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Research paper

Human Intruder Detection using MANET Technology

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Abstract

This study focus on MANET as a sensor based system to manage security on the designated area. MANET is a continuously self-configuring, infrastructure-less network of mobile devices connected without wires. MANET is relatively a new technology which people can use it to eradicate missing hardware in computer lab issues. By using MANET it can help us to know the location where there is the activity happen which then we can prevent the activity earlier. In addition, this study using Arduino Uno, a low cost and ARM-based computer on a small circuit board which can detect hardware movement up to 8 meters. Furthermore, o notification on intrusion are through the buzzer. Besides, the technology able to monitor voice, record the footage of intruder, controlling light switch and view room temperature from mobile phone. Therefore, this study can be considering valuable and can be commercialized.

Keywords: *MANET, Human Intruder Detection, Arduino Uno*

1. Introduction

Human Intruder Detection using Mobile Ad-Hoc Network (MANET) is a sensor based system to manage security on designated area. Security is one of the primary concerns around authorities and landowner.

The sensor of node can be place in the edge, at wall, back entrance or blind spot areas, which that have, low activity places. Therefore, deploying a mobile ad hoc network based security in these area is capable to detect human quickly and to locate which area that detect the intruder through a message send to the authority.

One of the issues is when a student or an unauthorized person enters a computer lab and try to steal the hardware in the lab, without the authority knowing of the activity it could cause a great threat and losses to the university. Hence, through an early alert the authority can check for the activity detected by the sensor in order to prevent such things from occurs.

Therefore, with the latest technology available such as MANET it can help to identify rapidly the theft activity. Additionally, with MANET the location of activity can be determined. In a MANET, the router connectivity may change frequently, leading to the multi-hop communication paradigm that can allow communication without the use of access point (AP) and provide alternative connections inside hotspot cells.
Therefore, the purpose of this study is to implement a wireless sensor network to detect presence of human intruder that trespassing the area, then alert the authority through the nodes implemented.
This paper is structure as follows: Section 2 presents the background study. Section 3 discusses the related works. Section 4 describes the methodology used. Sections 5 present the testing and result done. Section 6 concludes the paper

2. MANET Technology

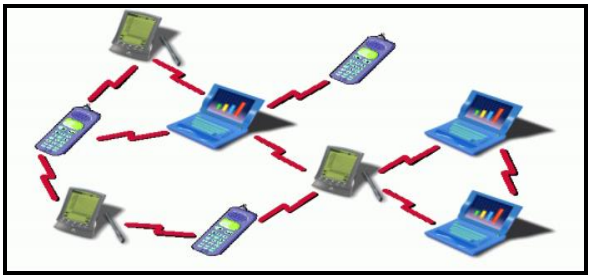


Fig. 1: MANET

2.1 Framework

Coordinator
It is the root for the network tree and bridge to other networks. For establishing a network, it requires sensible parameters. It stores information about the network. It coordinates up to eight endpoints in any combination. It stores information about the network, which is trustworthy and repository for security keys. It is also known as distance network where the coordinator s is involved with routers and routers are associated with endpoints.

Router
It is an intermediate router, which is use for passing data from one device to other. The goal of router is to extend the network range. It can also act as end device. It has two methods of routing. Mesh routing and Tree routing. Mesh router is use as extender for wireless monitors to allow transmission and receipt of monitor readings. It is also use for finding the optimal location for monitors. Up to tree Mesh, routers can be combining to extend communication range.

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End Device
It is a very basic device and it requires very limited resources. It is cheaper than coordinator and router. Its function is to talk to parent node. It is responsible for requesting pending messages from its parent and for finding and joining the correct network. It also helps in finding new parent if old parent is lost. The end device is portable and simplest type of device on a the framwork. It cannot route data but can sleep while not transmitting

3. Related Works

Gondaliya T P et,al. (2013) studied on how MAC layer applications is use for detecting malicious activities and focus on the finding of attack sequences in the Network. The research has successfully developed an intrusion detection system on MAC layer for detection and isolation of attacks in MANET networks which applicable to the Real Environment. [1]
Jadhav S S et al. (2014) studied performance measurement MANET along with Dynamic Source Routing protocol (DSR) in different network conditions. The simulation results shows comparison of DSR protocol considering the Network Throughput, Packet Delivery Ration, and Average end-to-end delay in NS 2 environment. [2]
Akshat J et al. (2017) studied method to improve monitoring system as well as enhanced on cyber security. The research has successfully developed a Smart Monitoring System with least human interference by using Raspberry Pi 2 for video and blowfish algorithm for security. [3]
Xiangzhong M et al. (2017) studied method to improve ECG signal detection and the accuracy of the doctor's diagnosis by designing wireless sensor network using ZigBee technology. The experiments show a computer software system based on Qt framework has been develop to achieve ECG signal waveform display and data storage. [4]
Quwaider M (2017) studied mechanism to detect the motion of intruders using Received Signal Strength Indicator (RSSI) in monitoring sensitive passages. The experiments show the RSSI of the received signal is reduce significantly when there are intruders in the passage and the amount of reduction depends on the number of intruders. [5]
In the studies, the testing differs on various aspects such as security, performance metrics, hardware, area or sensitivity. Similar to our work, these studies are on real-time intruder detection system.

4. Methodology and Benefits

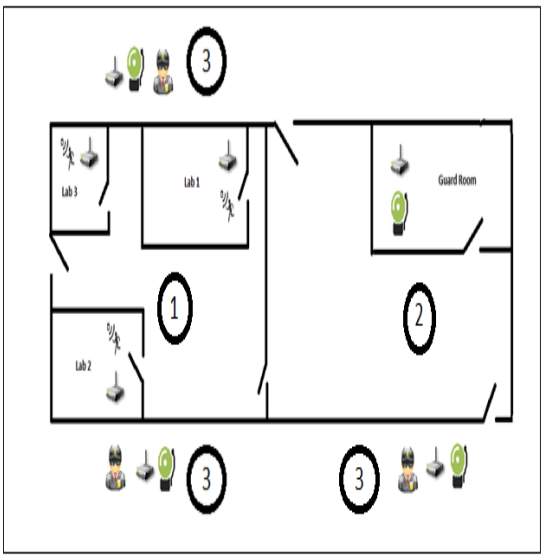


Fig. 2: Human Intruder Detection using MANET Technology

Refer Figure 2. Laboratory is equipped with a coordinator. Data are carries by the coordinator from the motion sensor and send it to the end nodes. The sensor devices allow connections within nodes without any base station. The end nodes is equip with buzzer, an alarm that will triggers upon detection in 10 seconds. It is place at the guardroom. The transmitter node work as a router, which received signal from the coordinator before send the intruder detection information to the authority. Refer Table 1.
Refer Figure 3. The systematic process taken in implementing the study. The implementation is conduct stage by stage because the components require one another to work properly.

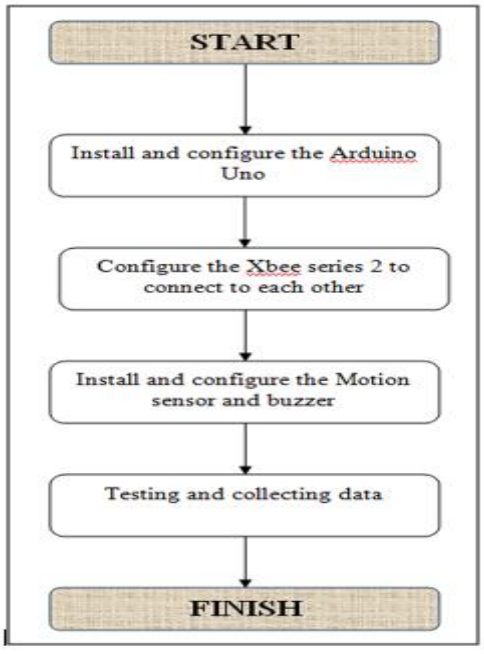


Fig. 3: Process Flow

Table 1: Prototype Requirement – Costing

Hardware	Function	Price (RM)
Arduino Uno	Program the overall system structure	90
Xbee Series 2	Form factor compatible radio modules	300
Xbee Shield	Allows an Arduino board to communicate wirelessly using Zigbee.	180
SKXbee	Starter kit for XBee module	50
Grove Sound Sensor	Simple microphone to detect sound strength of the environment	11
PIR Motion Sensor	To detect a human presence	15
Buzzer	Provide alarm during detection	4
Sub Total		**RM650**
Software	**Function**	**Price (RM)**
Arduino IDE	Open-source; runs on Windows, Mac OS X, and Linux; written in Java and based on Processing and other open-source software; can be used with any Arduino board.	Nil
X-CTU	free, multi-platform application compatible with Windows, MacOS and Linux. Graphical Network View for simple wireless network configuration and architecture.	Nil
Sub Total		**Nil**
Total		**RM650**

The benefits are:

4.1 Monitoring activities –

The authority ease to monitor the area in preventing the unauthorized person to enter the prohibited area. Therefore, the authority can minimal the patrol activities and focus on other higher priority areas or tasks.

4.2 Alert notification at guardroom –

Upon detection by the sensor, a signal is transmitted to the coordinator which is located at the authority room or open places and when the end nodes receives the signal, the buzzer is triggered.

4.3 Low cost implementation and user friendly –

None access point or central devices are used. Whenever a node is down, other nodes within the all nodes are still able connect.

5. Testing and result

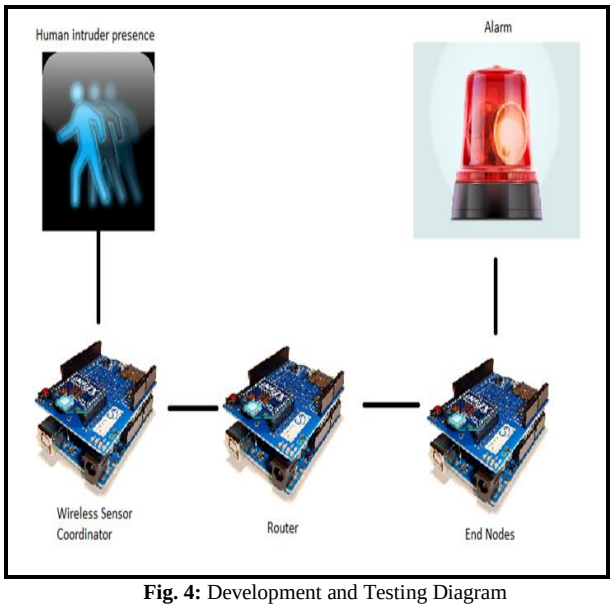


Fig. 4: Development and Testing Diagram

Refer Figure 4. Wireless sensor coordinator is place together with hardware at the designated area to be monitor while the end nodes are place in the authority room. The distance can be up to 80 meters. Refer Table 2.

Table 2: Testing and Result between one node to the other nodes

Distance	Result
0 – 10 m	Yes
10m – 20m	Yes
20m – 80m	Yes
80m – 100m	No

The results are:

5.1 Limited range of detection –

The more expensive type of PIR motion sensor shall be used to make the system capable of detecting human more than 80 meters. This study is to use a low cost sensor.

5.2 PIR motion sensor behaviour –

Adding infrared or and ultrasonic sensor will be effective yet powerful in overcoming the study which can only detect motion or movement of the object.

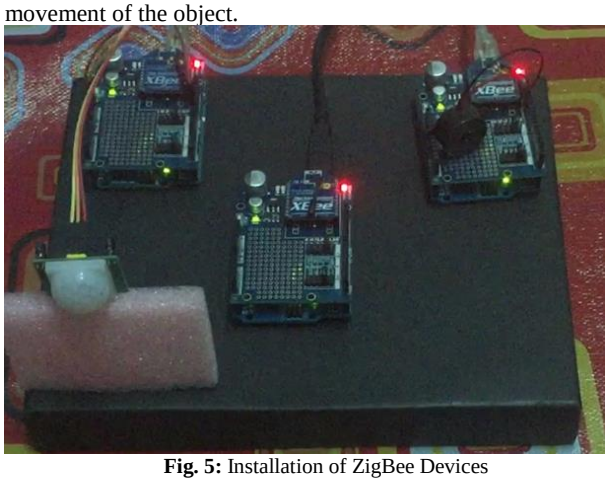


Fig. 5: Installation of ZigBee Devices

Refer Figure 5. All nodes are connecting to each other while PIR motion sensor and buzzer area in ready mode to detect and trigger the presence of human whom trespass the private area.

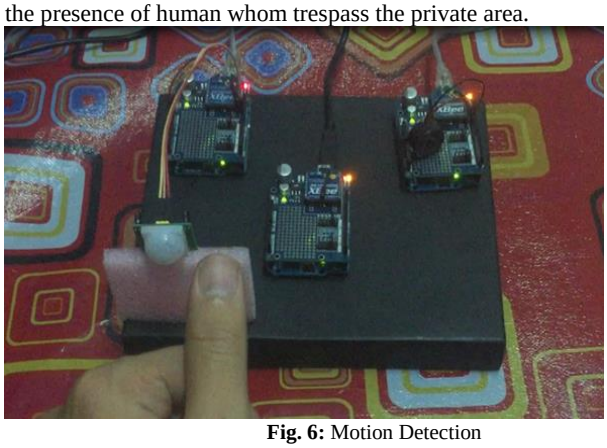


Fig. 6: Motion Detection

Refer Figure 6. When there is a movement around the motion sensor, the RSSI yellow light will be appear. It means there is data from the first node, which is the wireless sensor coordinator (motion sensor node). The first node will send the data to the second node (in the middle) and then straight through the buzzer that located at the nodes and the alarm will triggered.

6. Conclusions and Future Work

The study shows, the sensor node used does not require high cost but can detect any movement up to 80 meters. In order to monitor more than one area, additional sensor can be use and all of them can communicate simultaneously one to other nodes. Through the buzzer, it helps the guard in the guard room by just refer to the alarm buzzer which area the sensor triggered, this will ease their work and at the same time they can re-check with the patrolling guard whether the area have checked for intruder or not instead of not knowing of the event.

Another line of work that may be pursuing from this research would be adding extra features such as camera, enlarge the study for bigger purpose and use of data base system.

Acknowledgement

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