RATOWARD MOBILITY-BASED SURVEILLANCE MODEL FOR STATIC MULTI-TARGETS

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Abstract - Several individuals or families nowadays own more than one property. It could be fixed properties like houses and offices or moving properties like cars or other automobiles. Generally the crime cases involving home intrusion and car theft have been rising, resulting in many cases reported daily about such crimes. People become more aware on safety of their properties and start to subscribe to some security systems such as CCTV, ADT, and car alarm. Even so, the number of such crime cases is not much reducing, rather elevates, as criminals today become moreprofessional and know how to disable security systems from working. To overcome such limitations, an efficient security system is needed that integrate different technologies to detect the presence of an intruder. In this paper, a new Mobility Based surveillance model for Static Multi-Targets MBSMT is proposed to offers a suitable alarm system for owners of multi-properties (targets). The model integrateslatest or suitable technologies in mobility, microcontroller, sensors, camera and GPS to produce a low cost product. This paper focused only on static properties and shows the design and implementation of the proposed MBMTS Model. Sample of implementation results are obtained.

Index Terms— property security, static targets, property intruder, mobility-basedsurveillance.

I. INTRODUCTION

As the technology became more advanced, home security systems have become easier to be invaded. According to Ishiguro and Hunng (2011), the most commonly used home security systems today are fire alarm, burglar alarm and video surveillance systems. There are many criteria that were important to be included in a home security system including low cost, low power consumption, easy installation and rapid response to alarm incidents, based on the journal written by Zhao,Yanbo,Ye and Zhaohui (2011).

In US, the property (home) invasion crime became a huge and critical threat since mostly it could lead to other critical crimes such robbery, murdering and physical assaulting. Statistics and studies show that a single property crime occurs every 3 seconds and more than 8000 home invasion happens daily. Statistics also show that 1 out of 5 houses may experience a break-in or invasion which gives about 2,000,000 home invasions in total. Research and Studies also claim that an average of 3,600,000 home invasions occurs between 1994 and 2000. Assaults happen in 38% of home invasions in North America. However, studies maintained the increasing trend in crime which show that 125 of every 1000 houses experienced property crime in 2010, while the number increased to 139 of every 1000 houses in 2011.

Other studies held by Canada Uniform Crime Reporting (UCR) reported that more than 50% of home invasions in Canada involve the use of weapons. The most used weapon in home invasions are knives. Physical injuries and assaults reported in 47% of home invasions in Canada. Old people are most targeted victims of home invasion as they are less likely able to resist the intruders. Statistics in some cases may not be accurate due to restriction of publication of some information, secrecy, lack of investigations, and the absence of international statistical organizations.

As shown in figure 1, there are 68% of larceny-theft cases, and there are 24% of burglaries cases of the property crime in the year 2010.

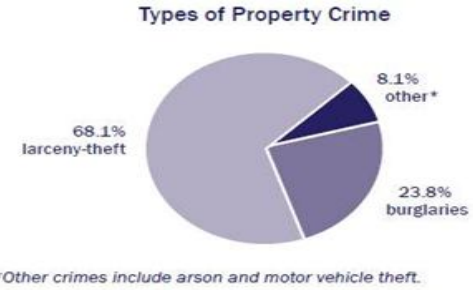


Figure 1: Types of Property Crime in North America

In Malaysia, based on the bar chart shown in Figure 2, the highest number of break-in cases occur in the suburbs area, that is at Selangor (5682 cases), followed by W.P Kuala Lumpur (1859), and the lowest number of break-in cases occur at Perlis (81 cases).

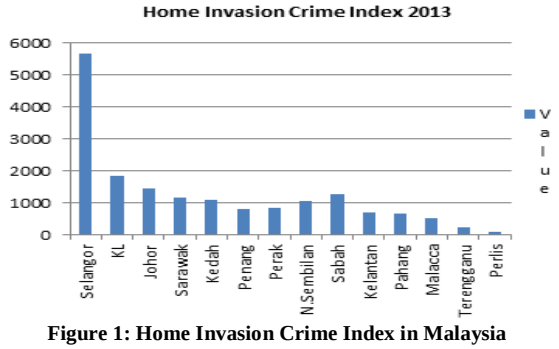


Figure 1: Home Invasion Crime Index in Malaysia

As such, surveillance systems can provide the capability of collecting accurate and purposeful information by forming appropriate decisions to enhance the safety of the users.

II. PROPOSED MBSMT MODEL

The previous section of introduction shows the need for efficient property or home surveillance system that can overcome the current weaknesses. In this paper we will describe briefly the proposed system. In order to make the alarm more efficient, this prototype was designed so that an email will be send to the owner. Thus the owner can control the alarm and avoid false alarm. Owner can confirm and respond to the email which contains an image that was captured by the system through the camera that was placed inside their house. If the owner confirmed the intruding case, the email will be forwarded automatically to the security unit in the residence and police so that they can take action.

In any home alarm or security system, sensors must be included to ensure that the system can function properly. There are several types of sensors used for home alarm system. One of them is the magnetic sensor which is normally put on the doors or windows. In this prototype for home alarm system, we also use Passive Infrared (PIR) sensor.

The main feature of our proposed model is to detect any motion inside the house using the PIR sensor while the magnetic door sensor will detect the status change of the doors or windows (Opened or Closed). When the sensors detect the presence of an intruder, then the microprocessor will command the camera to capture an image of the intruder. After that, an email attached with an image of the intruder will be sent to the owner to confirm. The system will be aborted if the owners' response was to abort the system. This technique is used to avoid false alarm. However, if the owners' response was to alert, the email will be forwarded to the security unit and police. Figure 3 shows the flow diagram of our proposed mobile based surveillance model for Static Multi targets-MBSMT.

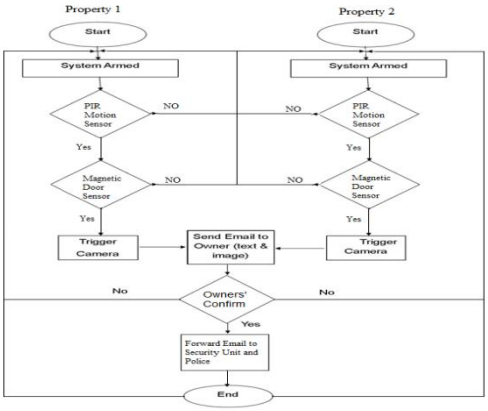


Figure 3: Flow Diagram of MBSMT model

III. MBSMT PROTOTYPE

Based on the proposed MBSMT model, we built a prototype. In order to test the prototype, a trial has been held in the laboratory. It is also important to ensure the system is connected to the internet to deliver the information obtained by the MBSMT. This prototype provides a system installation for fixed property, mainly to be installed at home.

For the hardware components, good price and performance value was a considrable priority in our hardware selection. We choose components that can be supported by Raspberry Pi, which is the microcontroller used in our project. We choose the D-Link router with four 802.11n capable Wi-Fi links or also known as the Gigabit Ethernet ports. An active USB Hub is used in order to connect multiple USB devices with more than 3W of accumulated power usage. 8GB Kingston SD Card was used to provide memory in the Raspberry Pi and VZTECH (VZ-WC1682) 5MP camera connected with the Raspberry Pi to capture the picture of the intruder. We use Passive Infrared Resistor (PIR) sensor to detect the motion based on the heat produced and magnetic door or window sensor to detect if the door or window was not opened properly by using keys (break-in). figure 4 shows the circuit disgram of MBSMT model.

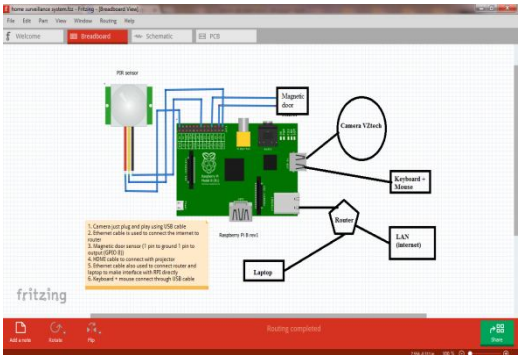


Figure 4: MBSMT (Circuit diagram)

The main components of the MBSMT prototype that we built for each property (home) is shown in the figure 5.

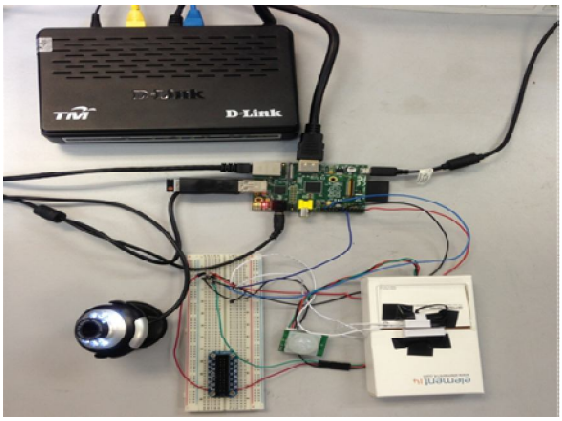


Figure 5: MBSMT prototype components

IV. IMPLEMENTATION AND RESULTS

In this section we will show sample of implementation and results obtained when we run (operate) the prototype. In this section we show two cases one related to using the door or window sensor while the other show the case of using the motion (PIR) sensor.

A. Using Door or Window Sensor

i - Door sensor detected intruder

When the system is armed, it waits for any movement that could trigger the door or window alarm. The magnetic door sensor is programmed to send an alarm to the system whenever it is triggered using python code for Raspberry Pi. The camera will immediately capture a photo of the intruder.

ii- Owner (iiumsurvtech14@gmail.com) received image of intruder.

The email of the owner is programmed to receive any alerts from the system if the door or window where the sensor is installed is opened. The alerts will be send in the form of images of the intruder that captured by the camera which is built together with the system. Figure 6 shows the email send by system to the owner including intruder image.

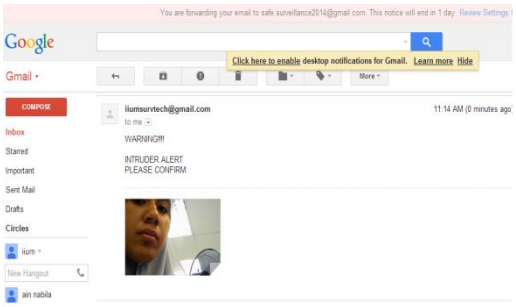


Figure 6: Email sent to the owner containing the image of the intruder.

iii-Security(safe.surveillance2014@gmail.com) received image of intruder .

In order to forward notice to the security unit or police so they can help to prevent intruding or help in capturing the intruder in a short time. The information is forwarded to the security unit or police using specific email. Figure 7 shows the forwarded email with captured image to the security unit or police.

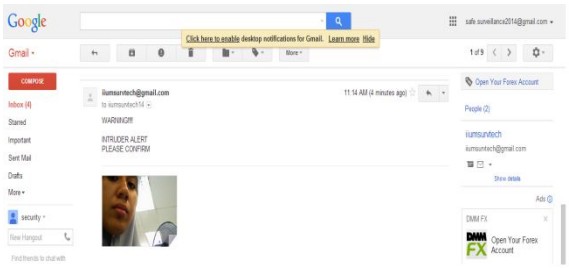


Figure 7: Email containing information is forwarded to the security unit or police.

B. Using PIR sensor

i- PIR detects presence of intruder

The PIR motion sensor which detects the presence of the intruder will give a closer look of the intruder when capturing image. The intruder probably will not stay far from the camera because of the PIR. The system will send an email with the captured image to the owner for confirmation.

ii- Owner (iiumsurvtech14@gmail.com) received image of intruder.

As soon as the motion is detected, the image will be sent to the owner. Figure 8 shows the email received by owner.

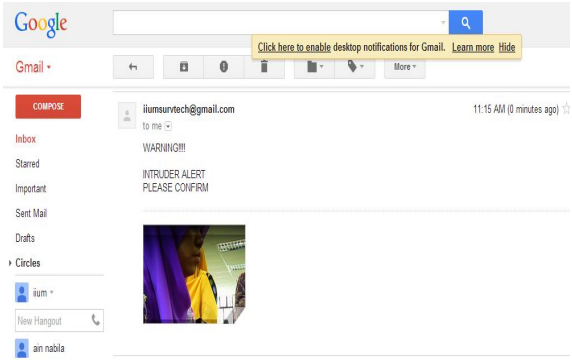


Figure 8: The owner received the image of the intruder.

iii- Security (safe.surveillance2014@gmail.com) received image of intruder.

When the owner receive the email he/she has to confirm it is not fake alert then the system will forwarded it to the security unit or police for action. Figure 8 shows the email received by security unit or police.

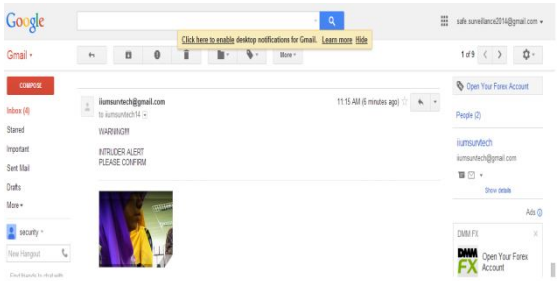


Figure 8: The security unit or police received the forwarded email.

V. COST OF PROPOSED MBSMT MODEL

One of our target was to produce a low cost surveillance model. The following table shows the cost of all the components used to build this prototype. Table 1 shows the total cost (approximately $100 USD) can be described as cheap compared to the function and service offered by this MBSMT model. This cost can be lower to half or less when we have commercial production for this product

Table 1: Cost of the components of the MBMTS

	COMPONENTS	PRICE
1	Raspberry Pi	RM111.00
2	SD Card Kingston 8GB	RM39.00
3	Router Dlink	RM95.00
4	PIR Motion Sensor	RM30.00
5	Switch / Magnetic Door Sensor	RM12.00
6	Camera Vztech 1682	RM25.00
7	Keyboard	Rm15.00
8	Mouse	RM10.00
	TOTAL	**RM337.00 Or 100 USD**

CONCLUSION

To prevent our properties from any unexpected occurrences of intruding, we should take early precautions as the saying goes, prevention is better than cure. The main objective of this project is to design and build an advanced surveillance model to offer efficient, low cost and fast response alert to help in preventing our properties. The implementation of the proposed MBSMT model shown quick respond, have the ability to integrate different parties (the owner, the security unit, and the police).The model has the ability to monitor multi-targets (properties) and has been successfully built with low cost (approximately $100 USD) per property.

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