Control Engineering 2 Task

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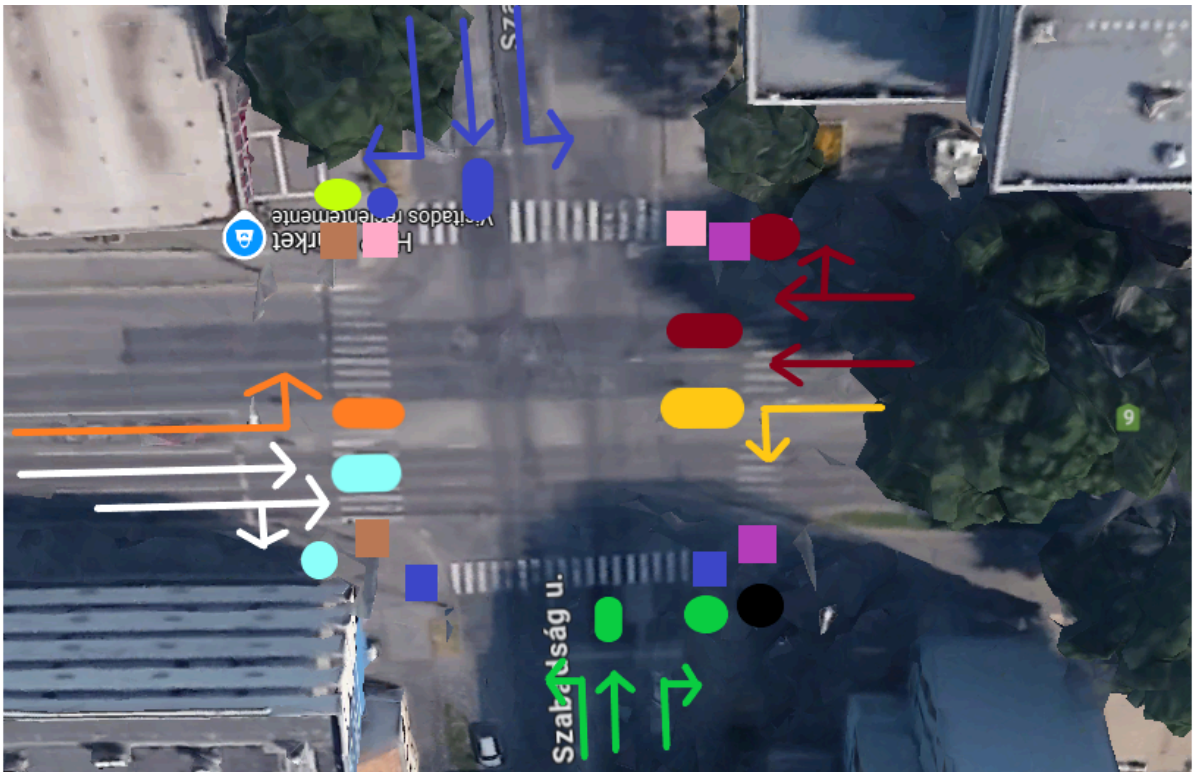
Description
Intersection: Szabadság u. & József Attila u.
(https://maps.app.goo.gl/v7VSkBFbMWBgvgfb7)

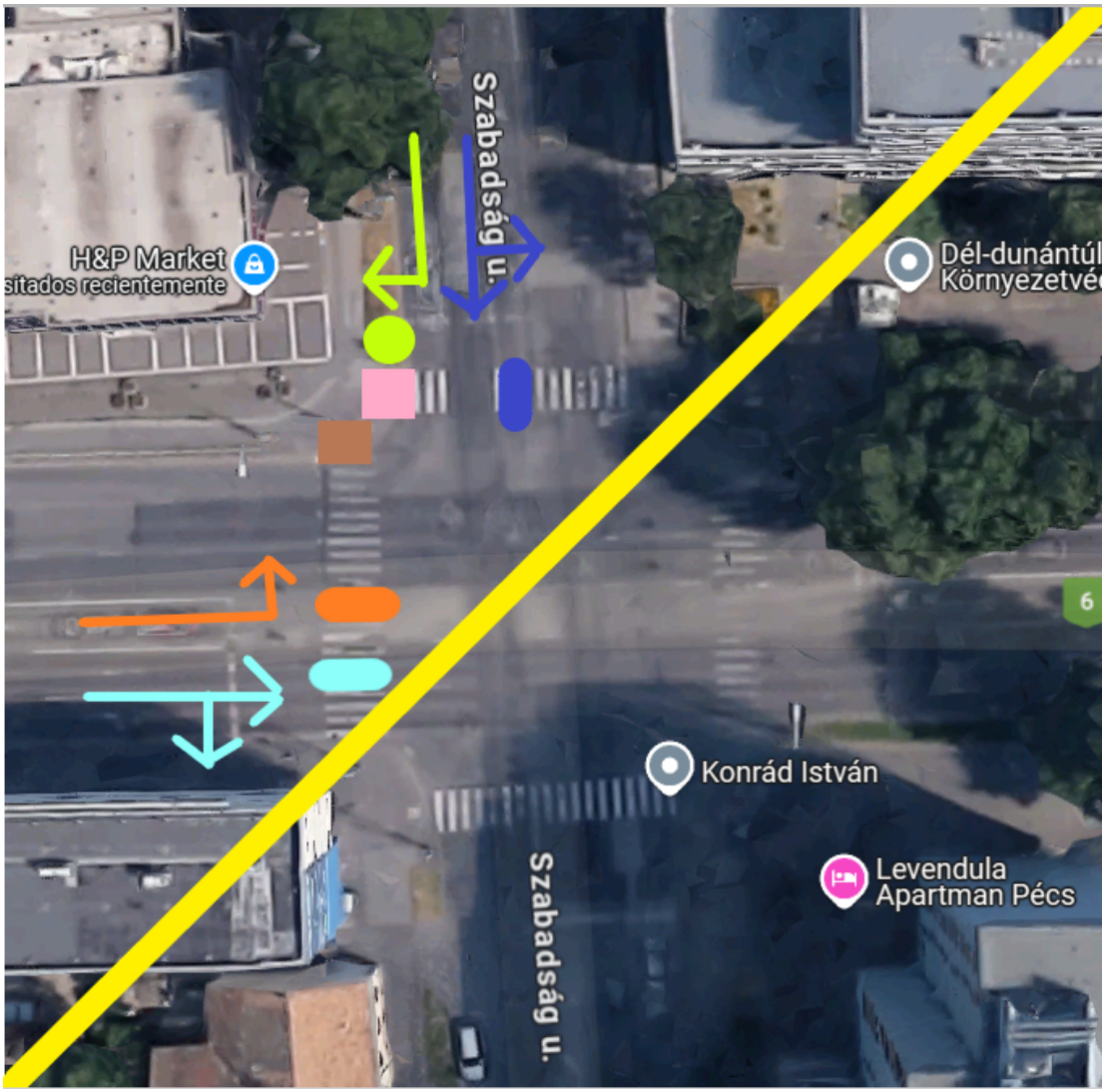


Blue: Traffic Light North-South**(TL_NS)**
Blue(Circle): Traffic Light North-South ground**(TL_NSG)**
Lime: Right Turn North-West**(TL_NW)**
Red: Traffic Light East-West **(TL_EW)**
Red(Circle): Traffic Light East-West ground**(TL_EWG)**
Yellow: Left turn East-South**(TL_ES)**
Green: Traffic Light South-North**(TL_SN)**
Green(Circle): Traffic Light South-North Ground**(TL_SNG)**
Black: Right Turn South-East**(TL_SE)**
Sky blue: Traffic Light West-East**(TL_WE)**
Sky blue(Circle): Traffic Light West-East Ground**(TL_WEG)**
Orange: Left Turn West-North**(TL_WN)**
Brown: Pedestrian Light West**(PL_W)**
Brown: Pedestrian Light West**(PL_W2)**

Pink: Pedestrian Light North**(PL_N)**
Pink: Pedestrian Light North**(PL_N2)**
Purple: Pedestrian Light East**(PL_E)**
Purple: Pedestrian Light East**(PL_E2)**
Blue(Squares): Pedestrian Light South**(PL_S)**
Blue(Squares): Pedestrian Light South**(PL_S2)**

Analysis

Because of the symmetry of the intersection the system will be simplified and solved accordingly.



Blue: Traffic Light North-South**(TL_NS)**
Lime: Right Turn North-West**(TL_NW)**
Orange: Left Turn West-North**(TL_WN)**
Sky blue: Traffic Light West-East**(TL_WE)**
Brown: Pedestrian Light West**(PL_W)**
Pink: Pedestrian Light North**(PL_N)**

The state table of this is:

State	C0	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17
Time(s)	9	5	1	2	4	1	2	5	1	2	3	2	19	5	6	3	3	1
TL_NS	G	G	G	Y	R	R	R	R	R	R	R	R	R	R	R	R	R	RY
TL_NW	OFF	OFF	OFF	OFF	OFF	G	G	G	G	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
TL_WN	R	R	R	R	R	R	RY	G	Y	Y	R	R	R	R	R	R	R	R
TL_WE	R	R	R	R	R	R	R	R	R	R	R	RY	G	G	G	Y	R	R
PL_W	G	BG	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
PL_N	R	R	R	R	R	R	R	R	R	R	R	R	G	BG	R	R	R	R

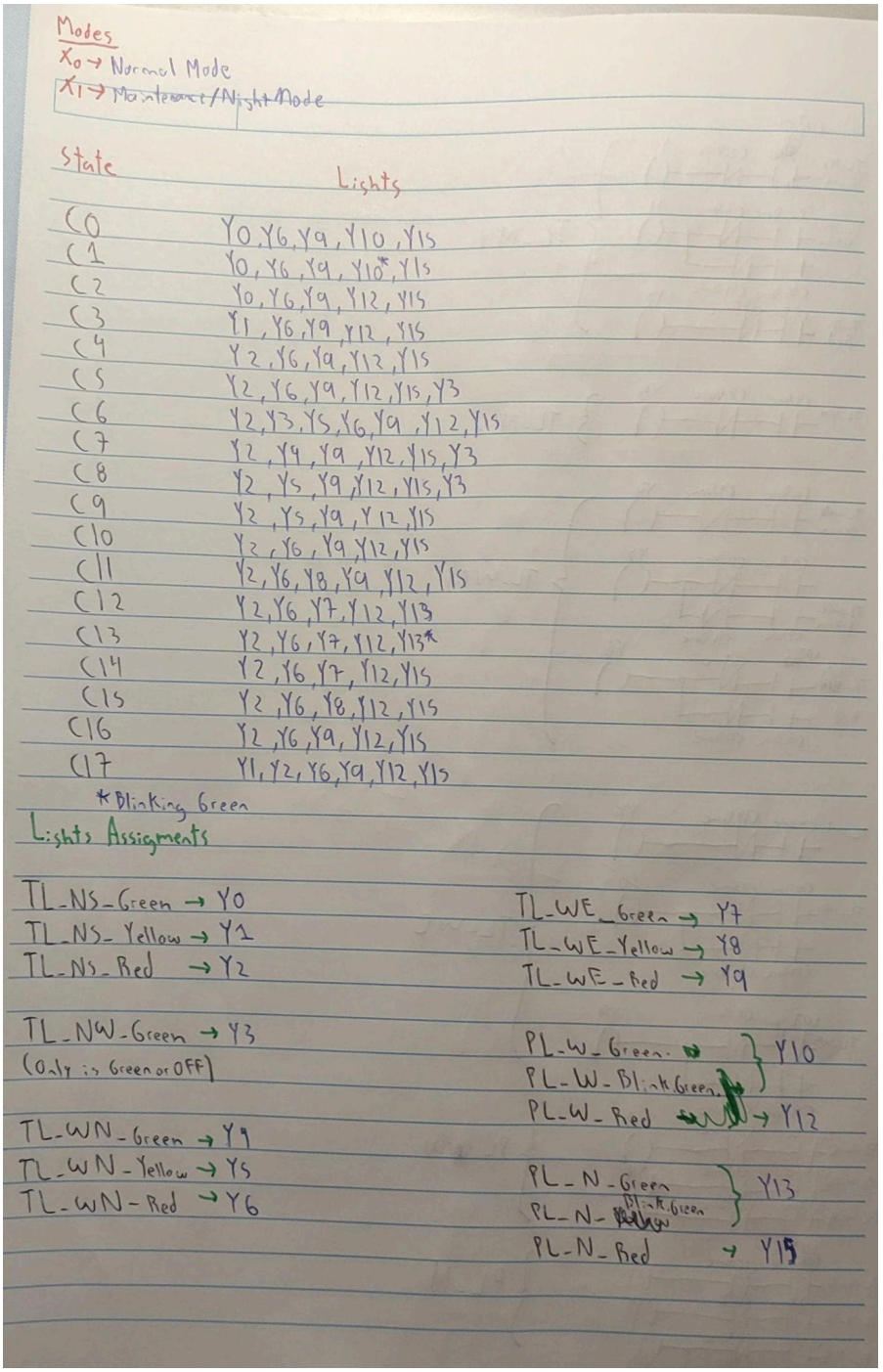
Based on the symmetry of the intersection we know:

- TL_NS = TL_SN
- TL_NW = TL_SE
- TL_WN= TL_ES
- TL_WE = TL_EW
- PL_W= PL_E
- PL_N= PL_S

So now the whole state table is:

State	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Time(s)	9	5	1	2	4	1	2	5	1	2	3	2	19	5	6	3	3	1
TL_NS	G	G	G	Y	R	R	R	R	R	R	R	R	R	R	R	R	R	RY
TL_NW	OFF	OFF	OFF	OFF	OFF	G	G	G	G	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
TL_WN	R	R	R	R	R	R	RY	G	Y	Y	R	R	R	R	R	R	R	R
TL_WE	R	R	R	R	R	R	R	R	R	R	R	RY	G	G	G	Y	R	R
PL_W	G	BG	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
PL_N	R	R	R	R	R	R	R	R	R	R	R	R	G	BG	R	R	R	R
TL_SN	G	G	G	Y	R	R	R	R	R	R	R	R	R	R	R	R	R	RY
TL_SE	OFF	OFF	OFF	OFF	OFF	G	G	G	G	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
TL_ES	R	R	R	R	R	R	RY	G	Y	Y	R	R	R	R	R	R	R	R
TL_EW	R	R	R	R	R	R	R	R	R	R	R	RY	G	G	G	Y	R	R
PL_E	G	BG	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
PL_S	R	R	R	R	R	R	R	R	R	R	R	R	G	BG	R	R	R	R

- For practical reasons the implementation on to-do-more designer will be only of the simplified state table.
- On the following pictures we can see the modes of the program, the lights which are “ON” during each state and the lights assignment.
- X0 is the “normal mode” and X1 triggers the “Maintenance mode / Night mode “



Modes

X_0 → Normal Mode

X_1 → ~~Maintenance/Night Mode~~

State	Lights
C0	Y0, Y6, Y9, Y10, Y15
C1	Y0, Y6, Y9, Y10*, Y15
C2	Y0, Y6, Y9, Y12, Y15
C3	Y1, Y6, Y9, Y12, Y15
C4	Y2, Y6, Y9, Y12, Y15
C5	Y2, Y6, Y9, Y12, Y15, Y3
C6	Y2, Y3, Y5, Y6, Y9, Y12, Y15
C7	Y2, Y4, Y9, Y12, Y15, Y3
C8	Y2, Y5, Y9, Y12, Y15, Y3
C9	Y2, Y5, Y9, Y12, Y15
C10	Y2, Y6, Y9, Y12, Y15
C11	Y2, Y6, Y8, Y9, Y12, Y15
C12	Y2, Y6, Y7, Y12, Y13
C13	Y2, Y6, Y7, Y12, Y13*
C14	Y2, Y6, Y7, Y12, Y15
C15	Y2, Y6, Y8, Y12, Y15
C16	Y2, Y6, Y9, Y12, Y15
C17	Y1, Y2, Y6, Y9, Y12, Y15

*Blinking Green

Lights Assignments

TL_NS_Green → Y0
TL_NS_Yellow → Y1
TL_NS_Red → Y2

TL_NW_Green → Y3
(Only is Green or OFF)

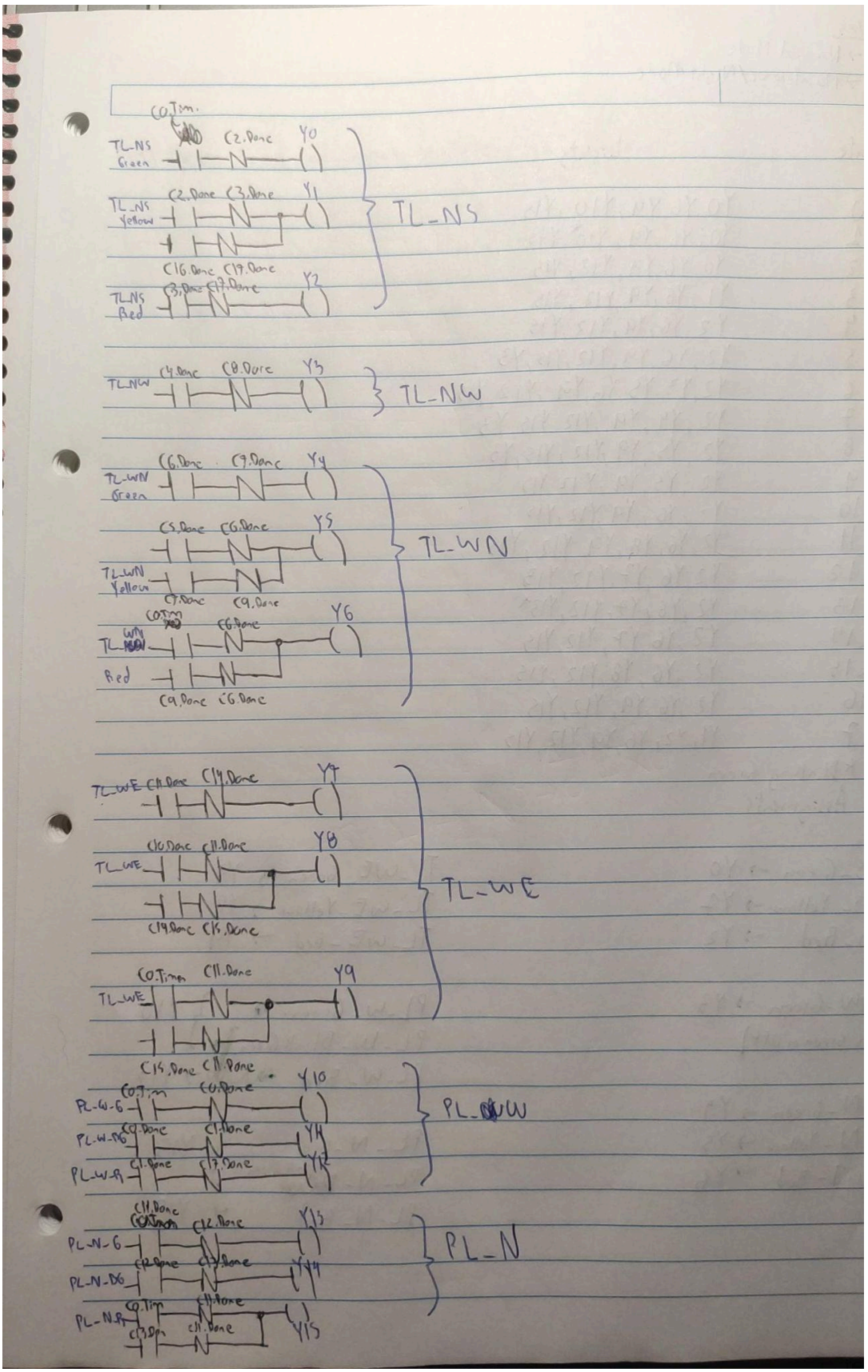
TL_WN_Green → Y4
TL_WN_Yellow → Y5
TL_WN_Red → Y6

TL_WE_Green → Y7
TL_WE_Yellow → Y8
TL_WE_Red → Y9

PL_W_Green } Y10
PL_W_Blink Green }
PL_W_Red → Y12

PL_N_Green } Y13
PL_N_Blink Green }
PL_N_Red → Y15

In the following picture there is the first ladder diagram I made.


C0.Tim.
TL_NS Green
C2.Done
Y0
TL_NS Yellow
C2.Done C3.Done
Y1
C16.Done C17.Done
C3.Done C17.Done
TL_NS Red
Y2
TL_NS
TL_NW
C4.Done C8.Done
Y3
TL_NW
C6.Done C9.Done
Y4
TL_WN Green
C5.Done C6.Done
Y5
TL_WN Yellow
C7.Done C9.Done
C0.Tim
C6.Done
Y6
TL_WN Red
C9.Done C6.Done
TL_WN
TL_WE
C14.Done C14.Done
Y7
C10.Done C11.Done
Y8
TL_WE
C14.Done C15.Done
C0.Tim
C11.Done
Y9
TL_WE
C15.Done C11.Done
TL_WE
C0.Tim
C0.Done
Y10
PL_W_G
C0.Done
C1.Done
YH
PL_W_DG
C1.Done
C7.Done
YI2
PL_W_R
PL_WW
C14.Done
C12.Done
Y13
PL_N_G
C12.Done
C13.Done
YH
PL_N_DG
C0.Tim
C11.Done
C13.Done
C11.Done
Y15
PL_N_R
PL_N