Project Report

Team 2 Furth

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Introduction

The Luisentunnel pedestrian underpass is in Fürth, Germany, which is a connector between two districts. But at the moment, there are a few issues, such as inadequate illumination, offensive odors, a lack of barrier-free access, and a lack of safety. Underutilization has resulted from these problems, especially among vulnerable populations like women, the elderly, and parents pushing strollers. The challenge presented by the Stadtplanungsamt Fürth is that we need to redesign this space in a participatory and inclusive manner using AI and digital tools.

Problem statement

The Luisentunnel acts more as a barrier than a bridge between neighbourhoods. Its current state discourages pedestrian use, reinforces social division, and presents safety concerns. Users report feelings of discomfort, especially at night, due to poor lighting, limited visibility, and lack of foot traffic. These factors particularly affect vulnerable groups.

"How can citizens be actively involved in redesigning the Luisentunnel to be barrier-free, safe, and inclusive using AI and digital participation frameworks?"

Challenge & Context

Given by: Stadtplanungsamt Fürth (Planning Office of Fürth)

- Population: 133,000 residents
- Location: Next to Nürnberg, Bavaria
- Core Questions:
  - How can public spaces be designed with citizens?
  - What design can connect two socially divided districts?

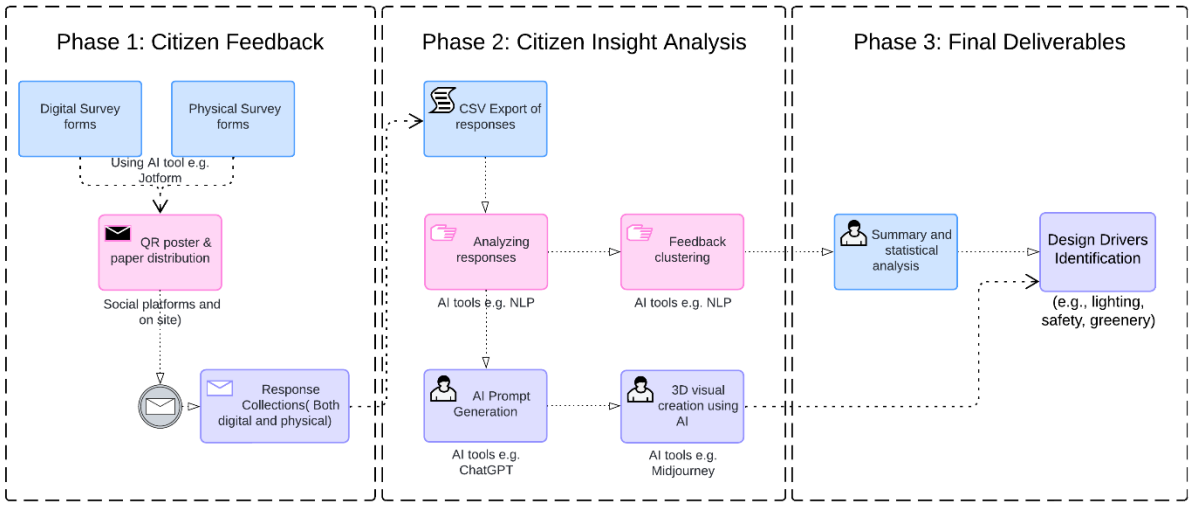
Project Goals and Desired Outcomes

- Empower citizens to co-design urban space through digital tools.
- Demonstrate how AI can simplify and enhance citizen engagement.
- Promote inclusivity, safety, and sustainability in urban mobility.
- Encourage planning authorities to adopt a participatory approach.

Shahzaib Hameed

Methodology and Workflow

To structure our approach, we divided the project into three core phases.



We divided our project into three key phases to guide our work, from citizen feedback to AI-powered design solutions.

In Phase 1, we concentrated on getting input from the Fürth community. We developed digital and paper surveys using AI programs like JotForm, ensuring they were user-friendly and multilingual. In these polls, respondents were asked how they feel about the underpass when they use it and what they would change to make it safer. We disseminated the surveys via QR posters, WhatsApp, and public spaces to reach a wide range of individuals, including parents, students, the elderly, immigrants, and those with impairments. To ensure that the process was completely inclusive, we manually and digitally gathered replies.

We collected all of the responses in Phase 2 and exported them to a spreadsheet. After that, we employed ChatGPT and other AI techniques to classify the input into relevant groups. For instance, many people discussed the necessity of ramps or green areas, safety, lighting, and cleanliness. Additionally, we employed AI to find recurrent themes and emotional patterns. Based on these observations, we created thorough text suggestions outlining the new underpass's appearance and feel. In order to produce graphic designs that were directly impacted by the public's input, these prompts were forwarded to design tools such as Midjourney.

Using images such as mood charts and word clouds, we summarized the findings in Phase 3. This made it easier for us to pinpoint important design elements like better lighting, vegetation, accessibility, and safety measures. Using AI-generated prompts, we created 3D visuals that represent what the public genuinely wants to see. Thanks to these pictures, we converted intangible comments into a format that planners and decision-makers could use.

Shahzaib Hameed

Questionnaire Data Collection Process

To involve citizens in the design process of the underpass in a flexible and inclusive way, we propose a hybrid questionnaire system that supports both traditional paper-based input and modern digital submissions. The goal is to make citizen participation accessible across age groups, digital literacy levels, and physical settings.

a) Paper Forms

For in-person engagement, especially with communities that may be less digitally active, we provide printed questionnaires. These forms are later:

- Scanned into image or PDF format,
- Processed using OCR (Optical Character Recognition) to extract handwritten or printed text,
- Then interpreted by a locally deployed LLM (e.g., DeepSeek) to understand the responses and transform them into a structured format,
- Finally, all responses are exported into standardized .csv files, ready for analysis.

Example:

	A	B	C	D	E	F
1	Respondent_ID	Age_Grou	User_Type	Response		
2	1	65+	Elderly	Floods when it rains		
3	2	30-45	Parent w/	Too many bikes parked inside		
4	3	12-18	Teenager	There's no art or color		
5	4	45-60	Woman	The tunnel smells bad		

```
import pandas as pd
df = pd.read_csv("sample_survey_responses.csv")
df
```

✓ 0.9s

	Respondent_ID	Age_Group	User_Type	Response
0	1	65+	Elderly	Floods when it rains
1	2	30-45	Parent w/ stroller	Too many bikes parked inside
2	3	12-18	Teenager	There's no art or color
3	4	45-60	Woman	The tunnel smells bad
4	5	18-25	Young Adult	It's too dark at night

b) Online Forms

Parallel to paper collection, an online form is made available to allow faster digital participation. These responses are directly exported as .csv files. This ensures consistency between the two data sources, making them compatible for unified processing.
Outcome: All citizen inputs, regardless of submission method, are aggregated into a clean and structured .csv dataset that serves as the foundation for the next stage.

Key Strategies to Improve Participation:

- Use of AI to analyze and summarize large-scale qualitative feedback.
- Physical forms for non-digital users and the elderly.
- Appealing visual prompts and icons in forms to boost engagement.
- Targeted outreach at schools, community centres, and local stores.

Text Processing and Statistical Analysis

While structured multiple-choice questions are easy to analyze, they often limit responses by forcing participants into predefined categories. To gain both quantitative and qualitative insights, our survey also included structured questions and open-ended ones, which let people speak freely and reveal unexpected issues. Each response was processed using a large language model (LLM) like ChatGPT to automatically classify feedbacks into new themes (Wang, 2024).

For example, with the sample question: “Is there anything you do not like about the tunnel?”, we can get:

Example Open Responses	Category
"Too many bikes parked inside."	Accessibility / Obstacle
"There's no art or color."	Aesthetics
"Floods when it rains"	Infrastructure issue
"The tunnel smells bad."	Sanitation

This method would help uncover **blind spots** and **emerging concerns** not captured by predefined categories. It is also proven to be significantly more time and cost-effective than manual analysis (Thematic, 2024), (Dahlke & Furuya-Kanamori, 2024). By tagging each response with a theme, we could then **analyze trends by demographic group**, highlighting:

- **Universal needs** (e.g. safety)
- **Group-specific concerns** (e.g. accessibility for the elderly or parents

This allowed planners to understand trade-offs and tailor solutions to real community needs.

Image Generation According to CSV Files

Each row in the .csv file represents a single citizen's responses to questions about color schemes, lighting, emotions, preferred features, and visual style of the redesigned underpass.

This information is passed through the following automated pipeline:

a) Response Analysis with LLM

A locally deployed large language model (LLM) processes each user's answers. It performs:

- Semantic interpretation of open-ended or "Other" responses,
- Classification into known visual categories (e.g., "nature-themed," "warm lighting"),
- Synthesis of a personalized text prompt that captures the essence of the user's vision.

b) Prompt-Based Image Generation

The generated prompt is then sent to a locally hosted image generation model, such as Stable Diffusion. The model produces a high-resolution image that visually reflects the user's ideas. For example: *"A warm and welcoming pedestrian underpass with soft lighting, forest imagery on the walls, and natural sound features. The atmosphere feels peaceful and inclusive."*
This output is saved and can be shown back to the user or used in workshops for further discussion.

Why This Matters: Enhancing Participation Through Visualization

In real-world urban planning, final design decisions are usually made by experts—urban planners, engineers, and architects—based on feasibility, cost, safety regulations, and technical standards. This often leads to citizen suggestions being ignored, either due to impracticality or misalignment with official guidelines.

By visualizing each individual's input, our system ensures that:

- Citizens feel seen and heard, even if their ideas are not directly implemented.
- Each participant receives a personalized image of what their imagined space could look like.
- The process shifts from one-way "consultation" to two-way co-creation.

This not only increases trust and transparency in the project but also motivates deeper, more meaningful engagement, especially among those who might otherwise feel excluded from technical decision-making.

Tianzhuo Wang

Conclusion and reflection

According to our research, AI can serve as a conduit between communities and urban planners. The following were made possible by the combination of digital feedback and AI-generated design:

- Quicker conversion of feedback into visual results
- Increased involvement from underrepresented and technologically literate groups
- New discussions around shared space between residents and policymakers

"The Luisentunnel became not just a path, but a place citizens wanted to help shape." Additionally, this project made city officials more aware of the benefits of tech-enabled, agile planning techniques, which could have an impact on upcoming infrastructure improvements in Fürth.AI helped transform unstructured citizen input into structured, actionable insights. It made participation more inclusive, creative, and efficient, empowering citizens, speeding up analysis for planners, and demonstrating the real-world value of AI to decision-makers in urban design.

Recommendations

- Expand the use of AI and participation in other urban infrastructure initiatives.
- Make a digital feedback portal available in several languages a permanent part of Fürth's planning system.
- Set up workshops or citizen juries to jointly assess AI-generated prototypes.
- Incorporate educational institutions and art centers into upcoming beautification initiatives

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