CE902 Science Fiction Brainstorming Exercise

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Abstract: In this paper, the author will utilize the tool of Science Fiction Prototyping to explore what's coming next with regard to Emotional Infrastructure AI. This will involve a blend of affective computing, smart cities, and Internet of Things to create a near-future prototype of how the city will be set up. This will involve how the prototype will utilize the opt-in wearable data and sensor data from the entire city to gauge the overall stress levels and then adjust traffic, street lighting, and sounds in the city in real time. It will also explore the business potential of such a concept, including potential business models such as B2G SaaS licensing and services, and then discuss the ethics of such a system, including privacy, behavioral manipulation, bias, inequality, and governance. The overall result will be that while there is potential for Emotional Infrastructure AI to improve the well-being and efficiency of the city, there needs to be proper regulation, transparency, and ways to earn public trust.

Keywords: AI, Smart Cities, Internet of Things (IoT), Ethical AI Governance.

GitHub: https://github.com/simaygoktug/robotics_and_control

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1 Purpose of Exercise

The goal of this exercise is to practice Science Fiction Prototyping (SFP) as a methodology for analyzing emerging technologies, thinking about their near-future applications, and critically evaluating their business value and ethical/societal impact. The outcome is a short prototype story (μSFP) and a set of thoughts that link the fictional story to realistic innovation planning.

2 Step 1 - Individual Brainstorming (Divergent Thinking)

I adhered to the brainstorming tips presented in the lecture: think a lot, think strange, and judge later. Based on the suggested domains, I developed some ideas for future technology in those areas.

2.1 Brainstormed Innovation Ideas (Minimum 3; Provided 5)

- **Idea 1 - Emotional Infrastructure AI (Smart City + AI + IoT)**

  I developed a city-wide system that would integrate data from voluntary wearable technology and municipal sensor systems to determine the emotional state of the population, such as stress, tension, or relaxation levels. Based on the emotional state data, the city would optimize traffic light timing, bus and train frequency, lighting levels, and even soundscapes to reduce traffic and stress levels and increase the general well-being of the citizens.

  - ❖ Main Technology Involved: Affective computing and sensor fusion
  - ❖ Main Benefit: Reduced stress levels in the city, smooth flow of people and vehicles, and improved general well-being
  - ❖ Key concern: Privacy, surveillance, manipulation risk

- **Idea 2 - Autonomous Learning Companion Chip (AI)**

  A learning assistant, almost in the spirit of the neural, closely monitors the learning process, providing bite-sized learning, adapting on the fly, reinforcing memory, and providing feedback.

  - ❖ Main Technology Involved: Personal AI tutor, neuro-adaptive interfaces
  - ❖ Main Benefit: Quick skills development, supports learning for a lifetime
  - ❖ Key concern: Risk of cognitive dependence, risk of inequality, need for consent

- **Idea 3 - Predictive Health IoT Mesh (IoT + AI for Healthcare)**

  Sensors in the home, and wearable devices, monitor slight changes in health, attempting to detect diseases before the onset of symptoms.

  - ❖ Main Technology Involved: Time series modeling, anomaly detection, continuous health monitoring
  - ❖ Main Benefit: Earlier detection, prevention
  - ❖ Key concern: Who owns the data, risk of insurance discrimination

- **Idea 4 - Energy-Symbiotic Smart Homes (Smart City + IoT)**

  A home that constantly optimizes energy consumption based on the number of inhabitants, the comfort level based on the vibes sensed by the biometric sensors, and the current energy prices, negotiating energy buy and sell transactions without human involvement.

  - ❖ Main Technology Involved: Predictive control, smart meters, Internet of Things
  - ❖ Main Benefit: Reduced costs, reduced emissions
  - ❖ Key concern: Transparency, risk of lock-in, risk of loss of autonomy

- **Idea 5 - Autonomous Negotiation & Compliance AI (Business + AI)**

  An AI agent analyzes contracts, negotiates terms, detects ethical and legal risks, and maintains tight compliance in real-time during B2B transactions.

  - ❖ Main Technology Involved: Natural language reasoning, negotiation optimization
  - ❖ Main Benefit: Faster business cycles, reduced disputes
  - ❖ Key concern: Accountability, bias, explainability

3 Step 2 - Selecting the Strongest Idea (Convergent Thinking)

Out of the ideas brainstormed, I chose Emotional Infrastructure AI as it meets the SFP criteria of matching technology and social impact. It also lends itself easily to a "future snapshot" story, as well as facilitating business modeling and ethics.

Chosen Concept: Emotional Infrastructure AI (Smart City + AI + IoT)

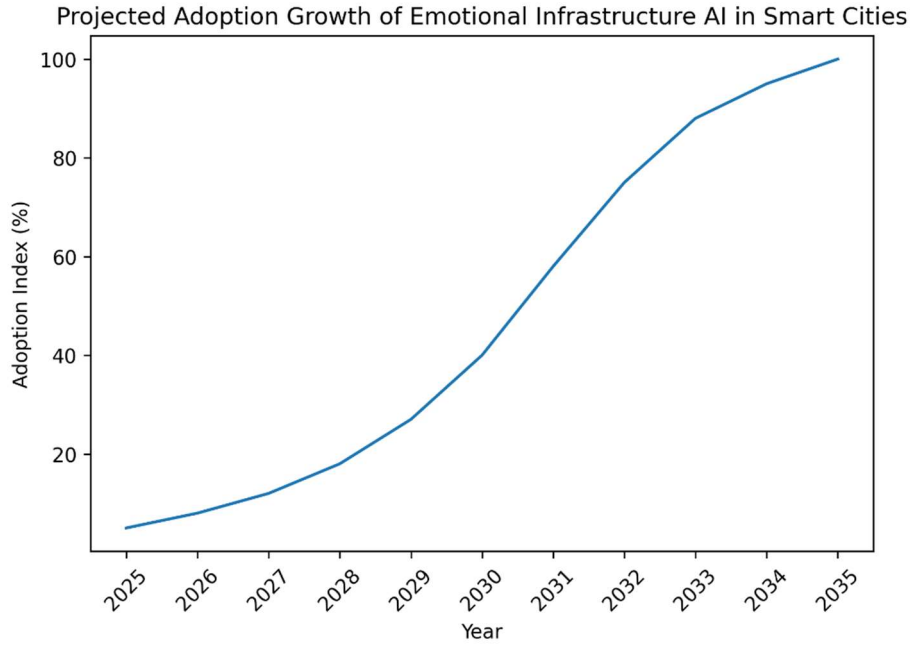

Figure 1 - This figure shows the projected adoption curve of Emotional Infrastructure AI Systems in smart cities from 2025 to 2035. This curve represents the pattern of adoption of any technology, which starts with early adoption and then grows rapidly after 2030. This pattern shows the increase in dependence on affect-aware infrastructure and predictive behavioral systems.

4 Step 3 - Writing a µSFP (Micro Science Fiction Prototype)

The CE902 lecture defines the µSFP format with a concise, structured narrative that includes the following components: (1) Who, (2) in what situation, (3) using what innovation, (4) doing what action, and (5) resulting in what benefit: [Person] in [Situation] uses [Innovation] to do [Action], resulting in [Benefit].

4.1 Final µSFP

Lina walks in the city after a long week of exams. Her wearable opt-in signal connects to the Emotional Infrastructure AI, which optimizes the traffic lights and reduces the intensity of the city sounds near the hotspots. People move more efficiently, reducing the stress levels in the city, and Lina reaches home in a much better state.

5 Step 4 - Technology Rationale (What Science Makes This Plausible?)

This prototype is built on existing, albeit incomplete, technologies:

- Wearables & bio signals - heart rate variability, skin temp, motion/activity detection
- Urban sensing - cameras, footfall counters, vehicle flow sensors, public transport data
- Affective computing - ML-based inference on stress proxies from multi-modal data
- Real-time optimization/control - adaptive traffic control, dynamic route balancing
- Edge/cloud orchestration - distributed inference to reduce latency and central exposure

The SFP value is not about "predicting the future perfectly," but about considering the possibility of emergent, incremental technologies adding up to a new socio-technical system and business opportunity.

6 Step 5 - Business Innovation Analysis

SFP should translate the story into innovation logic: what could be built, who pays, and why it creates value.

6.1 Target Customers (Who would buy/commission this?)

City and regional governments are promoting Smart City concepts to increase the quality of life for citizens and facilitate smooth traffic flow. Transportation departments aim to reduce traffic jams and increase road safety. Large spaces like airports, stadiums, and universities want to find ways to reduce stress in crowds. City infrastructure managers operate traffic systems, lighting systems, and sound systems.

6.2 Value Proposition (Why does it matter?)

Less congestion means happier commuters. More efficient traffic flow means cost savings and cleaner air. Improved safety means fewer accidents in stressful urban environments. Data-driven city management means smarter use of resources.

6.3 Business Models (How could it generate revenue?)

The B2G SaaS license model follows an annual subscription for the "Emotional Infrastructure AI Platform." The ecosystem requires a one-time setup fee and ongoing maintenance contracts. The API-based ecosystem enables partners to pay to integrate the traffic, lighting, and sound modules. The analytics reports offer aggregate and anonymous data to help with planning to improve wellbeing and reduce congestion. The premium zones offer "calm corridors" within city centers with "ethical management" to avoid unequal access.

6.4 Competitive Angle (Why would it win?)

The idea is unique in combining hard, urban-wide optimizations such as the flow and routing of traffic with soft, human-centric results such as reducing stress.

7 Step 6 - Risks, Ethics, and Critical Discussion

The lecturer also emphasized that SFP should highlight consequences, trade-offs, and constraints, rather than "cool features."

7.1 Key Ethical Risks

Privacy & Surveillance: With opt-in wearables, there can be an overlap between "wellbeing optimization" and "city surveillance."

Manipulation & Behavioral Control: A system that can adjust ambient conditions (sounds, light, traffic pacing) can also manipulate citizen behaviour without them being able to understand or agree to it.

Bias & Exclusion: With an SFP model that may not be representative of the population, some groups may be misinterpreted (neurodiversity, disability, cultural factors), leading to unfair "stress scoring."

Inequality / Two-tier Cities: With premium "calm zones," there can be an unequal distribution of wellbeing benefits, with some areas having more benefits than others.

Accountability & Governance: When there are negative consequences to citizens (e.g., ambulance route optimization errors), there should be clear lines of responsibility between city authorities, vendors, and system operators.

7.2 Risk Mitigation (Concrete Controls)

Ensure opt-in with complete transparency, including what signals are used and how the signals are processed. Use data minimization, rely on aggregated features, and avoid raw biometric data where possible. On-device or edge computing, keeping data away from centralized systems. Use independent checks, including third-party audits, for fairness, bias, and security issues. Use human oversight, including policy-based constraints (e.g., emergency vehicle exemptions). Use public governance, including citizen panels, with clear mechanisms for complaining and remedying.

7.3 Critical Reflection (What is the “SFP lesson”?)

This SFP lecture implies that the smart city of the future will not only be measured by its efficiency rates, such as how fast it can process information, but also by how it makes people feel inside, such as stress, safety, and feelings of autonomy. This optimization system that can bring happiness can also be used for control if governance, transparency, and permission are not sufficient. Therefore, the main design challenge here is not just how to make a system efficient, but how to win the trust of the people so that there can be ethical limits to its use.

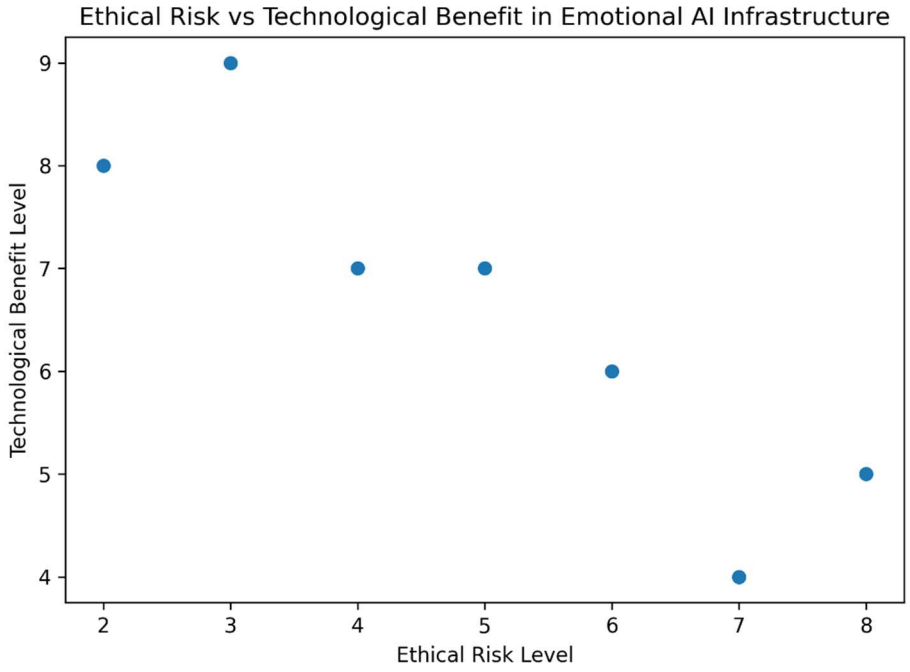

Figure 2 - The concept map above illustrates the balance between the ethical risk and the benefits of technology in Emotional AI systems. As a system increases in its potential and capabilities, its ethical risk in terms of issues of privacy, manipulation, and erosion of autonomy increases as well. The random pattern illustrates that progress and vulnerability do not always have a straight-line relationship.

8 Conclusion

This brainstorming session illustrates the process of Science Fiction Prototyping to take a wild idea and turn it into a solid innovation plan: brainstorming, choosing the best idea, creating a micro-SFP narrative, grounding the narrative in feasible technology, creating a business model, and conducting an ethical risk analysis. The "Emotional Infrastructure AI" prototype is a very viable smart city wellness platform, but its ethics depend on robust privacy, bias, and transparent public governance.

9 Appendix A - Quick µSFP (Template Mapping)

- **Person:** Lina
- **Situation:** crowded city commute after exams
- **Innovation:** Emotional Infrastructure AI + opt-in wearable signal
- **Action:** dynamic traffic & soundscape optimization
- **Benefit:** reduced stress + smoother flows

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