ECE 321 Lab
Software Requirements Engineering
Department of Electrical and Computer Engineering
University of Alberta

404 Team Name Not Found

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Contents

1 Customer:

Client: Alberta Traffic Supply Ltd.
7798 16 th Street
Edmonton, Alberta, T6P 1L9
Western Canada largest traffic sign manufacture and traffic control company

2 Definitions

Labels **1,2,3,P1,P2,P3,B3,S2,G1,G3** *can be found in Figure 1.*

1. **TLMS** - **T**raffic **L**ight **M**onitoring **S**ystem
2. **RB** - **R**eset **Button**
3. **M** - Hardware malfunction: 1 indicates a malfunction, 0 for normal operation
4. **1** - Light on Road 1
5. **2** - Light on Road 2
6. **3** - Light on Road 3
7. **P1** - Pedestrian light on road 1
8. **P2** - Pedestrian light on road 2
9. **P3** - Pedestrian light on road 3
10. **t1** - Timer for **1**
11. **t2** - Secondary timer for everything else
12. **G1** - Left turn signal on road 1
13. **G3** - Left turn signal on road 3
14. **S2** - Magnetic sensor which detects if a car/motorcycle is waiting on **2**
    Outputs: 1 if vehicle waiting, 0 otherwise
15. **B3** - Button on road 3 which a pedestrian can hit to request to cross the intersection
16. **BG** - **B**linking **G**reen
17. **BR** **B**linking **R**ed
18. **D** - **D**ay (6:00-20:00)
19. **N** - **N**ight (20:00-6:00)
20. **Clock** - Can have value **D** or **N**

3 Requirements

1. The software will be running on embedded system with a 550KB hard drive and 50KB RAM.
2. The software design should obey regulations on traffic lights posted by the Canadian Transportation Agency (CTA).
3. The software design should focus on safety, reliability and correctness. The system should be operating with minimal downtime.
4. The software should use different timers. Timer 1 is used for road 1 only, and timer 2 is used for the rest.
5. Road 1 and 3 are main roads, and road 2 is secondary. Priority should be given in the sequence of road 1, road 3, road 2.
6. Pedestrian lights should turn green when it is safe to cross.
7. System should go to emergency state when there is a hardware malfunction, and go back to default mode when exiting emergency state.
8. The system should have a physical button for reset. During a reset, the system should go to emergency mode first, and then the default mode.
9. The system should be tested using emulations. It should also demonstrate satisfactory performance before puting in use.

4 Nice-to-haves

1. Data logging system, but design should account for the limited storage.
2. Indication of which part of the system is malfunctioning.
3. Configurable timing for traffic flow optimization purpose.
4. Protection of the sensor S2.
5. Ability to change **t1** and **t2** in the future

5 State description

Note:

- *Labels* **1,2,3,P1,P2,P3,B3,S2,G1,G3** *are defined on page 2 and in Figure 1 on page 1. The state diagram (Figure 2) can be found on page 7*
- Green and Red text indicate what colour the light should be in the respective state

1. **Default**
    - **1,P2**

- **2,3,P1,P3,G1,G3**
- **t1** activated
- **M**: 0
- **Clock**: **D**

2. **Green G1**
    - **G1,P1**
    - **1,2,3,P2,P3,G3**
    - **t2** activated
    - **M**: 0
    - **Clock**: **D**

    Note:

    (a) **Green G1 S2** *is this state, but when* **S2**=1

3. **Green 3**
    - **3,G3**
    - **1,2,P1,P2,P3,G1**
    - **t2** activated
    - **M**: 0
    - **Clock**: **D**

    Note:

    (a) **Green 3 S2** *is this state, but when* **S2**=1

4. **Green P3**
    - **1,P2,P3**
    - **2,3,P1,G1,G3**
    - **t2** activated
    - **M**: 0
    - **Clock**: **D**

    Note:

    (a) **Green P3 S2** *is this state, but when* **S2**=1

5. **Green 2&3**
    - **2,3**
    - **1,P1,P2,P3,G1,G3**
    - **t2** activated

- **M**: 0
- **Clock**: **D**

6. **Night**
   - **1 BG**
   - **2,3 BR**
   - **P1,P2,P3,G1,G3** are turned off
   - **M**: 0
   - **Clock**: **N**
7. **Emergency**
   - **1 BG**
   - **2,3 BR**
   - **P1,P2,P3,G1,G3** are turned off
   - **M**: 1
   - **Clock**: **D** or **N**

   Note:

   (a) When the system first starts up, it should briefly go into emergency mode with **M**=0 then immediately switch to default mode. (Because hardware malfunctions should be fixed before the system starts.)

6 Special considerations

1. Security

   (a) The embedded traffic system and reset buttons should be locked, and inaccessible by the public.

   (b) Control mechanisms should be secure so that someone cannot hack into the system to control the lights.

   (c) Software best practices should be used to keep the system secure.

2. Reliability

   (a) The system should be tested in a virtual environment and tested thoroughly before being deployed.

3. Synced timings

   (a) The timing of the traffic lights changing states should be in sync with nearby intersections to relieve congestion.

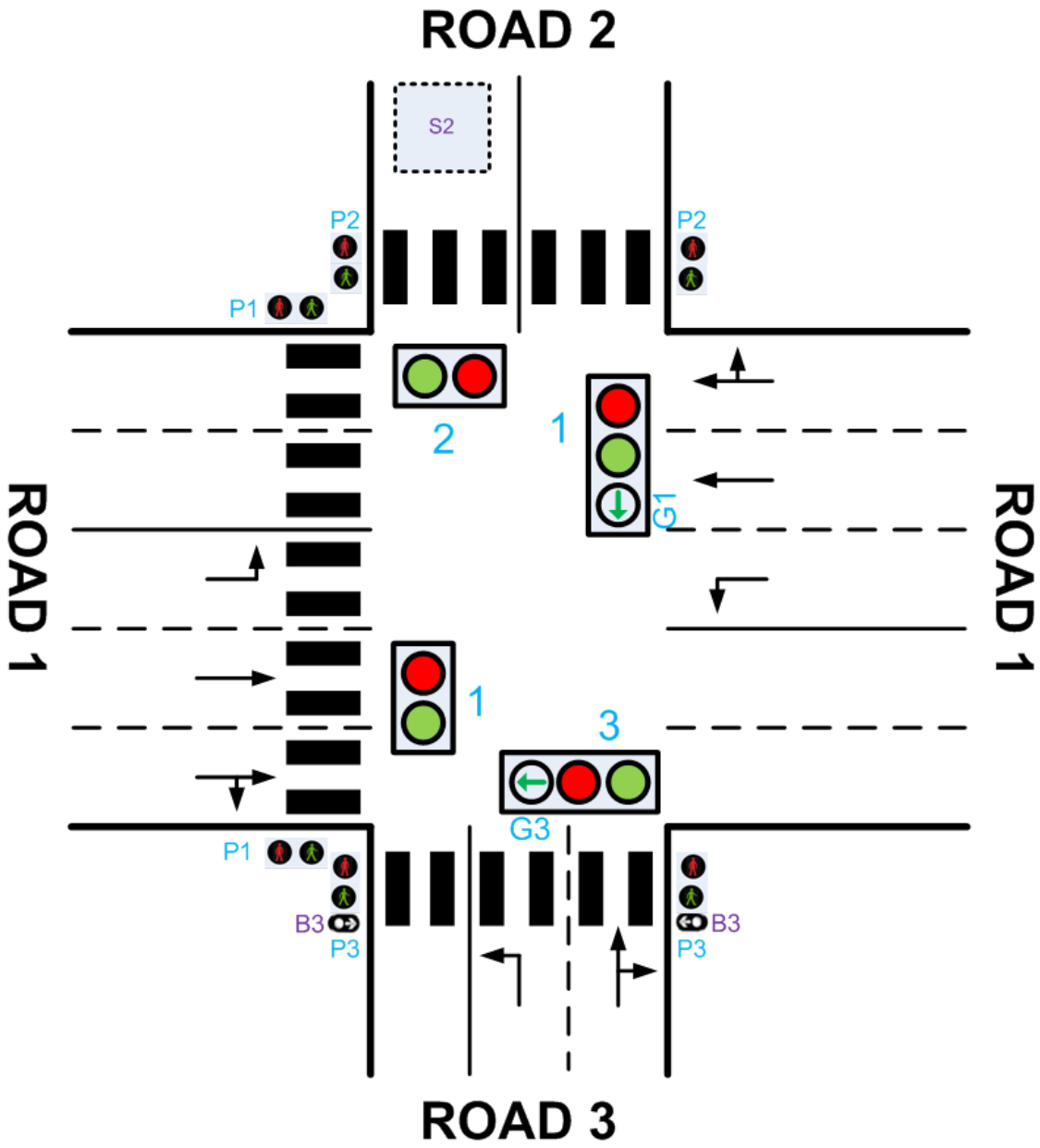

Figure 1: Illustration of the intersection. Labels are defined in Section 2 on page 2

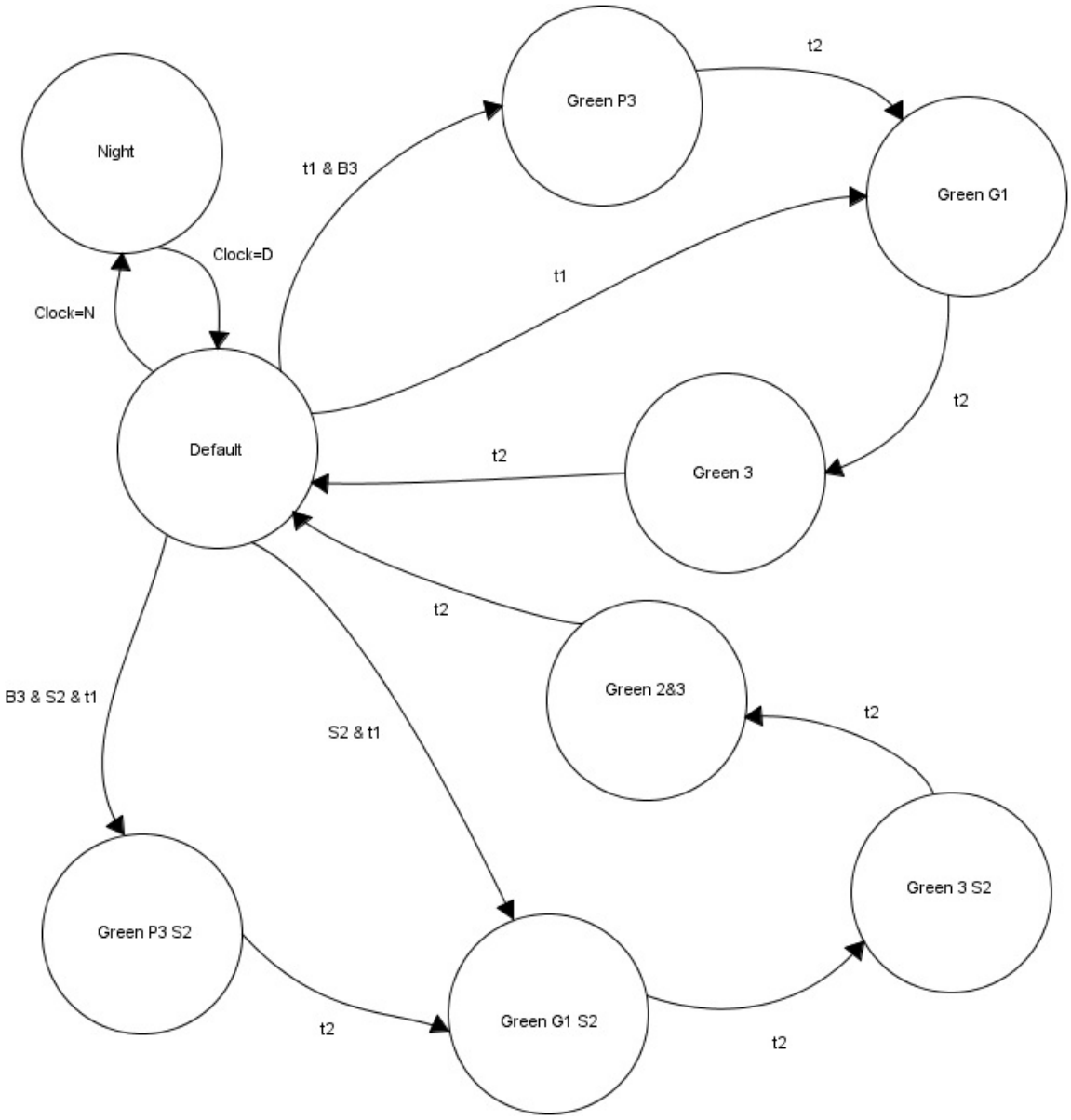

Figure 2: State machine diagram for the system. States are defined in Section 5 on page 3