional digital cameras are less applicable in. In this paper, we proposed two simple and fast detection algorithms into a cost effective thermal imaging surveillance system. This surveillance system not only used in monitoring the functioning of different machinery and electrical equipments in a factory site, it can also used for detecting the trespassers in poor lighting condition. Experimental results show that the proposed surveillance system achieves high accuracy in monitoring machines conditions and detecting trespassers.

B. Acoustic based Surveillance System for Intrusion Detection

This paper describes a surveillance system for intrusion detection which is based only on information derived from the processing of audio signals acquired by a distributed microphone network (DMN). In particular the system exploits different acoustic features and estimates of acoustic event positions in order to detect intrusion and reject possible false alarms that may be generated by sound sources inside and outside the monitored room. An evaluation has been conducted in order to measure the performance in terms of false alarms and missed alarms in presence of acoustic events produced inside and outside a test room.The obtained results are very promising and encouraging for future works aimed at improving the actual system accuracy.

C. AN/PPS Ground Surveillance RADAR System:

The AN/PPS-5 Ground Surveillance Radar is an American radar system that has been around since the Vietnam War, having been designed with 1950's technology. Despite its old technology, it has been the workhorse of MI Battalions in the U.S. Army since its original production. The radar is lightweight, man-portable, ground-to-ground surveillance radar set for use by units such as infantry and tank battalions. The PPS-5 radar is a pulsed Doppler radar, and is capable of detecting and locating moving personnel at ranges of 6000 meters and vehicles at ranges of 10000 meters, under virtually all weather conditions. The radar displays targets in a multimodal manner, both aurally and visually. The visual display is a Plan Position Indicator (PPI), and the aural indicator produces tones corresponding to target velocity. The system can operate in an automatic sector scanning mode or in a manual search lighting mode[2]. The PPS-5 is rugged enough to withstand rough field handling, and when packed in its watertight container, it can be parachute dropped and undergo repeated submersion. The radar can also be mounted in a jeep or humvee[4]. New versions of this radar system are being developed, which make use of modern computer and Digital Signal Processing (DSP) technology. carried by a single person. This system also has aural and visual indicators. The visual display is not a PPI, but a simple range indicator.

D. *Energy- Efficient Surveillance System using Wireless Sensor Networks*

The focus of surveillance missions is to acquire and verify information about enemy capabilities and positions of hostile targets. Because of the energy constraints of sensor devices, such systems necessitate an energy-aware design to ensure the longevity of surveillance missions. Solutions proposed recently for this type of system show promising results through simulations. However, the simplified assumptions they make about the system in the simulator often do not hold well in practice and energy consumption is narrowly accounted for within a single protocol. In this paper, we describe the design and implementation of a running system for energy-efficient surveillance. The system allows a group of cooperating sensor devices to detect and track the positions of moving vehicles in an energy efficient and stealthy manner. We can trade off energy awareness and surveillance performance by adaptively adjusting the sensitivity of the system. One of the key advantages of wireless sensor networks is their ability to bridge the gap between the physical and logical worlds, by gathering certain useful information from the physical world and communicating that information to more powerful logical devices that can process it. If the ability of the WSN is suitably harnessed, it is envisioned that WSNs can reduce or eliminate the need for human involvement in information gathering in certain civilian and military applications. In the near future, sensor devices will be produced in large quantities at a very low cost and densely deployed to improve robustness and reliability. They can be miniaturized into a cubic millimeter package in order to be stealthy in a hostile environment[7]. Cost and size considerations imply that the resources available to individual nodes are severely limited. We believe, however ,that limited processor bandwidth and memory are temporary constraints in sensor networks. They will disappear with fast developing fabrication techniques. The energy constraints on the other hand are more fundamental.

III.METHODOLOGY USED

In transmitter side various sensors such as magnetic sensor, PIR sensor, vibration sensor acoustic sensor are used. In addition to sensors PIC microcontroller, encoder and transmitting antenna is used to transmit the signal.

In receiver side various blocks used are receiving antenna, RF receiver, Decoder, PIC microcontroller, LCD display, driver circuit and alarm.

By using **magnetic sensor**, the intruder with any metal can be detected. For example, if the intruder carries any metals such as weapon or robots, this sensor will sends the signal to the central node.

If the intruder tries to damage this system, **acoustic sensor** will send the information to the central node.

If the human beings try to enter into the border, **PIR sensor** sends the motion of the human being to the central node.

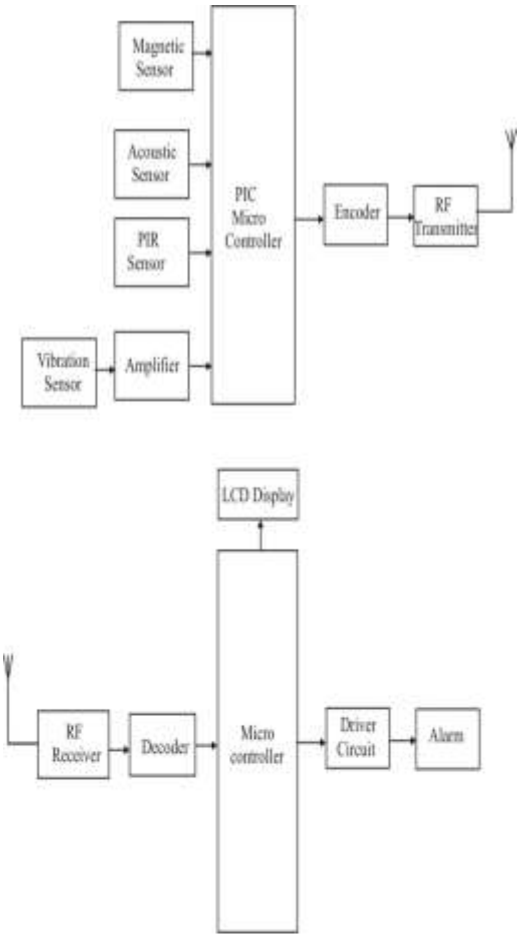

Fig 2.Block diagram of Transmitter and Receiver

Vibration sensor is used to detect the vibrations around the border. For example, if anyone tries to blast atom bomb on the border, this sensor senses the vibration and sends the signal to the central node so that the administrator can detect the damage.

According to the different motions around the border, the corresponding sensor will sends the signal to PIC microcontroller. PIC microcontroller is coded with all sensors. According to type of sensor output, the signal is encoded and it is transmitted through RF transmitter.

In the receiver side, the signal is received through the antenna and it is decoded and the decoded output is sent to the central node.

IV. ALGORITHM

Step 1: Include header files i.e. PIC, LCD, ADC.

Step 2: Define ports to indicate whether input port or output port.

Step 3:Initialize variables.
Step 4: Initialize starting address for ports and initialize input as 1.
Step 5: Initialize LCD display to display security system if no sensor is activated.
Step 6: Check magnetic sensor output is less than 100 or greater than 135.
Step 7: If true magnetic sensor activated and LCD displays "magnet sensing".
Step 8: If microphone sensor output value is greater than 50,acoustic sensor is activated then LCD displays "sound activated".
Step 9: Compare vibration sensor and PIR sensor output with constant value .If that condition is true then LCD displays "vibration detected" and "human detected"
Step 10: If sensor activated yes-buzzer on, no-buzzer off.

A.Tools Used

- **MPLAB IDE v8.30**
- **TOPWIN**

B.MPLAB IDE v8.30

MPLAB IDE is a Windows OS based Integrated Development Environment for the PIC micro MCU families and the ds PIC Digital Signal Controllers.

The MPLAB IDE provides the ability to:

- Create and edit source code using the built-in editor.
- Assemble, compile and link source code.
- Debug the executable logic by watching program flow with the built-in simulator or in real time with in-circuit emulators or in-circuit debuggers.
- Make timing measurements with the simulator or emulator.
- View variables in Watch windows

- Program firmware into devices with device programmers

In order to create code that is executable by the target PIC micro MCU, source files need to be put into a project and then the code is built into executable code using selected language tools (assemblers, compilers, linkers, etc.). In MPLAB IDE, the project manager controls this process.

All projects will have these basic steps:

- **Select Device**. The capabilities of MPLAB IDE vary according to which device is selected. Device selection should be done before doing anything else on a project.
- **Create Code**. Then source code will be written to the file.
- **Create Project**. MPLAB Project Wizard will be used to Create a Project.
- **Select Language Tools**. In the Project Wizard the language tools will be selected. For this tutorial, the built-in assembler will be used. For other projects built-in linker or one of the Microchip compilers or other third party tools might be set.
- **Put Files in Project**. Only one file will be put into the project, a source file.
- **Build Project**. The project will be built - causing our source files to be assembled into machine code that can run on the selected PIC micro MCU.

- **Test Code with Simulator**. And finally, the code will be tested with the simulator.

C.Sample Coding for LCD Display

```
#include<pic.h>
#include"pic_lcd8.h"
void main()
{

TRISD=0x00;
TRISC=0xcf;
TRISB=0x00;
ADCON1=0X09;
TRISA=0Xff;
Lcd8_Init();
Lcd8_Display(First_Line, "Securit System.",16);
Lcd8_Display(Second_Line," ,16);
}
```

D. TOPWIN

TopWin, a type of software developed for TOP series programmers, adapts to the TOP hardware products of a newN generation. TopWin has abandoned its method of one type of software matching for one mode of TOP product by operating different mode of hardware units. TopWin supports automatic identification of hardware mode and function. Once TopWin connects to hardware unit successfully, the name of hardware unit will appear at the bottom of window. The current basic modes that TopWin supported include TOP853, TOP2004, TOP2005 and TOP2048. Product of new mode developed in the future will be supported by new version of TopWin software[7].

E. Hardware Connection

USB interface should support hot swap, it can operate computer first and then reconnect programmer.

1. To connect flat head of cord to USB interface of computer, square head connect to programmer socket. (Both sides of cords are different and must have separation.) When power indicator turns on “POWER” (red), it means power supply of machine has been put through.
2. To operate on TopWin program, after two to ten seconds, programmer working indicator" READY" (Green) turns on, bottom of window shows the name of hardware unit topxxxx. It shows that machine had ready and can have normal operations.

To open set up \ system status in the main menu and press “testing USB load current”, it show that from grade five to grade ten is normal, the higher the grade, the stronger the driving force. Electric current of grade five can write most of devices, some specific high-current devices need the electric current above grade seven. Most of the computers can reach to grade seven or more. If the computer is below grade five, it can connect cord or to circumscribe 5V / 2A regulated power supply.

V..EXPERIMENTAL SETUP

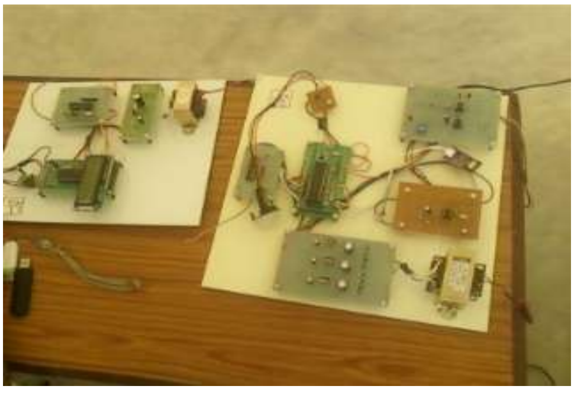

Fig.4. TRANSMITTER & RECEIVER KIT

Fig.5. LCD DISPLAY OUTPUT

VI.CONCLUSION

Hence in our paper the detection of magnet, sound, human beings and vibrations are done by using various types of sensors, it is easy to identify the intruders. By using PIC microcontroller the sensor output is processed. Then it is given to the RF transmitter unit. In the receiver section, RF receiver collects those processed information from RF transmitter continuously. The microcontroller placed in the receiver section activates the alarm circuit or LCD display according to the received processed information. If nothing is detected then LCD will display as “nothing detected”. So by using this we can easily find out the enemy intrusion mainly in border areas.

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