CSC 3328: Final Project
A Burglar Alarm System

James Peyton Jones. James.peyton-jones@villanova.edu
Fulbright Visiting Professor, Electrical & Computer Engineering, Villanova, PA 19085.

1. Academic Integrity

You are welcome to seek help, should you need it, from Dr. Peyton Jones, but please note that this project should be completed on your own, with no assistance given or received from other students. Any infringements of this requirement will be treated as a serious violation of academic integrity. If anyone asks you for help, please redirect them to Dr. Peyton Jones rather than risk 'helping' at significant risk and cost to yourself.

2. Project: Burglar alarm system

This project aims to bring together everything you have learned this semester. The goal is to design a burglar alarm system with a variety of features. It is acceptable to submit the basic system (described below), but the project is intended to be open-ended and students who complete more features (or who add useful additional features of their own) will receive additional credit.

2.1 The basic system

The basic system has three states, **Off**, **Armed**, and **Alarm**. The user presses **BTN1** to **Arm** the system (in which case **LED1** shines continuously) and presses **BTN1** again to disarm it back to the **Off** state (when all LED's are off). Any button press should also be acknowledged by a brief **beep** on the buzzer. Once **Armed**, the system will respond to intruders detected by the Reflected Light Sensor (**RLS**) by switching to the **Alarm** state, during which time the Buzzer **alarm** is sounded with a tone. The system should also alert the home owner by sending them an **email**. The Alarm falls silent (but remains **Armed**) if the intruder is scared off and departs, or if the system is disarmed back to the **Off** state by pressing **BTN1**.

2.2 Additional Features

The home owner is very pleased with the basic system but would like something with more features. A list of possible features is given below. None of these are required, nor is it necessary to do *all* of them but recognition will be given to those who undertake more challenging work. The best strategy is to do your best within the constraints of your other commitments while recognizing that it is unlikely that anyone is going to deliver the 'perfect' product.

The list is not presented in any particular order, but if you do add features then note the feature number and description in your program header. Note that implementing these extra features may require creating additional states.

i) The neighbors are getting annoyed by false activation of the alarm system. Add a feature so that the alarm is not activated until the intruder has been present for at least 3 seconds.

ii) In the basic system, the alarm falls silent as soon as the intruder leaves. Add a feature that the alarm remains active for 20 seconds after the intruder has left (unless the system is disarmed back to the Off state by pressing BTN1).

iii) The home owner would like to be able to arm or disarm the system remotely from the cloud. Create a feature which adds this functionality.

iv) The home owner also wants to monitor system operation by having it automatically make entries in a Google sheets spreadsheet showing the times when the system is armed or disarmed or when an intruder is detected. Use a cloud integration tool to add this functionality.

v) The home owner is worried that an intruder might now have enough time to deactivate the alarm before it goes off. Add a digital lock so that the a specific sequence or key of '0's and '1's (which you will be given by your instructor) must be entered using the two buttons (where BTN0 => 0, BTN1=>1) in order to arm or disarm the system.

vi) If you've implemented feature iii) the system can still be armed and disarmed remotely without the digital key. Add a feature that also requires the digital key to be entered for any remote operations.

vii) If the system is armed by entering the key locally, then there is a chance that the alarm might trigger before the home owner has left the house. Add a feature so that there is a 5 second delay between arming the system and the time when intruder detection becomes active. During this time LED1 flashes and the system should not respond to the Reflective Light Sensor.

viii) The alarm of the basic system sounds like a pure tone. Add a feature to make the alarm warble between two (or more) different tones.

ix) The pushbutton switches have a tendency to 'bounce' when pressed (or even when released) producing multiple btnPressed events instead of a single clear reliable event. Implement a method to 'debounce' these inputs.

x) The home owner is delighted with everything you have achieved and is running out of ideas for new features. Add any new features of your own invention, explaining carefully what they do.

2.3 Submission

Demonstrate your program to your instructor and upload the following to Canvas:

- Your program source code.
- A Word document in which you paste:
  o Drawings of the FSM diagram(s) that you use to implement your system
  o Screenshots of the email notification that you receive
  o Screenshots of the Google spreadsheet of alarm activations/deactivations and intruder detections (if implemented).

The Due Date for submission is midnight **Wed Dec 14** (last day of the semester), but you are strongly encouraged to complete the project significantly before the date of final submission.