

## REQUIREMENTS INFORMATION FOR TRAFFIC LIGHT MONITORING SYSTEM

### Purpose & Intent

In this system, Alberta Traffic Supply Ltd. will require us to create a traffic light monitoring system (TLMS) that will manage traffic flow through an intersection by utilizing a state machine that transitions between seven states. Figure I below shows the intersection layout for which the system will interact and work with.

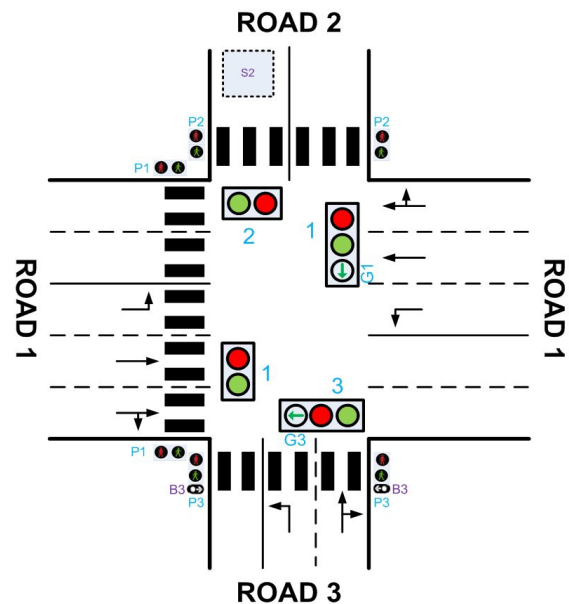
**Figure I: Intersection Layout**

#### Labels:

- 1 = Traffic light for road 1
- 2 = Traffic light for road 2 (secondary)
- 3 = Traffic light for road 3
- B3 = Button for pedestrian crossing on road 3
- G1 = Green arrow light for road 1
- G3 = Green arrow light for road 3
- P1 = Pedestrian crossing light for road 1
- P2 = Pedestrian crossing light for road 2
- P3 = Pedestrian crossing light for road 3
- S2 = Magnetic Sensor
  - Can detect any vehicle including motorcycles

#### Not shown on diagram:

- RB = Reset Button (on site)
- T1 = Timer 1
- T2 = Timer 2



### System Limitations

- Software developed will specifically only function with the intersection layout provided and any other software involved with interfacing with hardware and communication(s) will not be of concern.
- Maximum file size is 450 kB & maximum RAM usage: 54 kB.
- Operating System: Does not matter; will run on arbitrary computer.
- Abides by the Canadian Transportation Agency's traffic acts and regulations.

### Usability & Reliability

- System should be working and running 24/7 unless there is a malfunction wherein the emergency state is elicited until a reset button is pressed.
- The software will be installed on-site in a high-security control panel to prevent any interference or modifications made by external/other third-parties.
- Any hardware malfunctions or errors that occur within the system immediately causes the system to proceed into an emergency state with the malfunction code "M".
- Once the reset button is pressed, the system should go to the default state.

### Functional Requirements

- The state transitions are controlled by the timers (T1, T2), the button for pedestrian crossing, the magnetic sensor and the time of day.
- When the system first starts or is reset, it should initialize by first going to the emergency state and transitioning to the default state.
- The system can also enter the emergency state when the reset button is pressed, to be used for manual resetting of the system.
- When the emergency state is activated, the next state that the emergency state transitions to will depend on the time of day (i.e. any time from 10 PM to 6 AM will be the night state and any time that is not within that range will be the day state).
- Table I defines the states in which the system will transition between and each of their respective properties. Figure II shows how the system moves between states in a state diagram.

**Table I:** 7 States of the Traffic Light System to be implemented.

**Legend:** G = Green • R = Red • BG = Blinking Green • BR = Blinking Red • D = Daytime • N = Nighttime

| State        | Clock | 1  | 2  | 3  | P1  | P2  | P3  | G1  | G3  | T1  | T2  | Malfunction |
|--------------|-------|----|----|----|-----|-----|-----|-----|-----|-----|-----|-------------|
| S Default    | D     | G  | R  | R  | R   | G   | R   | R   | R   | ON  | OFF | OFF         |
| S Green 1    | D     | R  | R  | R  | G   | R   | R   | G   | R   | OFF | ON  | OFF         |
| S Green 3    | D     | R  | R  | G  | R   | R   | R   | R   | G   | OFF | ON  | OFF         |
| S Green B3   | D     | G  | R  | R  | R   | G   | G   | R   | R   | OFF | ON  | OFF         |
| S Green 2, 3 | D     | R  | G  | G  | R   | R   | R   | R   | R   | OFF | ON  | OFF         |
| S Night      | N     | BG | BR | BR | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF         |
| S Emergency  | D & N | BG | BR | BR | OFF | OFF | OFF | OFF | OFF | OFF | OFF | ON          |

**Figure II:** State Machine Diagram of Traffic Light System

