WSN SYSTEMS FOR BORDER SURVEILLANCE USING SHADOW SENSING MODEL WITH DBS METHOD: A REVIEW

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Abstract— Border surveillance is one of the top preferences in the domain of security worldwide. There are so many types of surveillance and it changes with time and requirement. According to vintage orthodox system, border inspections demands checkpoints and troops at borders, but this surveillance unable to provide do not provide absolute safety. To increase border surveillance with absolute safety smart fencing also deployed in a Border Patrol system. With momentum of time advance technology came into existence for example implementation of wireless sensor network, drones, various types of sensors, autonomous surveillance and many more techniques. These WSNs will fabricate an imaginary fencing system which consist huge number of heterogeneous sensor instruments. These instruments are implanted with cameras and other advance sensors which gives round the clock monitoring. Intelligent Border Monitoring System must be straightforward and capable to cover mammoth area with high security and accuracy so that unauthorized person cannot enter in restricted area, detection of intruder's movement and other illegal activities. This paper depicts role of WSN in border surveillance and techniques used for intruders in restricted area.

***Keywords*— Wireless sensor networks, border surveillance, Intruder, Surveillance System**

I. INTRODUCTION

Wireless sensor network (WSN) is an emanating technology with a wide broad scope of applications army and nonmilitant areas [3].The mankind invaded exposure in all border sides is a difficult work in countries all over world. The main worry marked by the border protection systems of any nation is the centralized surveillance of the border range. In conventional border surveillance systems, the military lookout the border range through predetermined routes at particular time periods. Extreme human engagement is the main challenge to safeguard lengthy borders. Many other problems are also there like huge price of the sensors, integrating many kinds of sensors on a single special device and selecting required communication set of rules for mismatched mediums. Different supervision and detection techniques, which are competent with one another, are mandatory for real-time surveillance of the border range with tremendous performance, proper accuracy, and minimal mankind interference.

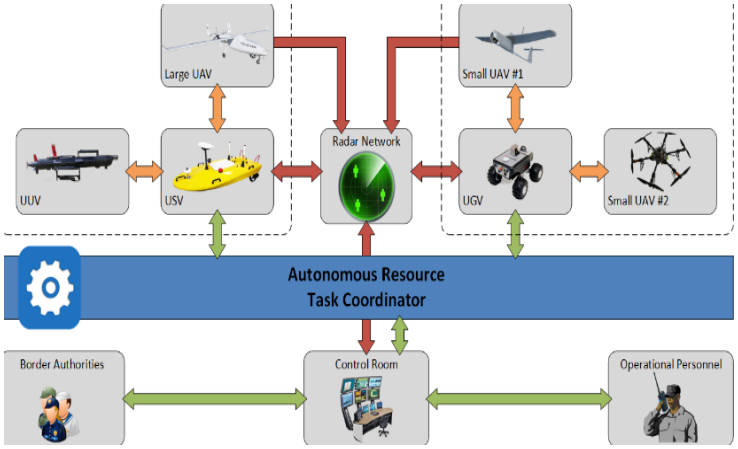

Figure 1 Surveillance System

To defeat the challenges faced by the conventional supervision and detection technologies, a survey was carried out that points to many wireless sensor network (WSN) dependent border supervision and human intruder detection methods. The growth in mankind intervention results in developing a safe Intrusion Detection System (IDS).

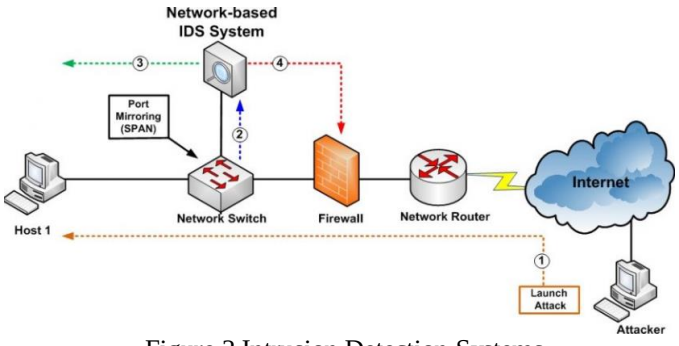

Figure 2 Intrusion Detection Systems

The main relevance of wireless sensor networks (WSNs) is area surveillance. Examples of area security are intervention detection and border surveillance In contrast to full range

analysis problem where every point of a area has to be considered, these applications target to detect an invader trying to enter or exit border of a particular territory [8]. WSN is having the ability to accommodate many sensors and communicate the collected data through wireless system to central station. The review explains mainly the hybrid WSN that consists of geophone sensor node for supervising the invader progress in the horizontal border regions, hydrophone sensor node for detection of the river/pond passing of the invader, microphone sensor node for detecting the bare leaves movement of human invader, Infrared sensor node for detecting the invader movement between the border regions and supervision camera sensor set up on the vigilance tower for real time border scrutiny purpose.

II. LITERATURE SURVEY

A. Saipulla, et al: Barrier coverage of WSN has been considered tremendously in past few years under the supposition that in vast area sensors are placed randomly. It is crucial to examine the barrier coverage of such line based deployment strategy as it depicts an appropriate realistic sensor location model with respect to Poisson point process model. This research established a fix lower-bound for the existence of barricade coverage under line-based deployments and simulated result show better the barrier coverage of the line-based deployments tremendously as compared to Poisson model when the random offsets are relatively small compared to the sensor's sensing range. Diverse implementation techniques may result in outstanding different barrier coverage. [1].

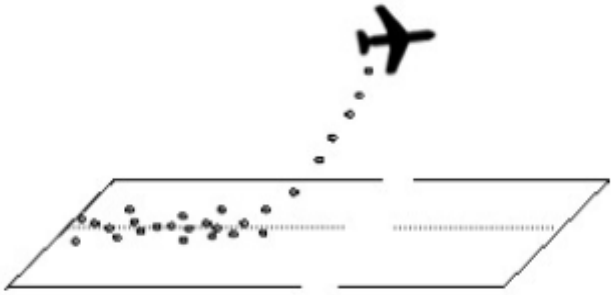

Figure 3 A line bases deployed wireless sensor network

J. He and H. Shi: The major issue highlighted in this paper is to fabricate sensor with minimum cost and to detect intruders entering restricted areas. Early research has studied the barrier coverage problem for intruder detection. This is a severe problem and its solution can be widely used in sensor barrier applications, such as border security and intruder detection. This work based on PUSH–PULL-IMPROVE algorithm which gives appropriate solution to keep in mind minimum-cost barrier coverage. In implemented algorithm, each node does not certainly know its exact location and only needs to communicate with its neighbors [2].

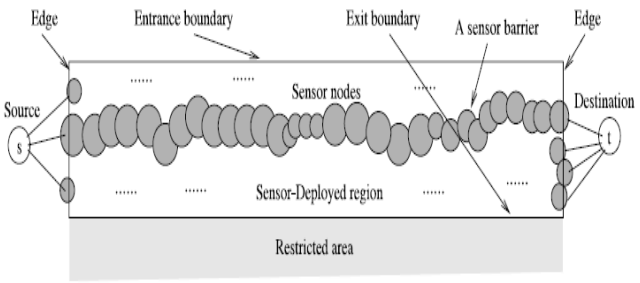

Figure 4 An example of deployed sensor barrier in a wireless sensor network

S. K. A. Imon, et al: In almost every WSN applications, all information gathered by sensor nodes and reported to base station via cluster head. To support such a data collection pattern, a tree structure rooted at the sink is defined. According to different factors, including dynamic topology of WSN and the accessibility of resources, the energy ingested by nodes in various paths of the information collection leads to affect overall network lifetime. This paper solved the problem of lifetime optimization of WSNs according on data collection trees. In this research an algorithm known as Randomized Switching for Maximizing Lifetime (RaSMaLai) used to enhance lifetime of WSNs through load balancing [4].

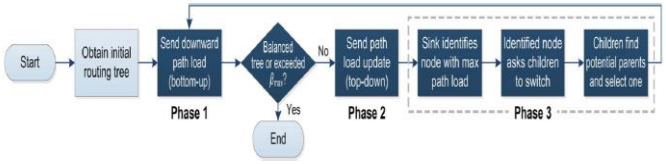

Figure 5 Flow diagram of D-RaSMaLai

R. Han, et al: Directional sensor network (DSN) has been deployed to detect encroachment and assist tight border surveillance. In recent time instead of some limitation for example barrier coverage, DSN has been tremendously considered under various suppositions for example tenure of sensor nodes haven't been considered into account. The lifetimes of sensors are generally different and depend upon various parameters and if a particular sensor failed then it affects overall life time of sensors and that particular area becomes blind spot which may be harmful. This paper used two-round maximum flow algorithm for strong barrier coverage with lifetime-heterogeneous rotatable directional sensors [5].

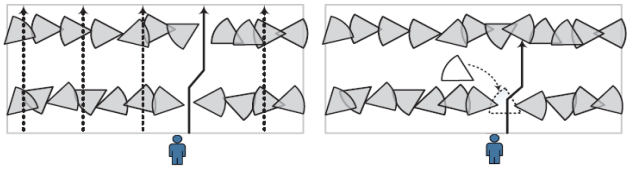

Figure 6 Weak and strong barrier coverage in DSN. (a) Weak barrier coverage.
(b) Strong barrier coverage

H. Mostafaei, et al: This article concentrated mainly for limited areas which need round the clock surveillance. This

paper used a robust algorithms which depends on learning automata to employ sleep scheduling technique and known as PCLA. It main focus is to minimize number of sensors to monitor targeted region that energy can be minimized but keep in mind there must be connectivity between all sensors. Simulated results depicts that PCLA selected the sensor in optimized way keeping various parameters like time complexity, time scalability life time of nodes performances in a standard range [6].

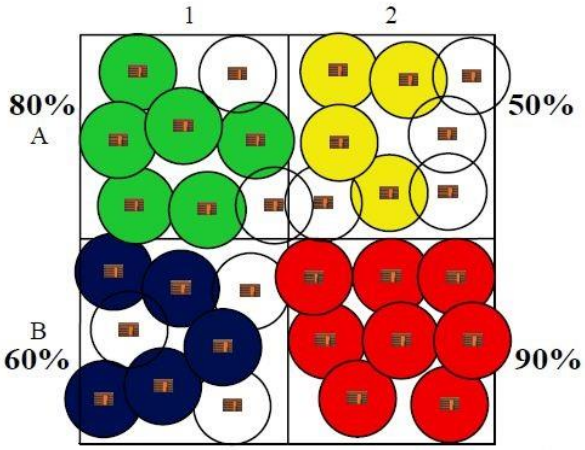

Figure 7 Partial coverage's with four sub-regions having different levels of coverage

Habib Mostafaei, et al: Border supervision is a very crucial application of WSNs and main focus is security from neighboring countries. The current problem of applying this application is barricade coverage in WSNs. In deploying WSN only major issue is that limited energy of sensor and our priority is to enhance life time of sensor as much can be using optimized approach. This paper presented an advance distributed method to the border inspection in WSNs in order to increase number of barriers and minimize energy consumption. DBS technique uses learning automaton assists to locate appropriate nodes to assure barrier coverage at any moment [10].

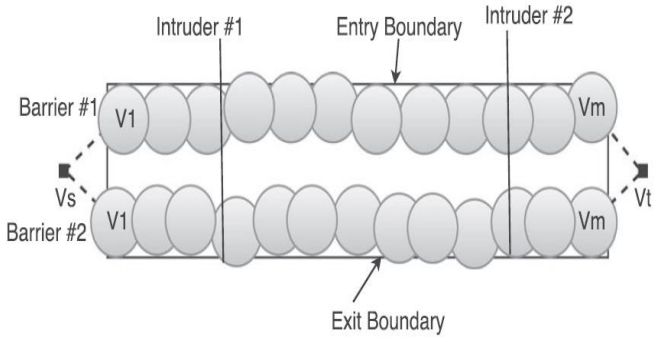

Figure 8 Network with two BP

III.ROLE OF WSN IN BORDER SURVEILLANC

Most of the WSN application focuses on data collection from different sensors, such as seismic, acoustic, surveillance camera, and light detectors. The main objective is the detection and signalling of human intrusion within a predefined area. The collected signals are processed using advanced WSN techniques, and the aggregated data are sent to the Central Monitoring Station, which provides necessary actions [7]. Many solutions are being suggested by the researchers from different organizations for issues related to border surveillance. The subjective parameters utilized for comparative analysis of motes includes physical measurements, size, weight, battery capacity, operating temperature, manufacturing details and cost. Based on the application necessities, the size of the motes may vary. Large false alarm rate and line of sight constraints are the main problems that encounters while using any of this single technique. For solving such problems, researchers have been proposed system architecture named as Border Sense with three layers is shown in Figure 9

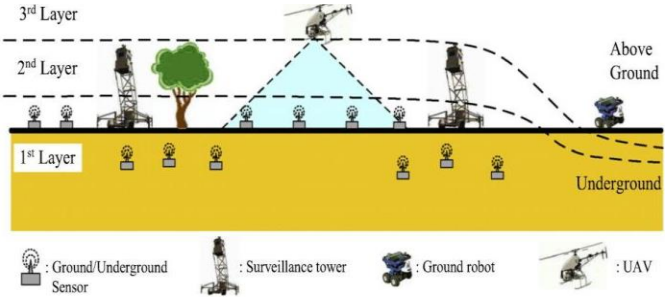

Figure 9 WSN system architecture of Border Sense [7]

The lower layer of the architecture contains underground sensors and the second layer contains multimedia sensors which enhance the accuracy of the overall system. The higher layer yields extra coverage using UAVs and robots. The border security system architecture is shown in Figure 10.

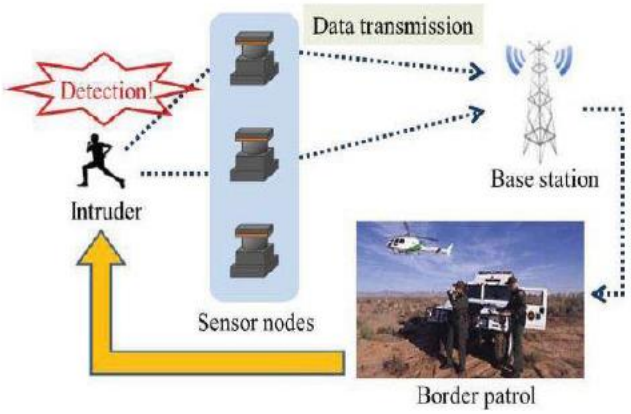

Figure 10 Border security system architecture [7]

The proposed system detects intruders crossing the border and report information of intrusion to a base station and a border patrol. Many sensor nodes are deployed in the vicinity of the border to detect intruders. A perception sensor with wireless communication technology is used in the sensor nodes. Connecting power source and all sensor nodes with wired line are unrealistic because of the wide monitoring area. So, it is

assumed that every sensor node is connected to own power source such as solar-electric power generator in the proposed border surveillance system. The position of the sensor nodes influences the actual performance of the system. The footstep signal of human on the ground/floor produces seismic signals from a few Hertz to ultrasonic frequencies and have two type of time characteristics, such as footstep repetition time and foot step duration time. The footstep ultrasonic friction signals have comparable sound magnitudes while considering the same speed. The passive (seismic and ultrasonic) and active Doppler movement characteristics of human are synchronized in time. Frequency variation of the footstep signals has minimum values related to leg and arm velocity in human active Doppler signals [7].

IV. BORDER SURVEILLANCE AND HUMAN INTRUDER DETECTION

It is possible to detect the human intruder movement on the

- Flat border area through the footstep detection using geophone sensors
- On dry leaves by using microphone sensors
- Crossing the river/pond by using hydrophone sensors
- Between border regions using IR sensors
- High quality camera sensors for efficient surveillance.

PIR Sensor

Pyroelectric Infrared (PIR) Sensor is a sensor which is primarily used to detect movement of an depending upon on heat radiation falling on it. Every lively thing emits some radiations from it. PIR sensors consist of two IR sensitive elements with opposite polarization. During the idle state both the slots in the sensor detect same amount of IR radiation. But when temperate object like human or any animal come in the range of sensor it causes change in output of PIR sensor making it positive. When the warm body is not in the range, the sensor produces a negative differential change. The motion of an object can be understood from the change of pulse. It accepts infrared radiation (IR) coming out of an object without any resistance. PIR sensors have many applications due to its low cost [9].

Figure 11 Pyro-electric Infrared (PIR) Sensors

Internet of Things (IoT)

The concept of IoT has been evolved in the year 2000. But now concept of IoT is to connect different objects together. It may be from industrial equipments to household chores even some living organism including plants, farm animals and people. In IoT, physical environment is observed by the different sensors connected. Collected and processed data will be communicated over an IP network [9].

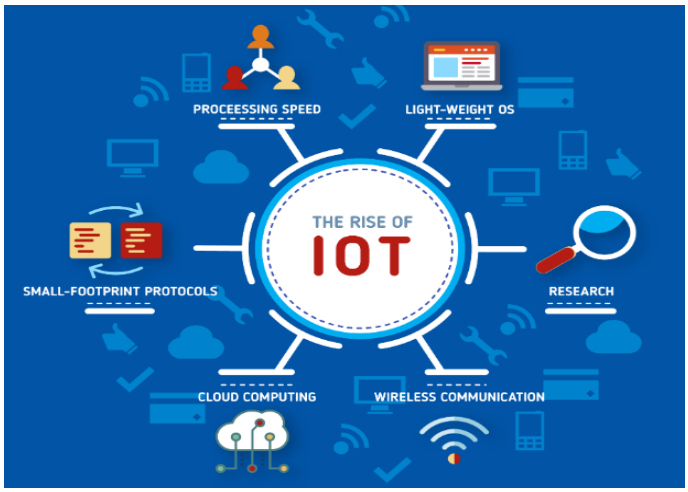

Figure 12 Internet of Things Concept

V. CONCLUSION

Security is the prime concern of each country and specially border security from their neighbouring countries. If border surveillance is not proper then it leads to heinous crime like smuggling, human trafficking, drugs and many more. Border monitoring systems are peculiar province of the intelligent technologies by the implementation of WSNs. WSNs itself have some restriction in terms of its security due to its dynamic topologies. In order to implement WSN for border surveillance, it is compulsory to have a secure WSN with appropriate protocols because there are possibilities of diverse attacks in WSN. Each country is trying to keep their border secure to control the unwanted entry from their neighbouring countries.

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