

ECE 321

Lab 2

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Introduction:

The following is a specification of a software system used to control a traffic light system (TLS) for Alberta Traffic Supply Ltd. The system is designed to work autonomously, handling traffic automatically unless a malfunction occurs. In that case, a manufacturing engineer will be responsible to operate and maintain the system, handle any errors, upload timing information and reset the system in case of any software issues. The project is designed to work at a simple intersection in Edmonton, offering scalability to spread out and be used in Alberta and then Canada in the future. As we can see in Figure 1, the system should be able to work with the intersection of two main roads, and a secondary road.

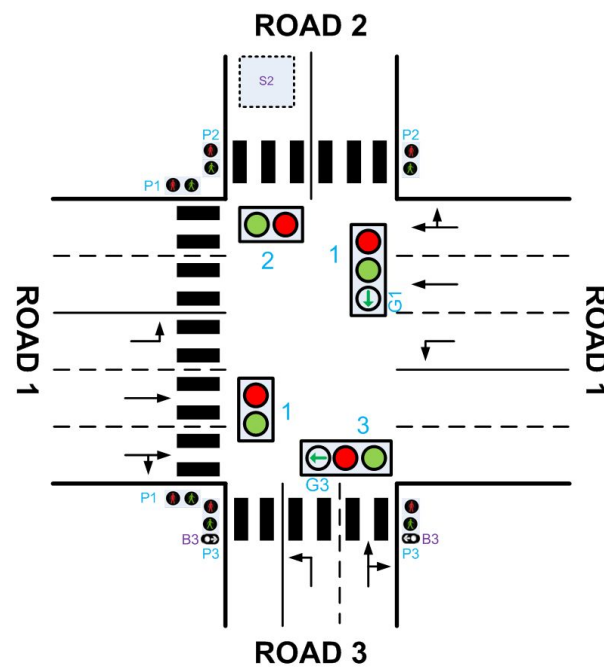


Figure 1: Diagram showing an example intersection the system will work on

Scalability is achieved by designing the project to require low memory (50 kb of RAM) and low disk usage (450 kb). It will be programmed using C in order to have highly efficient code that can work on very simple microcontrollers/ microprocessors.

States:

There are two main, important states in our system, which are 1) the default state, 2) the emergency state, which is reachable from any of the other states whenever a malfunction occurs. In the emergency state, the system will come to a halt until a third party person troubleshoots the issue and resets the system, fixing any hardware or software errors if necessary.

Note: in the table below, the names used match the labels draw in Figure 1. For example, G3 is the arrow signal in front of Road 3.

States	1	2	3	P1	P2	P3	G1	G3	T1	T2	M	Clock
Default	G	R	R	R	R	R	G	R	On	Off	Off	D
Green G1	R	R	R	G	R	R	G	R	Off	On	Off	D
Green S3	R	R	G	R	R	R	R	G	Off	On	Off	D
Green B3	G	R	R	R	G	G	R	R	Off	On	Off	D
Green P3	R	G	G	R	R	R	R	R	Off	On	Off	D
Green 2&3	R	G	G	R	R	R	R	R	Off	On	Off	D
Night	BG	BR	BR	Off	Off	Off	Off	Off	Off	Off	Off	N
Emergency	BG	BR	BR	Off	Off	Off	Off	Off	Off	Off	On	D/N

Figure 2: State table showing all the states

From any state, we can go to the emergency state. However, for the simplicity of the diagram, this is not displayed in the state diagram in Figure 3. Moreover, there is a reset button called Rb, which will reboot the system after a software or hardware malfunction.

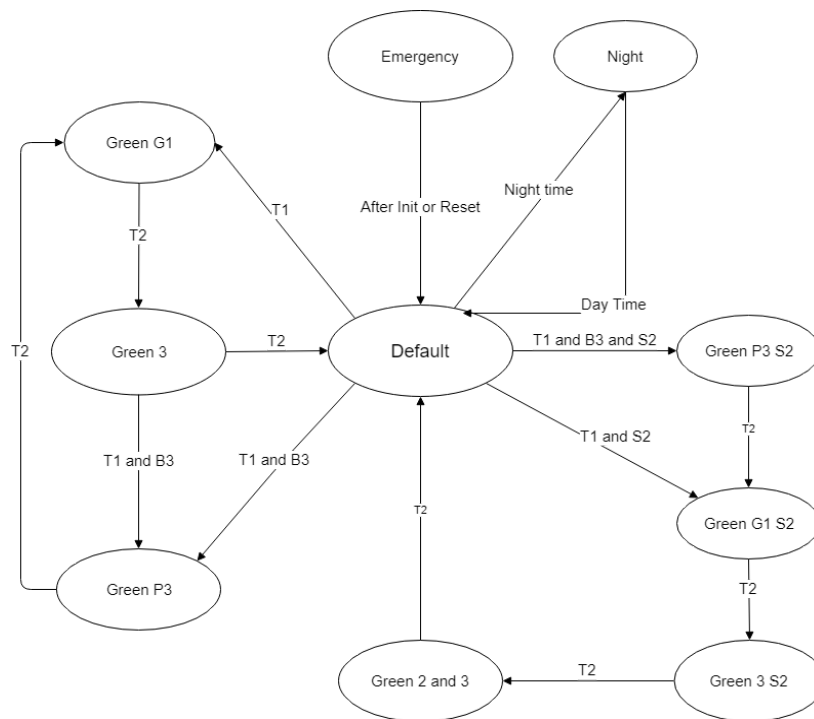


Figure 3: Finite State Machine showing transition between states

To clarify the figures above, the table below describes what some of the terms in the graph represent.

T1 and T2	Countdown timers, which send a signal at the end of countdown.
Clock	Keeps track of time. 10pm to 6am is night time, and 6am to 10pm is day time.
B3	A button used by pedestrians to request crossing the road
Rb	Reboots the system after a software or hardware malfunction
S2	A magnetic sensor which detects cars

When T1 or T2 are on, that means that those timers are in the process of counting down. A signal to transition is set when the timer finishes the count down. A preliminary count down time for T1 and T2 are 30 seconds and 15 seconds respectively.

Legal info:

This software design follows all necessary guidelines and laws stated in the Canadian Transportation Act.