**Mobile and Pervasive Design**

**FA16-BL-INFO-I527-13527**

**Lab Challenge**

**Intelligent Burglar Alarm System**

**Motivation**

Commercially available home monitoring systems are unreachable to most of the population not just due to the cost of setup but also the high maintenance required. We therefore propose an idea with a working prototype to build an intelligent burglar alarm system using electronic modules present in the Arduino kit. The project is a minified version of an energy efficient and cost effective burglar alarm system which runs 24 x 7, monitoring and notifying the owner of any issues within the premises of the house in real time.

**Design**

**Overview**

To monitor activities for the fencing/compound of homes, CCTV video recorders are usually used. These cameras record the events every second. This system requires constant supply of power for the video cameras. Moreover, storage required for the recordings is humongous[1] which makes it unaffordable for home users. There needs to be an efficient system which captures events only when the need arises but is still reliable.

More often than not, burglars/miscreants climb up the fence/compound wall to enter into homes. Our system helps in identifying this activity. During daytime, the soft potentiometer is used as a pressure sensor which detects the weight change when the burglar climbs on the compound wall. This immediately triggers the alarm (buzzer) inside the house. The house owner will be notified almost instantly about the mischievous activity which has taken place at the wall. This setup is the crux of a bigger system which includes an additional camera. Once coupled with the camera, the system enables the owner to confirm if the miscreant was really a burglar and also provides the photo as a proof for further legal purposes.

At night, the photo resistor detects the absence of sufficient amount of light for the camera to capture the miscreant's picture. The system therefore switches on the electric light bulb (simulated by the LED) **when the pressure is detected only** - which provides sufficient brightness for the camera to capture the image.

**Storage Efficiency**

In a typical CCTV setup, streaming data having video information of regular time intervals are stored into high capacity array of hard disks which usually range from few hundreds to thousands of terabytes.

However in the proposed model, we avoid the need of high capacity storage systems which may be replaced with a single desktop hard drive of normal capacity close to just a terabyte which would be sufficient for at least 5 years assuming the size of the pictures is 5 megabytes and the trespassing event occurs twice every week – which is too often in the first place.

**Energy Efficiency**

The collective energy required for the camera, photo sensors and the pressure sensors is much lesser than that required by the video cameras, the client-server computer system and the lights combined.

The key difference in energy is due to two factors:

1. Avoiding continuous data creation and storage (video creation, transmission and storage require more power than those for pictures – common knowledge).
2. Avoiding constant illumination by turning lights on need basis.

**Cost Effectiveness**

Initial setup avoids high end computer hardware, software and CCTV cameras which is close to a thousand dollars[2] to being replaced by simple Arduino kit available for less than a hundred dollars[3].  
Energy consumption in turn reduces the operating cost during the course of use.  
Operating cost is low due to lesser amount of storage required.

**Other Advantages**

Notifying the potential victims before the burglar breaks into the house by detecting risk at a farther distance (the fencing/compound instead of main door).

Burglar will be unaware of any camera due to no illumination until trespassed.

High resolution images maybe captured to better detect the miscreant in contrast to the compression algorithms applied in case of CCTVs which sometime reduce the ability to detect the guilty.

**Future Enhancements/Uses**

This system may be improved by capturing the metadata (such as the timestamp and the location of the household), on which machine learning algorithms may be applied to learn the occurrence and even predict the future events.  
  
Computer Vision software may be used to detect the burglar(s) whose records may already be present with the law enforcers.

***As a novel approach, when multiple homes are installed with this system, there is a virtual connection created automatically which helps in determining the path taken by the absconding burglar.***

**Arduino Devices used**

1. Soft Potentiometer
2. Photo Resistor
3. Buzzer
4. LED
5. Wires and resistors
6. Cardboard and Tape.

**Appendix A - References**

1. Seagate Technology LLC (2012). Video Surveillance Storage: How Much Is Enough? [Technology paper]. Retrieved from <https://www.seagate.com/files/staticfiles/docs/pdf/whitepaper/video-surv-storage-tp571-3-1202-us.pdf>
2. Fixr (2012). Install Video Surveillance Cameras Cost. [Website]. Retrieved from <http://www.fixr.com/costs/install-video-surveillance-cameras>
3. The best Arduino starter kits compared and reviewed (2014-10-9). [Website] Retrieved from <https://www.pretzellogix.net/2014/10/09/three-arduino-starter-kits-compared-and-reviewed/>

**Appendix B – Files Attached**

|  |  |  |  |
| --- | --- | --- | --- |
| **Sl** | **File Name** | **Description** | **Comments** |
| 1 | Idea.docx | This file describing the project system. |  |
| 2 | Softpot\_and\_photoresistor\_to\_led.ino | Arduino source code | Own code. Commented for readability. Deliberately reduced the size considering the memory constraints for an embedded system such as Arduino, when used along with other modules. |
| 3 | FinalHomeWork.fzz | Fritzing diagram | The image of soft potentiometer is unavailable in the Fritzing software hence we used an image of a thread based soft potentiometer – it is an old version which cannot be resized hence it alone is displayed bigger than other components |
| 4 | Video Demo.mp4 | Video demonstrating the working of the prototype |  |
| 5 | Intelligent Burglar Alarm.pptx | Presentation used in the lab during demonstration | This contains the storyboard illustrating the success use case. |