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Ambiguity and Architectural Questions

Software Systems Architecture

Group 7 – Class 3

Master in Informatics and Computing Engineering

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Part 1 - Architectural Questions

1. **What is the expected timeline for development and deployment?**
2. What are the legal and regulatory requirements for operating a traffic control system?
3. What will be the operating system?
4. How will the system handle unreliable or missing data from sensors?
5. How will the system account for factors like weather conditions, accidents, or construction zones?
6. What safeguards are in place to prevent the system from discriminating against certain types of vehicles or users?
7. Do we need to save information from the traffic? If yes, what information?
8. Should the system simply allow for safety by avoiding scenarios like having all traffic lights green simultaneously, or should it actively enhance safety measures, such as triggering a red light when a vehicle exceeds a specific speed limit?
9. What are the scalability requirements for the system (e.g., number of intersections, traffic volume)?
10. How will the effectiveness of the system be measured and evaluated?
11. **What is the estimated budget for the implementation and maintenance of the system?**
12. **What are the specific metrics we will use to define "optimized traffic flow" (e.g., average speed, wait times, emissions reduction)?**
13. Should the system check for pedestrians in the crosswalk ?
14. **What data sources will the system use to detect traffic (e.g., cameras, sensors, dedicated infrastructure)?**
15. **Is the system going to integrate with existing traffic signals or can the design of the traffic signals themselves be changed?**
16. What are the availability requirements of the system?
17. What are the cybersecurity considerations for a networked traffic control system?
18. Will the system prioritize emergency vehicles and/or public transportation access?
19. What datasets are available for training computer vision and flow optimization models?
20. What datasets are available with details about the overall road environment, including details on speed limits, road layouts, and other pertinent factors?
21. How do we define what is "too fast"?
22. Are there plans to integrate with emerging transportation technologies such as autonomous vehicles?
23. Are there plans for interoperability with neighboring jurisdictions or regional transportation systems?
24. Will the system have access to satellite imaging to anticipate traffic bottlenecks and proactively adjust signal timings before congestion occurs?
25. On what hardware will the service operate?

Part 2 - Question organization

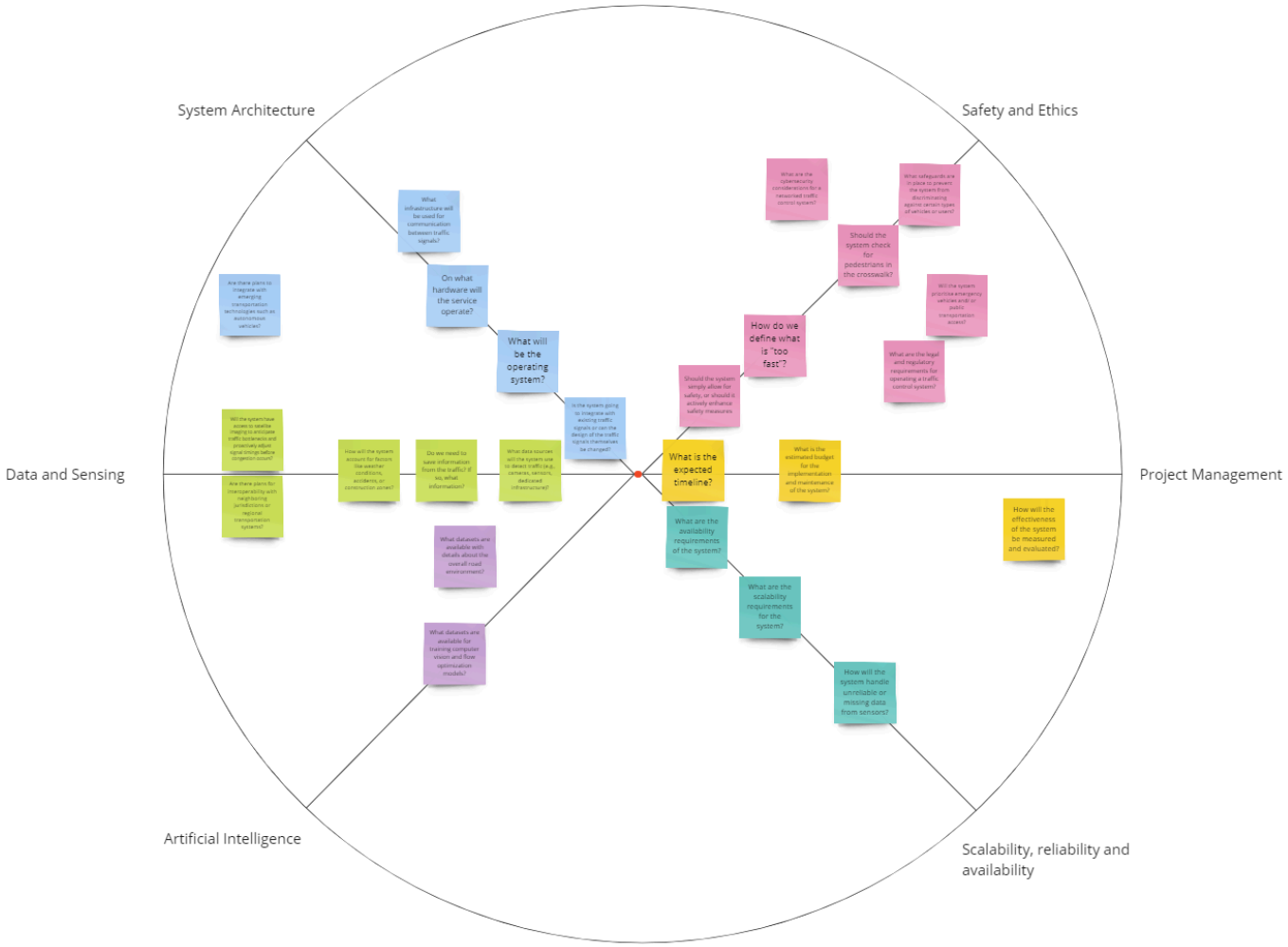
2.1 Question logical grouping

- **System Architecture**
  - What will be the operating system?
  - On what hardware will the service operate?
  - What infrastructure will be used for communication between traffic signals?
  - Is the system going to integrate with existing traffic signals or can the design of the traffic signals themselves be changed?
  - Are there plans for interoperability with neighboring jurisdictions or regional transportation systems?
- **Safety and Ethics**
  - Should the system simply allow for safety, or should it actively enhance safety measures
  - How do we define what is "too fast"?
  - What are the legal and regulatory requirements for operating a traffic control system?
  - Will the system prioritize emergency vehicles and/or public transportation access?
  - Should the system check for pedestrians in the crosswalk?
  - What are the cybersecurity considerations for a networked traffic control system?
  - What safeguards are in place to prevent the system from discriminating against certain types of vehicles or users?
- **Project Management**
  - What is the expected timeline?
  - What is the estimated budget for the implementation and maintenance of the system?
  - How will the effectiveness of the system be measured and evaluated?
- **Scalability, reliability, and availability**
  - What are the availability requirements of the system?
  - What are the scalability requirements for the system
  - How will the system handle unreliable or missing data from sensors?
- **Artificial Intelligence**
  - What datasets are available with details about the overall road environment?
  - What datasets are available for training computer vision and flow optimization models?
- **Data and Sensing**
  - What data sources will the system use to detect traffic (e.g., cameras, sensors, dedicated infrastructure)?
  - Do we need to save information from the traffic? If yes, what information?
  - How will the system account for factors like weather conditions, accidents, or construction zones?
  - Are there plans to integrate with emerging transportation technologies such as autonomous vehicles?

- Will the system have access to satellite imaging to anticipate traffic bottlenecks and proactively adjust signal timings before congestion occurs?

2.2 Question grouping in both logical and time dimension

For a better image quality checkout the following link.



Part 3 - 5 more important questions

3.1. What is the expected timeline for development and deployment?

- **Why is this important?**
  - Sets the overall project framework **impacts resource allocation, stakeholder expectations, and potential funding opportunities.**
  - **Guides decision-making** throughout the development process.
- **Whom does this impact?**
  - **Impacts** everyone involved in the project.
  - Stakeholders, clients, developers ...
- **When can this be answered?**
  - **As early as possible**, as it defines priorities to be accessed
- **How does the answer impact the architecture?**
  - The timeline can influence the choice of technologies, development methodologies, and resource allocation, potentially impacting the system's architecture.

3.2. What is the estimated cost of implementing and maintaining the system?

- **Why is this important?**
  - It helps **prioritize** features and functionalities based on their **cost-effectiveness**. Features exceeding the budget might need to be phased in later or eliminated entirely.
  - Knowing the budget helps **allocate resources** effectively for development, deployment, and ongoing maintenance.
- **Whom does this impact?**
  - **Impacts** everyone involved in the project such as stakeholders, project managers, developers, etc.
- **When can this be answered?**
  - **As early as possible**, as it defines the scope of the project
- **How does the answer impact the architecture?**
  - The budget directly impacts the **complexity** of the system, necessitating potential **simplification or phased implementation** of complex features to align with **financial constraints**. Additionally, budget considerations play a significant role in **technology selection**, with open-source solutions often preferred for being more budget-friendly when compared to proprietary or dedicated software options.

3.3. What are the specific metrics we will use to define "optimized traffic flow" (e.g., average speed, wait times, emissions reduction)?

- **Why is this important?**
  - The answer provides a clear benchmark for evaluating system effectiveness.

    - Ensures alignment among project stakeholders towards a common goal.
    - Guides decision-making and resource allocation.
- **Whom does this impact?**
    - Project managers and team leaders responsible for setting project goals and milestones.
    - Developers and engineers tasked with implementing the system according to performance metrics.
    - Quality assurance and testing teams evaluating system performance against defined benchmarks.
    - Executives and stakeholders overseeing project progress and outcomes.
    - Drivers, pedestrians, and public transit users.
- **When can this be answered?**
    - During the initial planning and design phase of the traffic control system.
- **How does the answer impact the architecture?**
    - Influences the selection of sensors, algorithms, and control mechanisms.
    - Guides the design of data collection, analysis, and decision-making processes.
    - For example, if the chosen metrics include average speed and wait times, the architecture may need to prioritize high-speed data processing and efficient communication between traffic signals to minimize delays.

3.4. What data sources will the system use to detect traffic (e.g., cameras, sensors, dedicated infrastructure)?

- **Why is this important?**
    - The answer provides more information about the system's physical level.
    - Knowing the data sources also gives the team insights into the format of data.
    - Knowing the specifications of the data sources is needed to ensure progress.
- **Whom does this impact?**
    - Developers choosing the best algorithms to work with the data and knowing the details of data sources to connect with them.
    - Drivers, pedestrians, and public transit users.
- **When can this be answered?**
    - After studying which data sources should be used, and selecting the devices to do so.
- **How does the answer impact the architecture?**
    - Influences the selection of algorithms, and control mechanisms.
    - Guides the design of data collection and analysis.

    - Influences the architecture for communication between the parts of the system.

3.5. Is the system going to integrate with existing traffic signals or can the design of the traffic signals themselves be changed?

- **Why is this important?**
    - The answer provides more information about the system's physical level
    - It is crucial to know whether the system will be an adaptation of the current traffic signals or if it will be made from scratch.
- **Whom does this impact?**
    - First and foremost, engineers designing the solution. This can impact the choice of sensors, the physical position of elements,
    - Developers, to decide how the parts of the traffic signal communicate with each other.
    - Stakeholders of the project, as this decision can impact the timeline, budget, and availability of the traffic signals during work.
    - Drivers, pedestrians, and public transit users.
- **When can this be answered?**
    - During the initial planning and design phase of the traffic control system.
- **How does the answer impact the architecture?**
    - Influences the all architectural structure, as if the system were to be an integrated solution, there would be the need to adapt to current technologies of the traffic lights, and if not, a different and tailored solution would be implemented.
    - Influences the architecture for communication between the parts of the system.