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Part 1

1. How frequently should the information be collected and updated? Regarding the data retrieved from the sensors
2. Where should the information retrieved be saved? And in which format?
3. In what countries is this system going to be implemented?
4. Will this system be implemented in streets with pedestrian crosswalks?
5. What kind of safety benefits will this system provide?
6. How will the system react in case an emergency vehicle, like an ambulance, needs to take the street where it is implemented?
7. What kind of safety measures will be implemented to ensure the system does not create dangerous traffic situations?
8. How should the system react in case of a power outage and other technical failures to ensure the safety of all drivers?
9. What will be the main source of energy for the system? (Ex.: Solar, power grid, etc.)
10. Should areas of high-intensity traffic only be considered? Or is the system going to be implemented in all traffic areas?
11. Can the system be implemented on a multiple-lane road?
12. What kind of technologies/sensors (for example cameras, radars, infrared, etc.) are going to be used for detecting the speed and volume of incoming traffic?
13. In case maintenance is needed, what state should the system assume to prevent disruption in the traffic flow?
14. Does the system need to take into account the non-motorized vehicles? (Ex.: bicycles, scooters, etc.)
15. How will the system, if it should, differentiate between various types of motorized vehicles? (Ex.: cars, trucks, motorcycles, etc.)
16. What kind of algorithms and models should we implement?
17. How will the system learn and adapt the traffic patterns over time?
18. What kind of information the sensors need to retrieve to accurately optimize the traffic flow?
19. Does the system need to be designed to easily change the traffic regulations, in case of change in the future?
20. Should the system be aware of weather conditions and work with that information to optimize the traffic flow maintaining the safety of the drivers?
21. What kind of infrastructure will we need for this type of system? Does this new infrastructure need to be built?
22. How should the systems communicate with each other?
23. What 's the budget?
24. Should the system be operated/managed remotely?
25. Should the system work without any connection to the Internet?
26. What’s the predicted project time frame?
27. Should the system include features to support autonomous or semi-autonomous vehicles in the future?
28. How will the system handle traffic flow during special events or holidays that significantly alter normal traffic patterns?
29. How will the system prioritize traffic flow from different directions during peak and off-peak hours?

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30. How will the system detect and respond to vehicles that do not comply with traffic signals, such as those running red lights?
31. What are the potential impacts of the system on public transportation?
32. Will the system offer any functionalities to support road maintenance and construction work zones to minimize traffic disruptions?
33. How will the system communicate with the remaining traditional traffic lights?
34. What is the benchmark, i.e., how efficient is the current solution and what will be a good measure to determine if this system is better than the existing one considering traffic flow, time, fuel and the environment?

Part 2

(The spiderweb is located on another page, to maintain the quality of the image)

Traffic detection

Will this system be implemented in streets with pedestrian crosswalks?

How will the system detect and respond to vehicles that do not comply with traffic signals, such as those running red lights?

How will the system react in case an emergency vehicle, like an ambulance, needs to take the street where it is implemented?

Implementation

Should the system work without any connection to the Internet?

Can the system be implemented on a multiple-lane road?

Safety

Does the system need to take into account the non-motorized vehicles? (Ex.: bicycles, scooters, etc.)

What kind of information the sensors need to retrieve to accurately optimize the traffic flow?

How will the system, if it should, differentiate between various types of vehicles? (Ex.: cars, trucks, motorcycles, etc.)

What kind of technologies/sensors (for example cameras, radars, infrared, etc.) are going to be used for detecting the speed and volume of incoming traffic?

Should areas of high-intensity traffic only be considered? Or is the system going to be implemented in all traffic areas?

What kind of algorithms and models should we implement?

Where should the information retrieved be saved? And in which format?

Evaluation & Optimization

How will the system prioritize traffic flow from different directions during peak and off-peak hours?

What kind of safety benefits will this system provide?

Should the system be aware of weather conditions and work with that information to optimize the traffic flow maintaining the safety of the drivers?

How should the system react in case of a power outage and other technical failures to ensure the safety of all drivers?

How should the systems communicate with each other?

How will the system communicate with the remaining traditional traffic lights?

How frequently should the information be collected and updated? Regarding the data retrieved from the sensors

What kind of infrastructure will we need for this type of system? Does this new infrastructure need to be built?

Should the system include features to support autonomous or semi-autonomous vehicles in the future?

How will the system learn and adapt the traffic patterns over time?

How will the system handle traffic flow during special events or holidays that significantly alter normal traffic patterns?

What kind of safety measures will be implemented to ensure the system does not create dangerous traffic situations?

What's the predicted project time frame?

What's the budget?

Management

What is the benchmark, i.e., how efficient is the current solution and what will be a good measure to determine if this system is better than the existing one considering traffic flow, time, fuel and the environment?

Will the system offer any functionalities to support road maintenance and construction work zones to minimize traffic disruptions?

What are the potential impacts of the system on public transportation?

Regulations

In what countries is this system going to be implemented?

Should the system be operated/managed remotely?

What state should the system assume to prevent disruption in the traffic flow?

Does the system need to be designed to easily change the traffic regulations, in case of change in the future?

Environment

Maintenance

What will be the main source of energy for the system? (Ex.: Solar, power grid, etc.)

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Part 3

Question #1 - In what countries is this system going to be implemented?

WHY is this question important?

During the development phase, it's important to be mindful of the countries where this system is going to be implemented. Traffic laws, road and street infrastructure, regulations and driving patterns aren't universally established and significantly differ between one country to another, which should be taken into consideration during the development of this system.

WHOM does this question impact?

This question, on one hand, impacts the architects and developers of this system, since they are the ones who will be idealizing and implementing it, respectively, and need to take into account each country's traffic legislations and other important driving considerations. On another hand, the users will also be impacted by this question. Since they are the ones who will have the most direct contact with the system, their driving patterns need to be considered by the end result.

WHEN can this question be answered? (when in the project lifecycle, such as early analysis, design, etc.)

This question can be answered in the early analysis phase.

HOW does the answer to this question impact the architecture of the system?

Answering this question will impact the architect of the system, since it's crucial to make choices that consider the differences between countries, creating an end result that is tailored and adapted to each location.

Question #2 - How should the system react in case of a power outage and other technical failures to ensure the safety of all drivers?

WHY is this question important?

When designing a critical system, like this one, every failure scenario must be considered. The answer to this question is crucial to define what is the system's expected behavior in this scenario, so that safety can be ensured.

WHOM does this question impact?

This question impacts the architect, who should design the system to work as intended, even in a faulty scenario. However, it's important to note that the end users will also be impacted. In a case of a failure, if we don't ask this question, the safety of a user cannot be guaranteed.

WHEN can this question be answered? (when in the project lifecycle, such as early analysis, design, etc.)

This question can be answered in the design phase.

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HOW does the answer to this question impact the architecture of the system?

Depending on the answer, different backup mechanisms can be implemented. For instance, this system can include alternative power supplies (UPS, for example) or maybe even have the ability to notify a central service that this outage occurred. All this must be considered when defining the architecture.

Question #3 - What is the benchmark, i.e., how efficient is the current solution and what will be a good measure to determine if this system is better than the existing one considering traffic flow, time, fuel and the environment?

WHY is this question important?

When developing a system which aims to optimize a task, we need to define a benchmark. This benchmark will be useful to determine if there is an improvement margin big enough to justify the development of the system and to compare the obtained results with the existing ones.

WHOM does this question impact?

This question impacts the developers considering that they will be the ones which will work to obtain good enough results. The users will also be impacted; if this question is not answered we might end with a solution worse than the existing one.

WHEN can this question be answered? (when in the project lifecycle, such as early analysis, design, etc.)

Can be answered in an early analysis.

HOW does the answer to this question impact the architecture of the system?

The answer to this question will enlighten the main weaknesses associated with the existing solution. This will help the architect focus on improving the highlighted weaknesses, which will also reduce useless efforts on trying to develop a solution to a problem that is already solved.

Question #4 - How will the system, if it should, differentiate between various types of motorized vehicles? (Ex.: cars, trucks, motorcycles, etc.)

WHY is this question important?

This question is essential because different types of vehicles have varying impacts on traffic flow and signal timing. For instance, trucks take longer to accelerate and slow down compared to cars or motorcycles, affecting how traffic signals should be optimized for different lanes or intersections. Additionally, understanding vehicle types can aid in more accurate traffic predictions and management, especially in a road with multiple lanes.

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WHOM does this question impact?

This question impacts system engineers and developers who are responsible for designing the traffic signal control system. It also affects all road users, as the system's ability to differentiate between vehicle types can lead to smoother traffic flow and reduced congestion.

WHEN can this question be answered? (when in the project lifecycle, such as early analysis, design, etc.)

This question should be answered during the system design phase, after the early analysis phase and before the detailed technical design and implementation begin. It should be in this phase.

HOW does the answer to this question impact the architecture of the system?

The answer to this question will provide the knowledge to guide the selection of technologies (e.g., sensors, cameras) and algorithms (e.g., image recognition, machine learning models) used in the system. Not only that but the answer could lead to a choice of more adaptable machine-learning models to accommodate evolving vehicle types and traffic patterns, thus impacting the overall hardware and software design of the system.

Question #5 - How should the systems communicate with each other?

WHY is this question important?

When developing the system, it is critical to understand how communication will occur because different latencies can affect other system components and implementations. A wired connection is faster than a wireless one, but it is more expensive and requires some street destruction to keep the cables hidden, whereas a wireless connection is simpler, but the range may be reduced.

WHOM does this question impact?

It directly impacts the architects as well as the system engineers since there is a difference between mounting wireless devices on a lamp post and managing kilometers of underground cables. It also impacts the drivers and pedestrians due to the possible need to close the streets for road work.

WHEN can this question be answered? (when in the project lifecycle, such as early analysis, design, etc.)

This question can be answered in the early analysis phase.

HOW does the answer to this question impact the architecture of the system?

The impact of this decision on the architecture is not as significant as the other questions, as the drawbacks are primarily implementation related. Having said that, we must account for potential communication delays to ensure that all systems have the most up-to-date information possible, even if they are physically separated.