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Traffic Self-Regulation Device

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Introduction

Traffic congestion is a major problem in Saudi Arabia, especially in big urban cities. As a result, tackling such an issue comes as a priority for decision makers. This project deals in locations where main and sub routes are linked together and frequent congestions occurs there. In addition, the whole process of regulating traffic is done through a self-dependent system leading to eliminate or at least minimize human direct interaction on controlling traffics.

Problem Statement

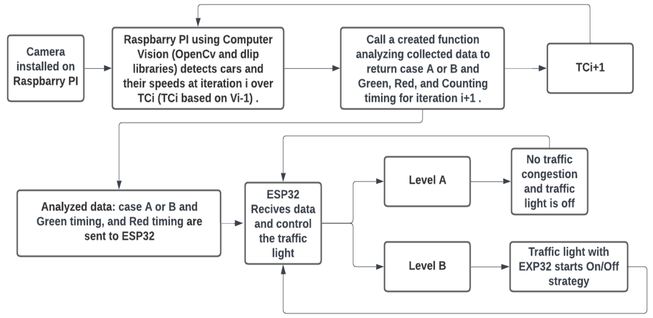
Smart and sustainable solution for traffic congestions

Constraints

- Limited budget
- Limitation on applying the idea in the real world
- Lack of civil engineering member
- Difficulties of approaching traffic police
- Maintaining huge amount of data and update the system

Prototype Design

System flowchart:



Traffic Light Optimization Model:

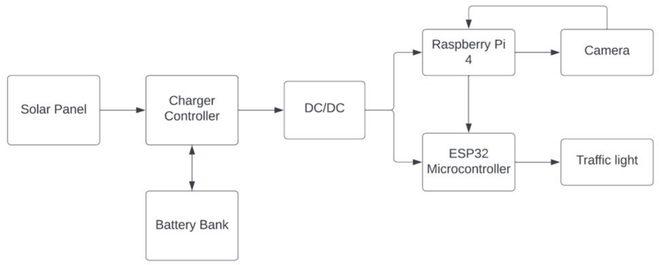
$$\text{Max } Z = T_g (F_{m,i} + F_{s,i}) + T_r (F_{r,i}/2)$$

Subject to :

$$T_g (F_{m,i} + F_{s,i}) \le 50$$
$$T_r (F_{r,i}/2) \le 10$$
$$T_{r,i} \le 30$$
$$T_{g,i} - T_{r,i} \ge 10 - M (1-x)$$
$$T_{r,i} - T_{g,i} \ge 10 - M (x)$$
$$T_{r,i} , T_{g,i} \ge 0 , x \in \{0,1\}$$

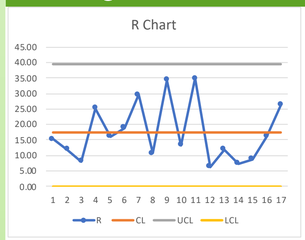
Tc_i = Counting time at iteration I
Tc_i = Distance / Average Speed $_{i-1}$
$F_{m,i} = Tc_i$ / # of cars in the main route
$F_{s,i} = Tc_i$ / # of cars in the sub route
$T_{g,i}$ = Green light time at iteration i , $T_{r,i}$ = Red light time at iteration i
$F_{m,i}$ = Flow of the main route at iteration i , $F_{s,i}$ = Flow of the sub route at iteration i , M = 10000 (Big Number)

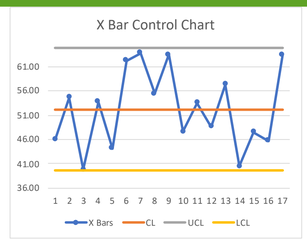
Power Supply System:



Target Specification	Unit	Value	Met ?
Detected speed	Km/h	[0,120]	Met
Camera reselution	P	640×480	Met
Detection range	m	50	Met
Operational temperature	C	[0,50]	Met
Red signal timing	s	30 or less	Met
Number of lanes detected	#	5 or more	Met
# of frames per second	FPS	30	Met

Testing / Validation





Conclusion

In conclusion, the traffic self-regulation system offers a solution for traffic congestion issues. By using technical components, this system aims for a smoother traffic flow, freeing time, reducing emissions, and creating a better urban experience. This project highlights our commitment for achieving safer, smarter, and sustainable traffic management.