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# Centralized Border Security

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**Abstract**: This paper presents a design of WINS (Wireless Integrator Network Sensor) in a distributed network using multi hop communication, operated at low power and low frequency. In WINS, the PIR Sensor (PASSIVE INFRARED) detects the human body around 200 feet and uses the concept of Black Body Radiation. The combined effect of Sensing, Signal Processing, Computation and Decision capability is been described with more advancement and accuracy in an Integrated System. WINS has an advantage over other security systems as it is cheaper, faster, compact, scalable and is implemented using micro power CMOS Circuits.

**Keywords**: Multi hop communication, PIR sensor, Security, CMOS circuits

## I. INTRODUCTION

A Sensor is a device which is used to sense, detect human body physically and produce certain response according to the input given like temperature or magnetic field etc. An activator is that component of machine which is responsible for moving or controlling mechanism of system. The first was the connection of sensors to computer systems and the second was the emergence of MEMS sensors with their small size, low cost, and high reliability [1]. The evolution of microelectronics and communication technologies facilitates the manufacturing of miniature sensors comprising a small transmitter/receiver, a processor, memory components and a low-power battery [2,3].

The combination of Sensing, Signaling, Computing, Networking in an integrated system is done by WINS However, the proposed method is self-monitoring and secure. It is used for short distance less than 1 km. WINS also permit monitoring of land, water, and air resources. In previous era, only computers and mobile phones can communicate when we request for any other object. But in the next era, worldwide networks of interconnected object based on standard communication protocol.

The signals sensed by the sensor are converted into power spectral density and then compared with Reference Value, the Reference Value is then processed using microprocessor and send that signal to the main node. The main advantage of WINS over other security systems like RADAR is that it produces less delay and is quite cheap and compact. The basic idea of the proposed work is by PIR Sensor to identify a stranger or some terrorists entering the border. The border area is divided into number of nodes. Each node is in contact with each other and with the main node. Recent advances in integrated circuit technology have enabled construction of far more capable sensors, radios, and processors at low cost, allowing mass production of sophisticated systems that link the physical world to networks [4,5] WINS networks are now Internet accessible, enabling global, remote, reconfigurable monitoring, control, and security [6].

## II. WINS SYSTEM ARCHITECTURE

WINS was first developed in 1993, at UCLA. There are N communication link hops between N+1 nodes in a dense WINS network and provide multi hop communication. WINS Multi hop Communication networks allow large power reduction and the implementation of dense node distribution. These networks are developed to built communication over long range up to 1 km with link bit rate over 100 kbps. In Wireless Networking the major limitation is the RF Communication path loss, with received power, PREC, decaying as transmission range, R, as PREC∞ R-∝ (where

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∝varies from 3-5 in typical indoor and outdoor environments). The multi hop communication can increase system complexity but the main advantage of this can be large power reduction and the implementation of dense node distribution. Micro power RF communication provides bidirectional network access for low bit rate, short range communication. The micro power components operate continuously for event recognition, while the network interface operates at low duty cycle.

Based on this approach, the Fig. 1 below shows the distributed sensors at border and Wireless Integrator Network Sensor.

**Advantage of Wins**

Provide multi hop Communication and greater scalability with low cost and low power consumption as it can be operated by solar batteries. If ground sensors are used then it can detect any activity underground with the help of thermal sensor. This is how we can find any intruder in border line.

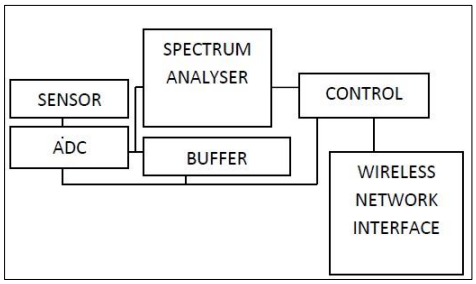


**Fig. 1.** Wireless integrator network sensor.

**Characteristics**

Support large number of Sensors with Dense Sensor Distribution. These sensors are also developed to support short distance RF communication. Internet access these sensors, control and process.

**Applications**

In a global scale, WINS will permit monitoring of land, water and air resources for environment monitoring. On a national scale, transport systems and borders will monitored for efficiency, safety and security.

## III. WINS NODE ARCHITECTURE

The first network demonstrated the feasibility of algorithms for operation of wireless sensor node and network at micro power level. In a joint development program with the Rockwell science center, a modular development platform devised to more enable more sophisticated networking [7,8].

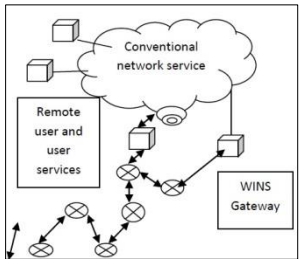


**Fig. 2.** WINS node architecture.

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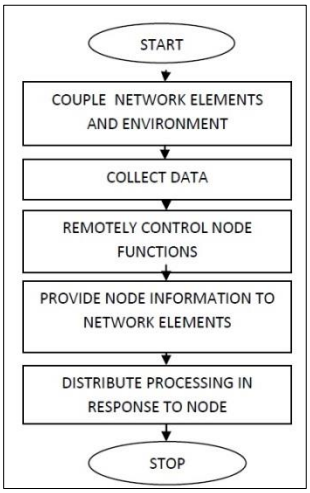


**Fig. 3.** Block diagram of WINS.

The continuous process of sensing, detecting and identifying the events is done by WINS Node. The process of Detection occurs continuously, the sensor, data converter, data buffer and spectrum analyzer all operate at micro power levels (Figs. 2 and 3). The spread analyzer output may trigger the micro controller. The WINS Node should be alerted as it determines any remote user, it supplies an attribute of an identified event. Now the signal processor supplies the Information to the user ranging from single bit event detection, to power spectral density (PSD) values. WINS Sensor nodes are powered by compact battery cell and average current supply must be less than 30 μA.

**Wins Microsensors**

To develop a compact sensor to maximize detection range with greatest sensitivity.

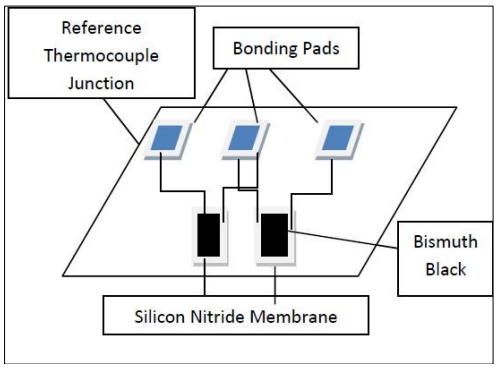


**Fig. 4.** Thermal detector.

It captures the harmonic signal of any stranger and convert it into PSD values then compare it with reference values set by the user.

**Micoz Sensors**

These types of sensors consist of Data Processors, Radio Transceiver and Embedded Batteries. By introducing the Phalanx shield unattended ground sensors (UGS). We can make innovative network autonomous sensors for border protection and Infrastructure protection including bases, FOBs and COPs and also for significantly improved situational awareness.

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**Components of Micoz Sensors**

- Whip Antenna
- 4 KHz Buzzer
- Thermistor
- LEDs
- Microphone
- On/Off Switch
- Radio, Processor, RAM and Flash (on board below)
- 2*AA Battery Pack [8]

**Flexible Employment**
No cables and external batteries are required and No repeaters and backhaul are required.

## IV. WINS DIGITAL SIGNAL PROCESSING

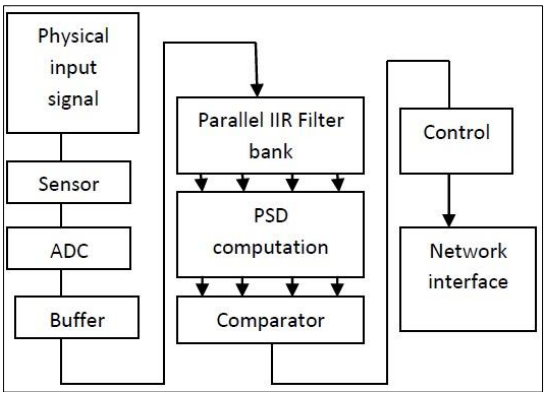


**Fig. 5.** WINS digital signal processing.

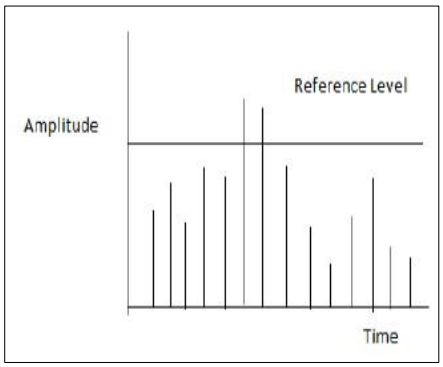


**Fig. 6.** Comparator plot.

When any stranger enters the border, his footsteps are monitored by sensors and captured as harmonic signals. The sensor then pass those signals to ADC (Analog to Digital Converter) low resolution power spectrum [9]. After converting it gets stored into buffer. Now the WINS spectrum analyzer contains the set of 8 parallel filters where

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the mean square power of each frequency bin is computed at the output of each filter, each filter is assigned with PSD computation. Here the PSD values are compared with background reference values.

As the architecture of WINS Spectrum Analyzer consist of Data Buffer where buffered data is stored during continuous computation of the PSD Spectrum [10]. The micro controller sends HIGH or LOW Signal according to the differences. Like for the reference value of 25 db, the comparison of the DFT signals is shown in Figs. 4-6.

**Energy Consumption**

CMOS is a technology for constructing the integrated circuits. High noise immunity and static power consumption are two characteristics of CMOS device. Implemented in VLSI chips. CMOS device do not produce waste heat and allow high density of logic functions. CMOS technology comprised of MEMS sensors [11].

**Sensor Monitor Environment**

Cameras, microphones, physiological pressure, biological sensors etc. Sensor data is limited in range and accuracy [12-15].

## V. WORKING

If any activity is performed in border line by the terrorist then the sensors store the data in centralized database and generate appropriate signal and send the information by the activator to the main server [16]. It is then sent in three modes (Figs. 7 and 8).

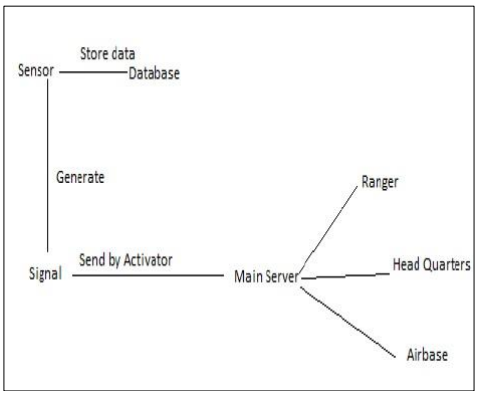


**Fig. 7.** Distributed sensors.

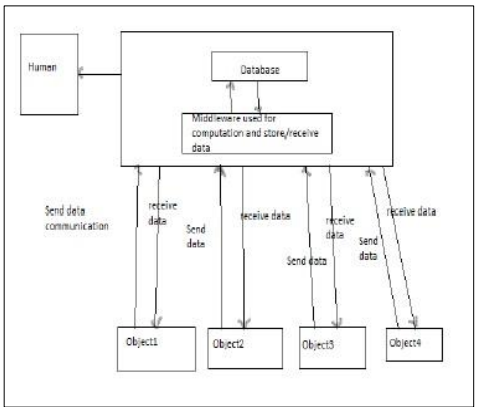


**Fig. 8.** Distributed sensor at border.

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First to the Ranger (police officer, solider) who do patrolling in the nearby area, either send wirelessly voice message or capture image of the intruder and send location. Secondly it is sent to Head Quarter. And the third is sent to Airbase center so that they can drop weapon from air if any terrorist activity is performed.

## VI. ROUTING BETWEEN NODES

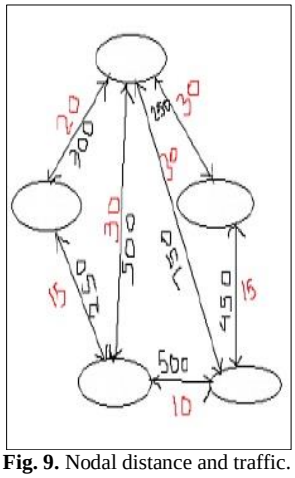


**Fig. 9.** Nodal distance and traffic.

The sensors capture the signal and pass the signal over network, the router maintains the routing table and forward the packet based on the shortest distance. The traffic between the nodes is considered, not the distance. Here is an example where signals are passed through routers like suppose router 2 wants to send signal to router 4 then it sees best possible path. The traffic to the path from node 2 via node 3 to node 4 is high and has higher distance so it will go from node 2 to node 4 directly (Fig. 9).

**Sensors Developed for OS Like**

Berths (pushpin computing platform), Magnet OS (ad-hoc network), Lite OS (Unix-like abstraction) and Tiny OS (Tmote Sky and event driven OS).

## VII. SIMULATIONS AND EXPERIMENTAL RESULTS

The proposed solutions have been designed using language PHP.

**Database connection**

```
<?php
$con = mysql_connect('localhost', 'root', '');
if (!$con) {
   die('Could not connect: ' . mysql_error());
} catch (PDOException $e) {
print "Error!: " . $e->getMessage() . "<br/>";
die();
}
mysql_select_db('cgsrs');
?>
```

As shown in Fig.10.

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**Configuration connection**

```
<?php
$dbhost_name = "localhost";
$database = "cgsrs";// database name
$username = "root"; // user name
$password = ""; // password
//////// Do not Edit below /////////
try {
$dbo = new
PDO('mysql:host=localhost;dbname='.$database,
$username, $password);
} catch (PDOException $e) {
print "Error!: " . $e->getMessage() . "<br/>";
die();
```

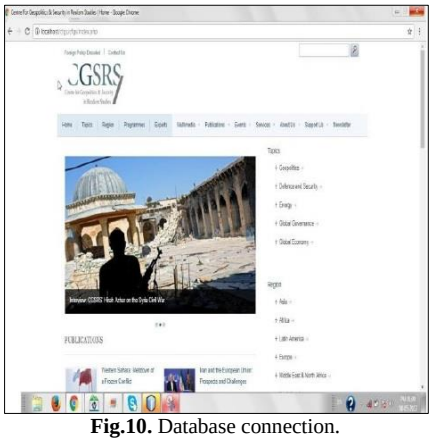

**Fig.10.** Database connection.

## VIII. CONCLUSION

Hence CGSRS web application provide real time security in many countries for monitoring border security by sensing, monitoring, computing, and decision making. If anyone tries to cross the border then the sensor detects and signal it to micro controller switch on the camera which captures the image and transmit it to near security station.

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