

Humber College Institute of Technology & Advanced Learning

MAIDS HOME/BUSINESS INTRUSION DETECTION SYSTEM REPORT

Submitted by: Claudio, Meis - Submission 2

Discipline: Computer Engineering Technology

Date Submitted: January 20, 2020

Status

/1 Hardware present?

/1 Introduction (500 words)

/1 Scope and Requirements

/1 Background (500 words)

/1 References

# Introduction

## A break-in is a very disturbing experience. Family, home and business are our most precious assets and their security is of great importance to all. A security system provides the peace of mind that comes from knowing that our loved ones and our possessions are protected. The consequences of a break-in can be deeply overwhelming emotionally and financially. One may recover from the financial loss but the trauma of the act perpetrated on the family and on oneself may linger for a lifetime.

## Burglary is always a crime of opportunity and taking preventative measures reduces the likelihood of being affected by it. (SGI CANADA, 2020) For our families and businesses, taking a preventive measure, such as deploying MAIDS, can act as an effective deterrent against criminals from committing crimes against our family and our property. For example, when criminals see a sign informing them that security measures have been implemented, it reduces the likelihood of the crime happening. Moreover, homes and businesses with alarm systems are statistically less likely to be burglarized than homes or businesses with no security; burglars realize there is a greater chance of being caught, if activated. Finally, security alarms also reduce substantially vandalism and damage done to a person or property. An activated alarm system reduces the amount of time a thief has to commit a crime once inside the premises. In turn, the short time inside the home or business reduces harm to a person and the damage to the property and valuables, since once activated, thieves resort to fleeing the scene of the crime, promptly.

## MAIDS is an affordable, reliable and simple self-monitoring home/business intruder detection alarm system based on the Raspberry Pi 4 platform, motion (Passive Infrared Sensor) and sound sensors, and connected to the internet (IoT) to deliver home/business intrusion alerts via email (with intrusion picture), Android push notifications, phone call and SMS messaging after detecting an authenticated intrusion. MAIDS hardware can be remotely controlled via an Android application. The software implements hardware-responsive (LED/motion/sound sensor) code that delivers human/animal intrusion detection system alerts in real-time and through a variety of communication channels.

## Since most security events are initiated due to some sound that includes gunshots, aggressive behavior or breaking of glass, MAIDS includes a sound sensor. The sound sensor uses a microphone which detects the intensity of sound. The sound sensor captures the sound vibrations and changes them into signals (voltages). The output voltage then triggers the alarm system.

## Moreover, a home or business intrusion involves movement on the part of the assailant, therefore, MAIDS also includes a motion sensor. A passive infrared (PIR) sensor device is used to detect a person moving in/out of the detection zone with high reliability. Positive or negative thermal radiation changes in contrast to a background are focused onto a lens that triggers the sensor element. The sensor produces an electrical output signal when the temperature of the incident radiation changes and triggers the alarm system.

## Unarguably, by making your home more secure with MAIDS, you can save yourself inconvenience and money.

## 1.1 Scope and Requirements

MAIDS is an Internet of Things (IoT) capstone project undertaken at Humber College Institute of Technology and Advanced Learning in partial fulfillment of the requirements for the Computer Engineering Technology diploma. Its scope encompasses the design, development, modification and production of a home and/or business intruder alarm detection system.

The Meis Alarm Intrusion Detection System (MAIDS) implements a distributed computing model whose components include the following: 1. locally installed XAMPP server, 2. MySQL/MariaDB database administered with phpMyAdmin, developed with HTML, CSS. PHP, and JavaScript, and accessible via the Internet, 3. Capable of connecting to an enterprise wireless network and storing certificates, 4. A Raspberry Pi 4 Model B 2019 embedded system with power supply and 32GB SDHC card fitted with a custom PCB board containing a motion sensor, a sound sensor and a dual LED module, 5. A custom acrylic, 3-D and laser cut/etched enclosure fitted with a small (3 mm x 3 mm) fan for cooling and an ON/OFF switch.

Furthermore, the project is documented by following and producing an acceptable OACETT technical report. Also, it is important to emphasize that the MAIDS project was not CSA tested.

The specifications for the MAIDS software-hardware components are as follows:

* **Raspberry Pi 4 Model B 2019:** CPU: 1.5GHz quad-core 64-bit ARM Cortex-A72, RAM: 4GB of LPDDR4 SDRAM, Ethernet: Full-throughput Gigabit, Wireless: Dual-band 802.11ac wireless networking, Bluetooth: 5.0, USB ports: Two USB 3.0 and two USB 2.0 ports, GPU: Dual monitor support, at resolutions up to 4KVideoCore VI graphics supporting OpenGL ES 3.x4Kp60 hardware decode of HEVC video.
* **HC-SR501 Human Sensor Module Pyroelectric Infrared PIR Motion Sensor Detector:** Product Type: HC--SR501 Body Sensor Module, Operating voltage range: DC 4.5-20V, Quiescent Current: <50uA, Trigger: L (Default repeated trigger), Delay time: 5-200S (adjustable), Block time: 2.5S (default), Angle Sensor: <120  cone angle, Lens size sensor: Diameter: 23mm (Default), PCB board size: 3.7x2.5x2cm (1.46x0.98x0.79inch), Digital output pulse high (5V) when triggered (motion detected) and digital low when idle (no motion detected), Sensitivity range between 7-20 feet (3-6 meters).
* **Sound sensor:** Operating range between 3.3 V DC to 5.0 V DC, Operating current between 4-5 mA, Voltage gain of about 26 dB, Impedance of 2.2k Ohms, Frequency range between 16 to 20 kHz, Noise to signal ratio of 54 dB, Output model: digital switch outputs (0 (low) and 1(high)), PCB size: 3.4 cm x 1.6 cm.
* **Dual Color LED Module:** Dual-color LED: red and green, common cathode, PCB size: 2.0 cm x 2.0 cm, 3-Pin anti-reverse cable, working voltage: 3-5V DC.
* **Rocker Switch - SPST (round):** Rated up to 10A at 125VAC, Two-Pin switch, Size: 20 mm diameter.
* **Enclosure:** *Design:* CorelDraw 2018landscape .pdf file, stroke width: hairline (0.000 mm), outside laser cut: green, inside laser cut: red, etching color: black with stroke width thicker than hairline. *Physical Characteristics:* Small footprint (100 mmx 67 mm x 100 mm), Hollow shell WT2447-1-8/1212 Acrylic White Sheet, Translucent: 10%, thickness: 3 mm (1/8"), Glossy/shiny surface, Weatherproof/UV stable, etched icons and lettering, 3-D printed camera holder bracket and laser cutouts: round rocker switch, SDHC card, fan (30 mm x 30 mm), USB2.0, USB3.0, Ethernet, 2 micro HDMI connectors and audio ports.
* **Raspberry Pi 4 Compatible Power Supply:** ON/Off Switch, 5V 3A USB-C Charger Adapter for Raspberry Pi 4 Model B 1GB / 2GB / 4GB Version.
* **Storage** - Sandisk Extreme Pro: 32GB SDHC UHS-I Card (SDSDXXG-032G-GN4IN)
* **Android Device:** Display: 9.60-inch (800x1280), Processor: 1.3 GHz quad-core or higher, Front Camera: 2 MP, RAM: 1.5 GB, OS: Android, Storage: minimum 8 GB, Rear Camera: 5 MP, Battery Capacity: 5000 mAh.
* **MySQL/MariaDB Database:** *Hardware:* CPU: Intel Core or Xeon 3GHz (or Dual Core 2GHz) or equal AMD CPU, Cores: Single (Dual/Quad Core is recommended), RAM: 4 GB (6 GB recommended), Graphic Accelerators: nVidia or ATI with support of OpenGL 1.5 or higher, Display Resolution: 1280×1024 is recommended, 1024×768 is minimum. *Software:* Windows 7 (64-bit, Professional level or higher), Mac OS X 10.6.1+, Ubuntu 9.10 (64bit), Ubuntu 8.04 (32bit/64bit), Fedora 11 (i386/x64), Microsoft .NET 3.5 Framework, Cairo 1.6.0 or later, glib-2.10, libxml-2.6, libsigc++ 2.0, pcre, libzip.
* **XAMPP 7.4.1-1:** PHP 7.1.1, Apache 2.4.25, OpenSSL 1.0.2j, MariaDB 10.1.21, Perl 5.16.3, OpenSSL 1.1.1d (UNIX only), phpMyAdmin 5.0.1.
* **Languages:** HTML 5.0, CSS 3.0, JavaScript ECMAScript 2019.

# 2.0 Background

Break-ins occur every 90 seconds in Canada and more than 80% of break-ins occur during daylight hours. (SGI Canada, 2020) Statistics from 2018, showed that there were 159,812 burglaries across Canada and all types of properties. That is 431.24 reported burglaries per 100,000 persons. In other words, 4% of all Canadian households were burglarized; that is to say 1 out of 28 households were burglarized across the country. (Statistics Canada, 2018) Furthermore, once burglarized, a home or business is 12 **times** more likely to be burglarized again! (Woodall, 2019)

Closer to home, in the City of Toronto, Statistics Canada reported that in 2018 there were 14,265 Break and entering cases reports; that is 227.36 reported burglaries per 100,000 persons, an increase of 3.81% from 2017. According to the report, 1,723 persons were charged with the offence; 145 youths between the ages of 12 and 17 years of age were charged. (Woodall, 2019)

More disturbing, according to the Canadian Centre for Justice Statistics, a typical home/business invasion robbery in Canada is carried out by strangers 68% of the time in which a weapon is present 62% of the time (firearms 33%, Knives or cutting instruments 30% other weapons 42%) during the home/business invasion and victims sustain injuries in 50% of the cases. (Statistics Canada, 2002)

Taking into account the abovementioned statistics, it is not surprising that home/business owners are looking for a home intrusion detection system to safeguard their families and property. However, they are finding it more difficult to protect their families, homes and businesses with the skyrocketing pricing of commercial alarm systems. For example, Vivint will charge around $700 just for the basic starter equipment package and a monthly monitoring fee between $30 and $45 dollars per month on a 42 to 60 month contract; that is between $1300 and $2700 per year! (Safety.com, 2020)

According to research studies, homes with a monitored security system are 2.2 times less likely to be burglarized and business with a monitored security system are 4.5 times less likely to be burglarized. (Canadian Centre for Justice Statistics, 2019) In addition, 85 percent of police chiefs recommend the installation of monitored security systems. Furthermore, in its criminology study, the University of North Carolina at Chapel Hill found that thieves check for alarms in a home or business 83 percent of the time and if one is found more than 50 percent of them are deterred from committing the break-in. (Canadian Living, 2019)

# 3.0 References

Brinks. (2019). Retrieved from https://help.brinkshome.com/hc/en-us/articles/360006895212-Faster-response-with-ASAPer?kbid=117104, September 2019

Canada, S. (2002). *Breaking and Entering in Canada - 2002*. Retrieved from Statistics Canada: http://www.publications.gc.ca/site/archivee-archived.html?url=http://www.publicatio

Canada, S. (2018). *Incident-based crime statistics, by detailed violations, Canada, provinces, territories and Census Metropolitan Areas*. Retrieved from Statistics Canada Table 35-10-0177-01 : https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3510017701&pickMemb

Canada, S. (2020, September). *Preventing break-ins*. Retrieved from SGI CANADA. 2020: https://www.sgicanada.ca/news?title=preventing-break-ins

Safety.com. (2020, January 22). *The Best Home Security Systems of 2020*. Retrieved from Safety.com: https://www.safety.com/best-home-security-systems/

Seymour, R. (2015, November 1). *Organization & Cleaning - Home security: 10 ways to protect your home from intruders*. Retrieved from Canadian Living: https://www.canadianliving.com/home-and-garden/organization-and-cleaning/article/home-security-10-ways-to-protect-your-home-from-intruders?kbid=117104

Woodall, M. (2019). *Canadian Crime Rates Burglary & Home Invasion: A Real Threat*. Retrieved from SecureHouse.ca: http://www.securehouse.ca/canadian-crime-rates-burglary-home-invasion-toronto.html