SAIT School of Information and Communications Technologies

LAB 1

Basic Inputs and Outputs

Information Systems Security – ITSC 305 – Reverse Engineering of IoT Systems
Version 1.02

Lab report rubric:

Submission(s)	Level 4	Level3	Level 2	Level 1	Criterion Score
Correctness	25 points Every deliverable / part is correct, working solution to the problem, understanding is evident.	20 points Some deliverables / parts are not correct - or - do not perform as per Lab Procedure - or - full understanding is not evident	15 points Most deliverables / parts are not correct - or - do not perform as per Lab Procedure - or - understanding is not evident	0 points No deliverables were submitted	/ 25
Completeness	15 points Student submitted all deliverables / parts as per Lab Procedure - and - all code follows proper commenting techniques	10 points Student submitted most non-optional deliverables / parts as per Lab Procedure - or- code doesn't follow proper commenting techniques	5 points Student submitted some non-optional deliverables / parts as per Lab Procedure - or- code doesn't follow proper commenting techniques	0 points No deliverables were submitted	/ 15
Critical Reflection	5 points Critical Reflection is included - and - shows evidence of information synthesis	0 points N/A	0 points N/A	0 points Critical Reflection is not included - or - doesn't show evidence of information synthesis	/ 5
Timeliness	5 points Report was submitted before due date	0 points N/A	0 points N/A	0 points Report was submitted after due date	/ 5

Every student must submit their own report for <u>every</u> lab (unless otherwise stated). Report to include:

- Cover page with lab **number**, student **name**, **date** and other important information
- Answers to questions, tables, graphs, etc. from lab, as necessary.
- **(Private YouTube) Link to video recording** showing functionality of the device. (**Notes:** multiple students from the same group can submit the same video, but every student <u>must include their own explanation</u> of the functionality)
- **Python code** (.py file or screenshots) including proper **comments**
- **Critical Reflection** (see details at the end)

Reports must be submitted via Brightspace in MS Word format no later than one week after the lab was finished. (The exact due dates will be identified in class prior to start of the lab rotations)

This lab will introduce learners to General Purpose Inputs and Outputs of Raspberry Pi and basic electronics components, including LEDs, Resistors, Buttons and Switches.

Pre-Lab Preparation

1. Read **Chapters 2.1, 2.2, 2.3, 2.5 and 5.1** of the **Lessons In Electric Circuits: Volume I – DC** book, available through Brightspace
2. Lookup forward voltage V_f and maximum forward current I_f for Red, Green, Blue, Yellow and White LEDs

Lab Objectives

1. Investigate the basic concepts of GPIOs on Raspberry Pi
2. Relate Voltage, Current and Resistance through application of Ohm's Law
3. Gain understanding of basic electro-mechanical components (switches, buttons) and electrical components (LEDs, resistors)
4. Investigate and setup basic logic using *gpiozero* python library

Equipment, Materials and Resources

1. Raspberry Pi
2. Electronic components:
    a. Various coloured LEDs
    b. Resistors
    c. Buttons, Switches
3. Breadboard, ribbon cable, GPIO extension board, jumper wires
4. Oscilloscope or DMM (available in lab)
5. *Gpiozero Resources* *https://gpiozero.readthedocs.io/en/stable/*

Part 1 – Outputs

1. Using *Gpiozero Resources* and *Chapter 2 of Electronics book* (or internet) investigate the connection between Raspberry Pi GPIO and one LED of any colour

   Note: make sure you use appropriate resistors, as calculated in pre-lab preparation

2. Create a Python code that will:
   a. Make the LED turn on/off
   b. Make the LED blink at 0.5 second interval using *blink method*
   c. Make the LED blink at 0.5 second interval using *loops*

3. Show these to your instructor **and include code in report**

Part 2 – Inputs

4. Using *Gpiozero Resources* (or internet) investigate the connection between Raspberry Pi GPIO and one Button.

   Note: make sure you setup your GPIO Input with a pull-up resistor activated (see gpiozero resources for details)

5. Create a Python code that will:
   a. Prints the state of a button (pressed/released)
   b. Prints how long (in seconds) has the button been pressed

6. Show these to your instructor **and include code in report**

Part 3 – Inputs and Outputs combined

7. Using the previous knowledge combine together at least one button and one slide switch with at least 3 LEDs. Give your circuit some digital logic and record the video of its functionality.

   Example of a digital logic: if the button is pressed, red LED turns on; if the switch is on and button is pressed, green LED turns on; if switch is off and you hold the button for 5 seconds, all LEDs turn on.

8. Show this to your instructor, **include code and video in report**

Critical Reflection

Create **critical reflection** about this lab, contemplating the learning process.

Some cues to help you get started (these don't have to be answered directly):

- Really think about how this lab fits into your idea of IoT devices and Information security.
- Critically evaluate your own knowledge of the topic before and after the lab.
- What problems and solutions have you encountered?
- Do you still have unanswered questions? (this is the time to ask them)