

## Rough Ideas:

### Smart City - Traffic Management and Optimization

**Knowledge Representation:** Create a database of traffic patterns, road layouts, and historical data. Use this data to represent the current state of traffic in the city.

**State Space Search:** Develop an AI system that optimises traffic flow, considering real-time data and minimising congestion using algorithms like Reinforcement Learning or Genetic Algorithms.

**Intelligent AI:** Implement an intelligent traffic management system that adapts to changing conditions, synchronised traffic signals, and offers alternate routes to drivers through a mobile app.

#### 1. Empathise with the users and discover their pain

- Conduct user interviews, surveys, and observations with city residents, commuters, and traffic management authorities to understand their traffic-related challenges and pain points.
- Identify common issues such as traffic congestion, delays, accidents, and environmental concerns.

#### WHO are we empathising with?

- Commuters: Everyday commuters who use various modes of transportation to travel within the city.
- Traffic Authorities: Officials responsible for managing and optimising traffic flow, ensuring safety, and handling traffic incidents.

#### What do they need to do?

- Commuters need to reach their destinations efficiently and on time. They want to experience minimal traffic congestion and a safe commute. Success for them means reaching their destinations with minimal delays.
- Traffic Authorities need to ensure smooth traffic flow, respond to incidents promptly, and manage traffic signals effectively. Success for them means reducing traffic congestion and minimising accidents.

#### What do they see?

- Commuters see traffic congestion, road signs, traffic signals, and public transportation options. They observe the behaviour of other drivers and pedestrians on the road. They might also follow traffic-related news and updates in their city.
- Traffic Authorities see real-time traffic data, road cameras, incident reports, and data on public transportation. They monitor traffic trends and patterns in their city and may also analyse data related to traffic accidents.

#### What do they say?

- Commuters might express frustration about traffic jams, accidents, and road conditions. They may also discuss their preferred commuting routes and alternate routes.
- Traffic Authorities discuss traffic management strategies, potential

improvements, and incident responses. They may also report on the effectiveness of existing traffic control measures.

What do they do?

- Commuters currently plan their routes based on personal experience and real-time traffic apps. They may also adjust their routes if they encounter unexpected congestion.

- Traffic Authorities currently monitor traffic using cameras and respond to incidents as they occur. They also control traffic signals to manage traffic flow.

What do they hear?

- Commuters hear about traffic conditions and incidents from traffic apps, news sources, and social media. They may hear friends and colleagues sharing their own commuting experiences.

- Traffic Authorities hear about traffic incidents from reports, their colleagues, and possibly from automated systems that monitor traffic.

WHO are we empathising with: Their pain and gains

- Commuters' pain points include being stuck in traffic, arriving late, and encountering unpredictable road conditions. Their gains involve reaching their destinations faster and with less stress.

- Traffic Authorities' pain points include managing traffic flow during peak hours and responding to accidents quickly. Their gains involve optimising traffic management, reducing congestion, and enhancing road safety.

By considering these questions, you can gain a deeper understanding of the needs, experiences, and pain points of both commuters and traffic authorities, which will help in designing effective AI-driven solutions for traffic management and optimization.

## 2. Define user needs and requirements

- Analyse the data collected during the empathy phase to identify key user needs and requirements.

- Prioritise the identified issues and challenges based on user feedback and the impact on the community.

- Create user personas to represent different types of users, including commuters, pedestrians, cyclists, and traffic authorities.

## 3. Ideate solutions using AI

- Brainstorm potential AI-driven solutions to address the defined problems. For Traffic Management and Optimization, you can consider the following ideas:

- Adaptive traffic signal control: Implement AI algorithms that adjust traffic signals in real-time based on traffic flow and congestion data.

- Predictive traffic analysis: Use AI to predict traffic congestion and suggest alternative routes to commuters.

- Incident detection and response: Develop AI systems that can detect accidents or road incidents and provide real-time alerts to authorities for faster responses.

- Public transportation optimization: Use AI to optimise public transportation schedules and routes.

- Collaborate with stakeholders, traffic experts, and AI specialists to refine these ideas.

#### 4. Prototype your ideas into Proof of Concept (POC)

- Select one or more of the ideated solutions to prototype.

- Develop a POC for the chosen solution(s). This may involve creating a software prototype that simulates the AI-based traffic optimization system.

- Collect real or simulated traffic data to test and demonstrate the effectiveness of your solution.

- Iterate on the POC based on feedback and test results.

For the Traffic Management and Optimization project, the key is to engage with the community and stakeholders, identify specific problems, and then apply AI to address those issues in a way that improves traffic flow, reduces congestion, and enhances overall transportation experiences within the smart city. The prototype can be a software-based system that can be demonstrated and tested in a controlled environment before considering a larger-scale deployment.

### Smart Healthcare System - Optimisation in treating patients and staff scheduling

**Knowledge Representation:** Create a knowledge base including resources for the facility, staff knowledge, treatment guidelines, and medical data. To represent medical knowledge hierarchically and enable effective information retrieval and utilisation, use ontologies and knowledge graphs.

**State Space Search:** Use AI algorithms to forecast demand for various medical services and model patient flow. To maximise staff assignments, bed distribution, and patient scheduling based on anticipated demand and available resources, apply state space search strategies.

**Intelligent AI:** Use machine learning models to forecast patient influx, evaluate past patient data, and spot possible bottlenecks. Examples of these algorithms include predictive analytics and natural language processing. Provide intelligent decision support systems that can make recommendations to healthcare administrators about the best ways to allocate resources and modify schedules.

#### 1. Empathise with the users and discover their pain

- To gain insight into the workflow, issues, and difficulties faced by healthcare personnel in properly managing patient care, conduct interviews and shadow them.

WHO are we empathising with?

Healthcare Workers (Doctors, Nurses, and Administrators):

- Doctors diagnosing and treating patients, administrators overseeing personnel and resources, and nurses caring for numerous patients.
- Personnel across a range of departments, such as general wards, surgery, and emergency.
- The general facility administration is the responsibility of healthcare administrators.

What do they need to do?

- Nurses must monitor vital signs, give patients individualised care, dispense medication, and interact with doctors and other staff members in a clear and efficient manner.
- Doctors are required to diagnose patients, make treatment plans, carry out treatments, and communicate with experts and nurses.
- Administrators are responsible for managing patient flow, allocating resources effectively, scheduling staff, and making sure regulations are followed.

What do they see?

- Nurses: Review patient histories, prescription regimens, and health charts. Observe the patient wait times, resource availability, and workload.
- Doctors: See diagnostic reports, medical histories, and treatment options. View surgery suites, consulting rooms, and patient conditions.
- Administrators: View patient admission and discharge procedures, waiting areas, staff assignments, and overall facility occupancy.

What do they say?

- Nurses: Talk to patients about their ailments, plans for treatment, and prescription drugs. Share patient updates and concerns with physicians and other healthcare professionals.
- Doctors: Talk to patients about diagnosis, available treatments, and procedures. Discuss patient care plans and resource needs with nurses, experts, and administrators.
- Administrators: Talk to employees about shifts, scheduling, and policies about the facility. Assist in coordinating patient flow and resource allocation with department heads and medical personnel.

What do they do?

- Nurses: Give medicine, keep an eye on patients, update medical records, offer emotional support, and work together with other members of the healthcare team.
- Doctors: Examine patients, request testing, perform procedures, write prescriptions for medications, confer with specialists, and make important medical choices.
- Administrators: Schedule personnel, assign beds and medical supplies, supervise facility upkeep, control spending, and guarantee regulatory compliance.

What do they hear?

- Nurses: Pay attention to patients' complaints, comments on their treatment, and directives from physicians and managers.
- Doctors: Listen to symptoms, worries, and inquiries from patients. Get updates from administrators, specialists, and nurses.
- Administrators: Get staff and patient input. Get updates from medical professionals, department leaders, and government regulators.

WHO are we empathising with: Their pain and gains

- Pain Points
  - Nurses: Overwhelmed by difficult patients, hefty workloads, and scarce resources.
  - Doctors: Juggling long hours, difficult situations, and the requirement for teamwork.
  - Administrators: Handling the demands of efficient operations, regulatory requirements, and resource limitations.
- Gains
  - Nurses: Better patient results, less stress due to shortened procedures, and favourable patient feedback.
  - Doctors: Increased productivity, precise diagnosis, effective treatment, and better work-life harmony.
  - Administrators: Best use of available resources, adherence to rules and guidelines, satisfied patients, and a smoothly operating medical centre.

The healthcare management system may be developed to effectively address the pain points of these stakeholders and offer significant improvements in their daily duties and overall job satisfaction by developing empathy and understanding for these stakeholders and their experiences.

## Smart City - Traffic Management and Optimization

**Knowledge Representation:** Create a database of traffic patterns, road layouts, and historical data. Use this data to represent the current state of traffic in the city.

**State Space Search:** Develop an AI system that optimises traffic flow, considering real-time data and minimising congestion using algorithms like Reinforcement Learning or Genetic Algorithms.

**Intelligent AI:** Implement an intelligent traffic management system that adapts to changing conditions, synchronised traffic signals, and offers alternate routes to drivers through a mobile app.

### 1. Empathise with the users and discover their pain

- Conduct user interviews, surveys, and observations with city residents, commuters, and traffic management authorities to understand their traffic-related challenges and pain points.
- Identify common issues such as traffic congestion, delays, accidents, and environmental concerns.

WHO are we empathising with?

- Commuters: Everyday commuters who use various modes of transportation to travel within the city.
- Traffic Authorities: Officials responsible for managing and optimising traffic flow, ensuring safety, and handling traffic incidents.

What do they need to do?

- Commuters need to reach their destinations efficiently and on time. They want to experience minimal traffic congestion and a safe commute. Success for them means reaching their destinations with minimal delays.
- Traffic Authorities need to ensure smooth traffic flow, respond to incidents promptly, and manage traffic signals effectively. Success for them means reducing traffic congestion and minimising accidents.

What do they see?

- Commuters see traffic congestion, road signs, traffic signals, and public transportation options. They observe the behaviour of other drivers and pedestrians on the road. They might also follow traffic-related news and updates in their city.
- Traffic Authorities see real-time traffic data, road cameras, incident reports, and data on public transportation. They monitor traffic trends and patterns in their city and may also analyse data related to traffic accidents.

What do they say?

- Commuters might express frustration about traffic jams, accidents, and road conditions. They may also discuss their preferred commuting routes and alternate routes.
- Traffic Authorities discuss traffic management strategies, potential improvements, and incident responses. They may also report on the effectiveness of existing traffic control measures.

What do they do?

- Commuters currently plan their routes based on personal experience and real-time traffic apps. They may also adjust their routes if they encounter unexpected congestion.
- Traffic Authorities currently monitor traffic using cameras and respond to incidents as they occur. They also control traffic signals to manage traffic flow.

What do they hear?

- Commuters hear about traffic conditions and incidents from traffic apps, news sources, and social media. They may hear friends and colleagues sharing their own commuting experiences.
- Traffic Authorities hear about traffic incidents from reports, their colleagues, and possibly from automated systems that monitor traffic.

WHO are we empathising with: Their pain and gains

- Commuters' pain points include being stuck in traffic, arriving late, and encountering unpredictable road conditions. Their gains involve reaching their destinations faster and with less stress.
- Traffic Authorities' pain points include managing traffic flow during peak hours

and responding to accidents quickly. Their gains involve optimising traffic management, reducing congestion, and enhancing road safety.

By considering these questions, you can gain a deeper understanding of the needs, experiences, and pain points of both commuters and traffic authorities, which will help in designing effective AI-driven solutions for traffic management and optimization.

## 2. Define user needs and requirements

- Analyse the data collected during the empathy phase to identify key user needs and requirements.
- Prioritise the identified issues and challenges based on user feedback and the impact on the community.
- Create user personas to represent different types of users, including commuters, pedestrians, cyclists, and traffic authorities.

## 3. Ideate solutions using AI

- Brainstorm potential AI-driven solutions to address the defined problems. For Traffic Management and Optimization, you can consider the following ideas:
  - Adaptive traffic signal control: Implement AI algorithms that adjust traffic signals in real-time based on traffic flow and congestion data.
  - Predictive traffic analysis: Use AI to predict traffic congestion and suggest alternative routes to commuters.
  - Incident detection and response: Develop AI systems that can detect accidents or road incidents and provide real-time alerts to authorities for faster responses.
  - Public transportation optimization: Use AI to optimise public transportation schedules and routes.
- Collaborate with stakeholders, traffic experts, and AI specialists to refine these ideas.

## 4. Prototype your ideas into Proof of Concept (POC)

- Select one or more of the ideated solutions to prototype.
- Develop a POC for the chosen solution(s). This may involve creating a software prototype that simulates the AI-based traffic optimization system.
- Collect real or simulated traffic data to test and demonstrate the effectiveness of your solution.
- Iterate on the POC based on feedback and test results.

For the Traffic Management and Optimization project, the key is to engage with the community and stakeholders, identify specific problems, and then apply AI to address those issues in a way that improves traffic flow, reduces congestion, and enhances overall transportation experiences within the smart city. The prototype can be a software-based system that can be demonstrated and tested in a controlled environment before considering a larger-scale deployment.

## Text-to-Sign Language System - Enhancing Communication and Proficiency

**Knowledge Representation:** Develop a knowledge base that encompasses resources for sign language learning, instructional materials, assessment criteria, and user progress data. Organise sign language knowledge hierarchically using ontologies and knowledge graphs to enable efficient retrieval and utilisation of information.

**State Space Search:** Implement AI algorithms to predict the demand for sign language communication services and model the flow of learning. Optimise sign language instruction by maximising user assignments, resource allocation, and lesson scheduling based on expected demand and available learning resources, much like a state space search.

**Intelligent AI:** Utilise machine learning models to forecast the influx of new learners, evaluate past user progress data, and identify potential challenges in learning sign language. Examples of these algorithms include predictive analytics and natural language processing. Develop intelligent decision support systems that offer recommendations to learners and instructors for efficient learning resource allocation and personalised learning paths.

### 2. Empathise with the users and discover their pain

- To create a text-to-sign language system that facilitates better communication and enhances proficiency in sign language, it's crucial to empathise with the potential users. Let's understand the various stakeholders and their specific needs:

#### WHO are we empathising with?

##### 1. Deaf and Hard of Hearing Individuals:

- Individuals who rely on sign language as their primary means of communication.
- People with varying levels of sign language proficiency, from beginners to advanced users.

##### 2. Sign Language Instructors:

- Educators who teach sign language to both beginners and advanced learners.

##### 3. Caregivers and Family Members:

- Individuals who want to communicate effectively with their deaf or hard of hearing loved ones.



What do they need to do?

1. Deaf and Hard of Hearing Individuals:

- Need to communicate with both sign language users and those who are not familiar with sign language.
- May want to improve their sign language skills or teach others.

2. Sign Language Instructors:

- Must provide effective sign language instruction to learners of different levels.
- Need tools to assess and track students' progress.

3. Caregivers and Family Members:

- Desire a way to communicate more easily with their loved ones who use sign language.
- May want to learn sign language themselves to improve their communication.

What do they see?

1. Deaf and Hard of Hearing Individuals:

- See the need for a reliable communication tool that can bridge the gap between sign language and spoken/written language.
- Seek an efficient way to learn and practise sign language.

2. Sign Language Instructors:

- See the need for interactive teaching materials and tools that engage and assess learners.

3. Caregivers and Family Members;

- See the importance of clear and effective communication with their deaf or hard of hearing family members.

What do they say?

1. Deaf and Hard of Hearing Individuals:

- Discuss their communication challenges, the desire to improve sign language skills, and the need for accessible learning resources.

2. Sign Language Instructors:

- Discuss the challenges they face in teaching sign language, including the lack of engaging resources.

### 3. Caregivers and Family Members:

- Discuss their desire to enhance communication with their loved ones who use sign language.

What do they do?

#### 1. Deaf and Hard of Hearing Individuals:

- Use sign language for communication and are willing to learn and practice.

#### 2. Sign Language Instructors:

- Teach sign language to students, create lesson plans, and assess learners' progress.

### 3. Caregivers and Family Members:

- Seek ways to learn sign language to communicate effectively with their loved ones.

What do they hear?

#### 1. Deaf and Hard of Hearing Individuals:

- Hear about available resources for learning sign language but may face challenges in finding effective and engaging tools.

#### 2. Sign Language Instructors:

- Hear from their students about the need for interactive learning materials and assessment tools.

### 3. Caregivers and Family Members:

- Hear from their deaf or hard of hearing family members about the importance of effective communication.

WHO are we empathising with: Their pain and gains

#### 1. Pain Points

- Deaf and Hard of Hearing Individuals:
- Struggle to communicate with non-sign language users.
- May find it challenging to access high-quality sign language learning resources.

Sign Language Instructors:

- Face difficulties in engaging and assessing their students effectively.

Caregivers and Family Members:

- Encounter communication barriers with their loved ones who use sign language.

## 2. Gains

### Deaf and Hard of Hearing Individuals:

- Enhanced communication with a broader audience.
- Improved sign language proficiency and access to effective learning resources.

### Sign Language Instructors:

- Engaging teaching materials that facilitate effective instruction and assessment.

### Caregivers and Family Members:

- Improved communication and stronger relationships with their loved ones who use sign language.

By empathising with these stakeholders, a text-to-sign language system can be developed to address their needs, pain points, and offer significant improvements in their ability to communicate effectively through sign language.

## **TASK CHECKLIST**

### **1. Design Thinking Oriented Proposal (REFER TO SAMPLE FOR EX)**

Task	Description	PIC
Describe the process of Empathise in DT	Problem and pain, user/stakeholder and the goals are clearly described. Who is my user? What matters to them?	Hafiz
Describe the process of Define in DT	Covers user/stakeholder needs in-depth with details and examples. What are their needs?	Adam
Define in DT Summary		
Empathise in DT Summary	Summary	Jalkhan
The goal of AI solution	AI solution shows large amount of original thought. Ideas are creative and inventive.	
AI solution	Introduction	Airil