Smart City

Feasibility- Team Gold

Weston Carmack, Carlos Moll Rolon, Nick Kooshki, Tony Cairuz, Derrick Stewart

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Meet the team

Tony Cairuz

I’m passionate about sports, especially skiing, and I was proud to become the champion of skiing in Lebanon for a while. Outside of sports, I’m studying Computer Science and working alongside my studies.

Nick Kooshki

I am currently a senior at ODU with a major in computer science. My biggest interests in technology are computer hardware alongside reviewing MacBooks and exploring the latest artificial intelligence trends and capabilities.

Meet the team

Carlos Moll Rolon

I am currently a senior at ODU studying Computer Science. I enjoy being able to problem-solve through code. Some hobbies of mine outside of school are lifting weights, listening to music, reading manga, and cooking.

Derrick Stewart

I’m a senior at ODU studying Computer Science. I enjoy technology, music, and working on creative projects.

Meet the team

Weston Carmack

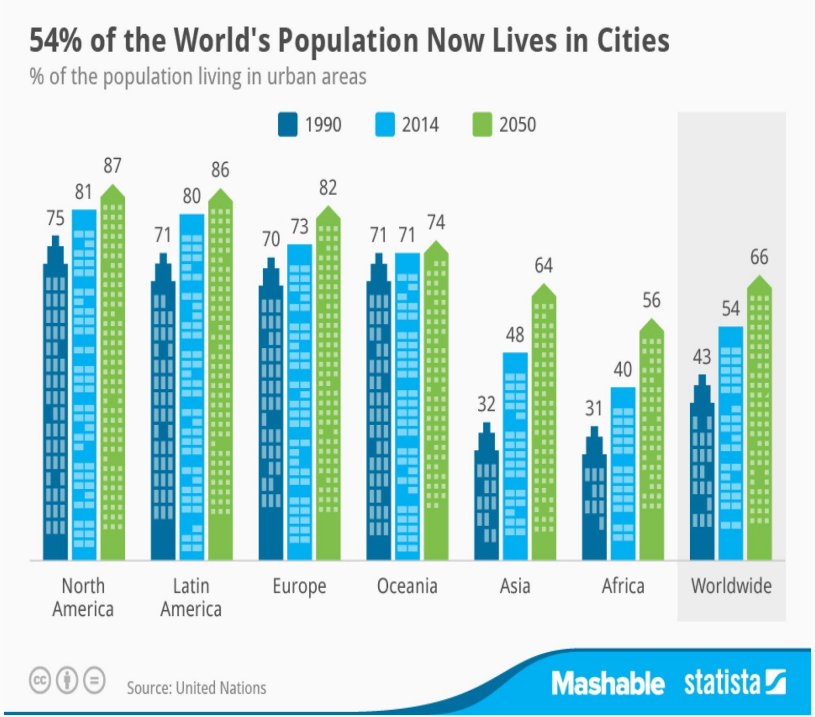
I’m currently a senior in computer science here at ODU. My favorite programming languages are C++ and Python, and plan on picking up Rust in the future. Outside of class I enjoy watching football, Formula 1, working out and attending car shows.

The Problem

Background - Rapid Urbanization

- By 2050, the UN projects 6.5 billion people will live in urban areas, most in developing countries, intensifying demand for public services [number analytics].

- As people migrate across the world, cities have seen an increase in population size which has lead to overcrowding in the communities that have been established in these cities for a long time.



[4]

How does rapid urbanization affect us and why is it important?

- Health Issues [2]
  - We see health issues such as respiratory disease, tuberculosis, mental health problems and higher mortality rates.
- Traffic Jams and Overall Congestion [1]
- Poor Quality Housing [1, 2, 3]
  - Homes can be illegally converted in order to accomodate more guest leading to poor living conditions.
- Inadequate Waste Management [1]
- Water Scarcity [1]
- Increased Crime Rate [1]

[5]

Why has this not been solved?

- Current infrastructure is not sustainable to deal with rapid urbanization and there is little investment towards those systems. [4]
- There is insufficient communication between local government agencies and the organizations that support them.
- Efforts to address the problem have relied on governments and city officials with no voice for the people.

[6]

Who are the people affected?

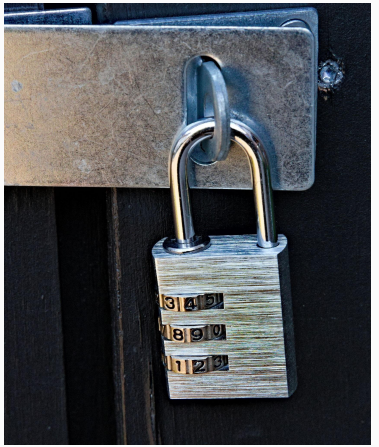
- Residents living in these high-density areas experiencing rapid urbanization. This group is the most affected. [1]
- Commuters who have to travel to these areas in order to work are dealing with congestion and high volume of traffic. American motorists lost an average of 42 hours to highway congestion in 2023. [9]
- City officials who have to work with the communities are facing these challenges as they are trying to coordinate efforts. [1]
- Business owners who are having their businesses affected by long wait times.

Problem Statement

- **What's happening?**
  - Rapid urbanization and poor planning create overcrowding, reducing quality of life.
- **Why It's Happening**
  - Mass migration to urban areas
  - Data gaps leading to poor urban planning causing:
    - Health Issues
    - Traffic Jams
    - Poor Quality Housing
    - Inadequate Waste Management
    - Water Scarcity
    - Increased Crime Rate
- **Impact**
  - Longer commutes, unaffordable housing, and reduced community well-being.

[8]

Problem Characteristics



— Congestion

- As more people move into cities they experience congestion when traveling in their day to day lives.
- If only there was a way to see how crowded areas in their communities will be and provide suggestions based on that.

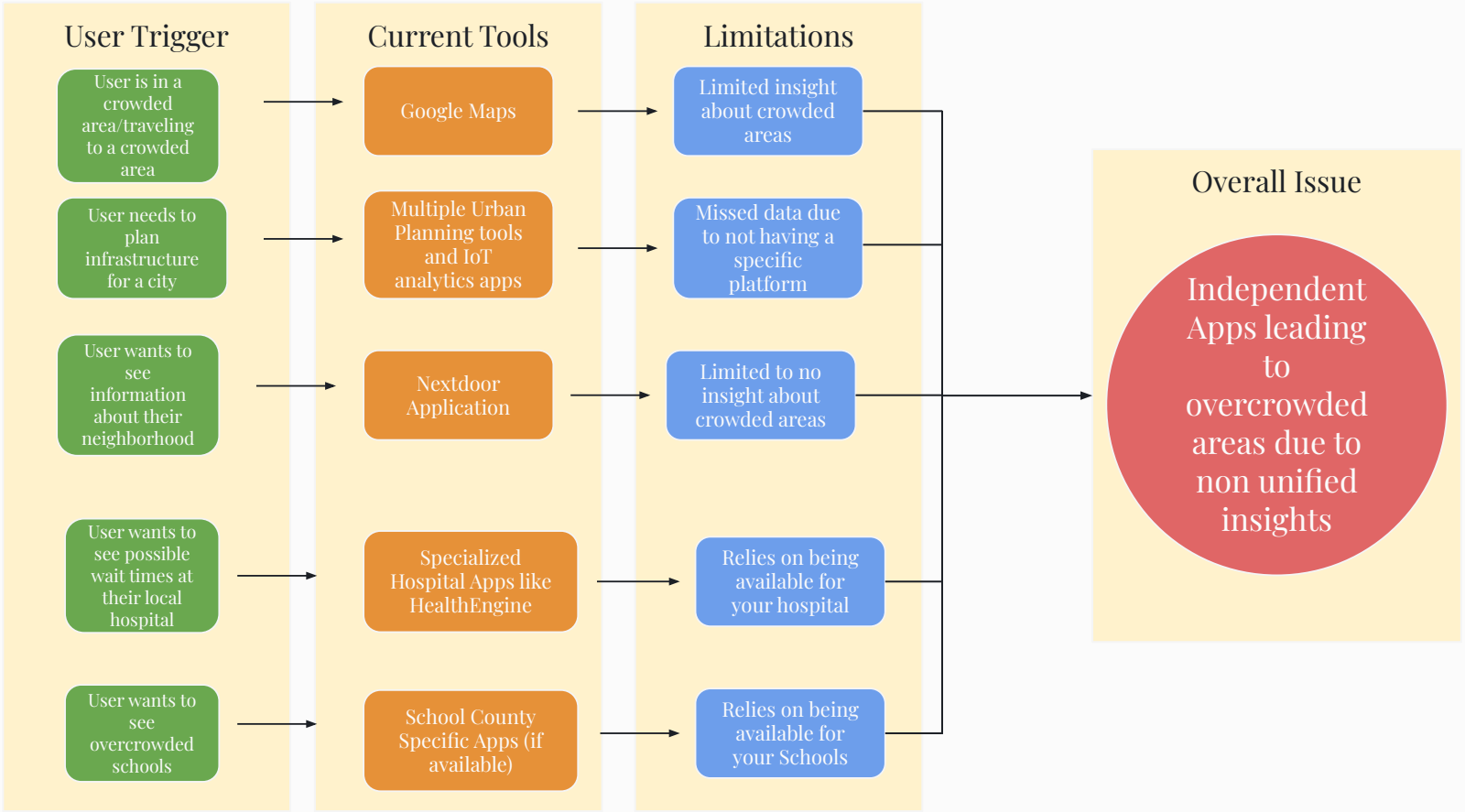
— Community Interaction

- With small community driven efforts and no platform to congregate leaves people feeling lost and out of touch with their own communities
- If only there was a platform for the people to share data and events regarding their community in order to drive improvements.

— Poor Infrastructure

- Deteriorating infrastructure with minor investments leads to poor quality of life for the people living in these conditions.
- If only there was a way to leverage underutilized and underfunded infrastructure to provide better living conditions for the people

Current Process Flow



The Solution

Smart City: A Community-Driven Data Platform

- Crowdsourced Data leveraging AI-powered predictions, IoT, and APIs
- Helps residents avoid overcrowding & plan smarter
- Provides governments with accessible, real-time insights

What Users Gain Today

Find less-crowded clinics & schools

Get alternate transit routes

Share & view community updates

Save time and reduce stress

Citywide Impact (Long-Term)

Historical Trend Analysis

Community Insight Dashboard

Open Data Access

Why Smart City Wins

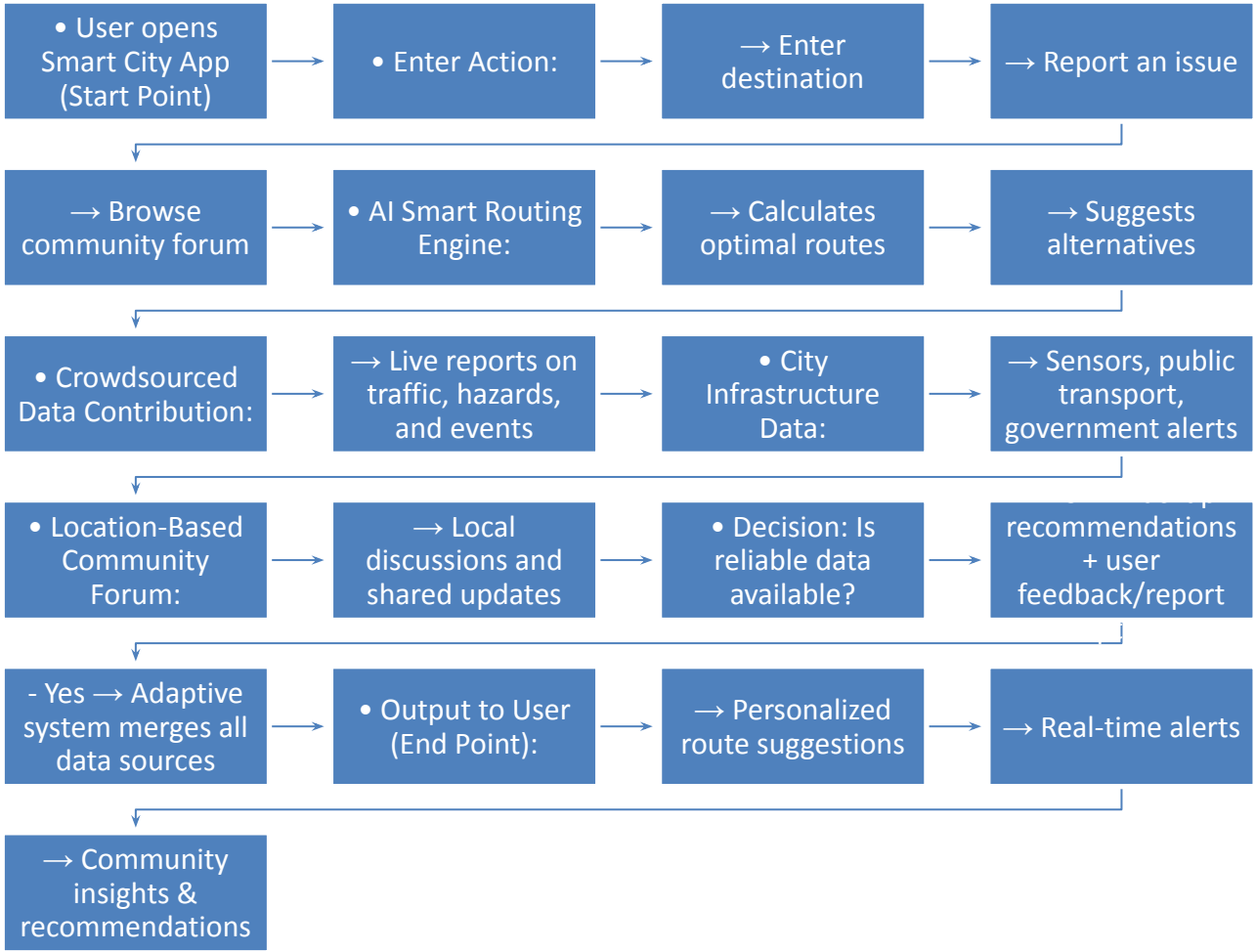
Holistic Coverage (health, transit, education)

Citizen Feedback Loop

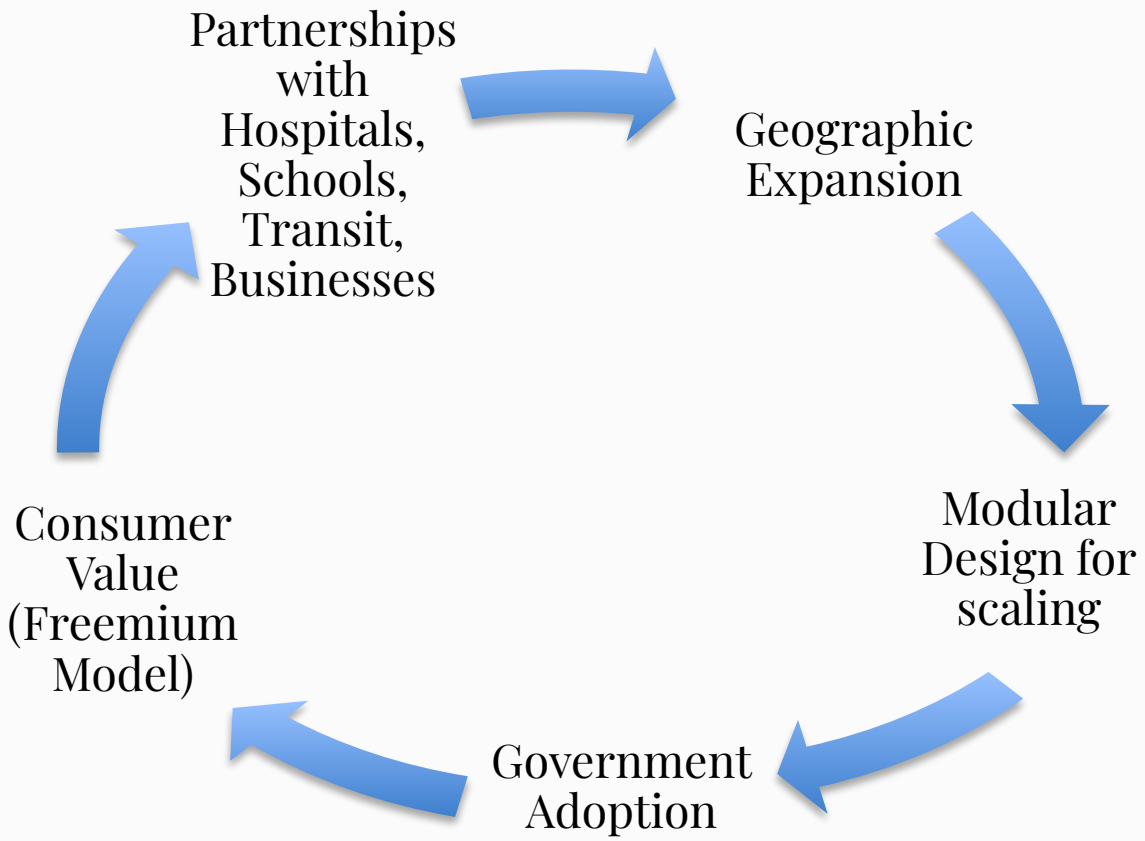
Privacy-First Approach

Open Data for Innovation

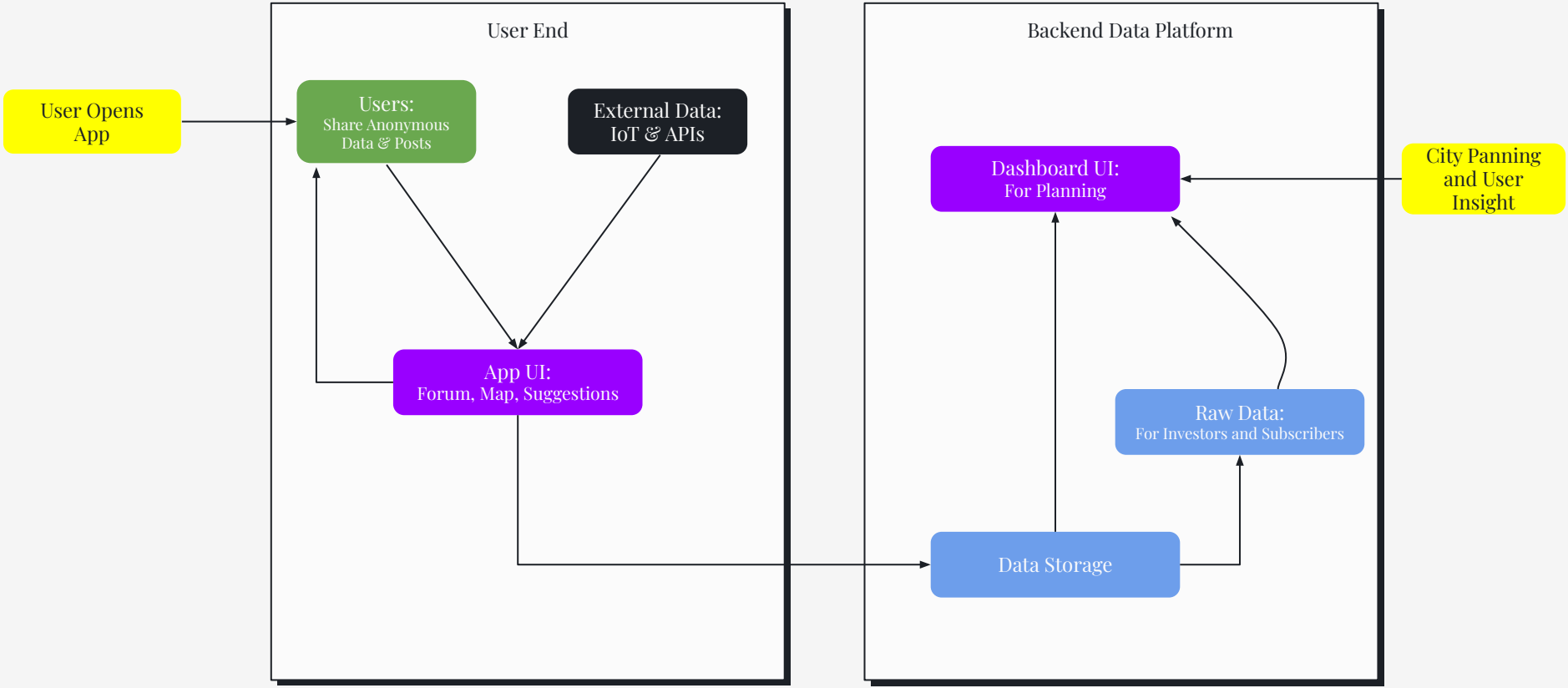
Solution Process Flow – Smart City App



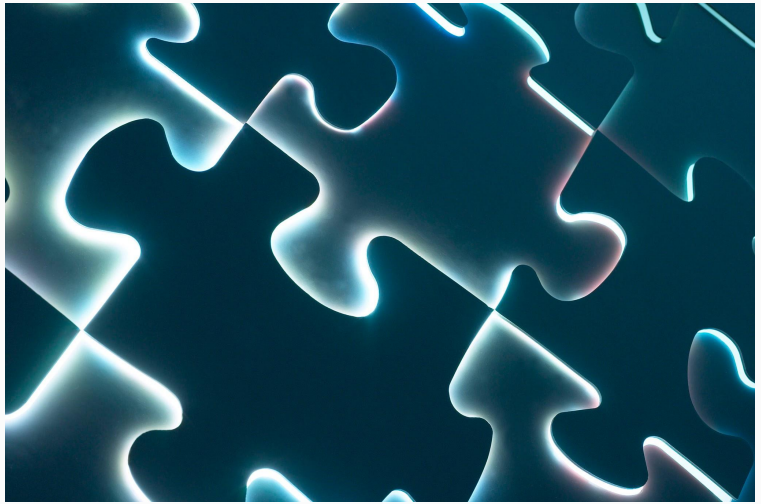
Growth Potential



Major Functional Components Diagram



Major Functional Components



01

User Interface

An interface that can offer suggestions based of data provided anonymously by the user. It can also provide a forum in order for residents to be able to discuss.

02

Data Processing and Data Storage

A module to handle short-term data processing that occurs when the user shares their data. A second module to handle long-term data storage and track historical trends.

03

Insights and Support

Help provide insights to city planners and shareholders based on the long-term data handling. Key in establishing communication with customers.

04

Artificial Intelligence

Use of artificial intelligence algorithms in order to predict needs for city planners. Also potential to use AI in order to offer real time suggestions for users.

Hurdles to Overcome

Public Acceptance ↠ Privacy campaigns, gamification, partnerships

Safety Concerns ↠ Aggregated data, anomaly detection, access control

Sustainability ↠ Seed datasets, phased rollout, municipal partnerships

What Smart City Will Do

- Provide real time AI powered routing to avoid congestion and suggest alternatives
- Show live wait times for clinics, schools, and other crowded locations
- Enable crowdsourced community updates (events, traffic, safety alerts)
- Give city officials a dashboard for better coordination and planning
- Improve daily navigation and quality of life for residents and commuters
- Protect users' privacy by sharing only approximate locations, encrypting data, and giving full control over what's shared

What Smart City Will NOT Do

- Build or repair physical infrastructure (roads, housing, utilities)
- Replace or act as an official government system, it only supports them with data
- Directly address crime, poverty, or housing shortages
- Guarantee 100% accurate predictions, insights depend on user contributions
- Eliminate congestion completely, it reduces and helps manage it, not remove it entirely

Customer Risks

Risk Matrix			Impact				
			Very Low	Low	Medium	High	Very High
			1	2	3	4	5
Probability	Very High	5					
	High	4				C4R	
	Medium	3		C3M	C1R, C4M	C2R, C3R	
	Low	2		C2M	C1M		
	Very Low	1					

Risks

C1R: Viewed as low value - users may think Smart City is unnecessary because they could already access traffic updates

C2R: Doubts about accuracy - users think Smart City's real time updates aren't accurate

C3R: Too Many Updates - too many updates could make users mute the app or uninstall it

C4R: Hard to Use - The app may feel confusing for new users since it includes many different tools and features.

Mitigations

C1: Viewed as low value – Highlight what makes Smart City unique, such as real-time AI updates, community features, and all-in-one access.

C2: Doubts about accuracy - give a confidence rating on updates to show how accurate an update is

C3: Too Many Updates - tailor updates to the user allow them to select which updates they receive

C4: Hard to Use – Simplify the interface with clear buttons, a clean layout, and short tutorials to help users get started easily.

Security Risks

Risk Matrix			Impact				
			Very Low	Low	Medium	High	Very High
			1	2	3	4	5
Probability	Very High	5		S4M S3R		S4R	
	High	4				S2R	
	Medium	3		S3M S1R			
	Low	2	S1M		S2M		
	Very Low	1					

Risks

S1R: Surveillance through IoT sensors, public APIs and crowd sourced data to know where people are at all times

S2R: All information in one place makes the app a prime target for cyber attacks

S3R: Companies may exploit user data for profit, sharing it with advertisers or other entities.

S4R: Governments may use this information to limit free speech or movement in certain countries outside the U.S. that don't have laws preventing this.

Mitigations

S1M: Data Anonymization; showing "high crowd level" vs a hard number

S2M: Decentralized database and frequent security audits on random intervals

S3M: Enforcing clear opt-in data sharing options and rate-limiting to mitigate scraping

S4M: Implement strong privacy protection and produce quarterly reports of data access. Assess laws in markets Smart City is published to and adjust privacy protection accordingly.

Technical Risks

Risk Matrix			Impact				
			Very Low	Low	Medium	High	Very High
			1	2	3	4	5
Probability	Very High	5					
	High	4					
	Medium	3					
	Low	2			T2	T1	
	Very Low	1	T2		T1		

Risks:

T1: **Software integration complexity** - As we work to combine different forms of software and tools (mapping, artificial intelligence, community hub) the application architecture could become complex and bloated

T2: **Prediction/AI accuracy** - Integrating AI (could also fall under T1?) needs to be reasonable with accurate results. There are risks with our models generating false information.

Mitigation:

T1M: **Software integration complexity** - Start small and ensure systems are working before adding on. Clean coding and proper documentation. Taking actionable steps to prevent risk.

T2M: **Prediction/AI accuracy** - Implement information vetting through unit, integration and systems testing otherwise monitoring the results and having a check for those.

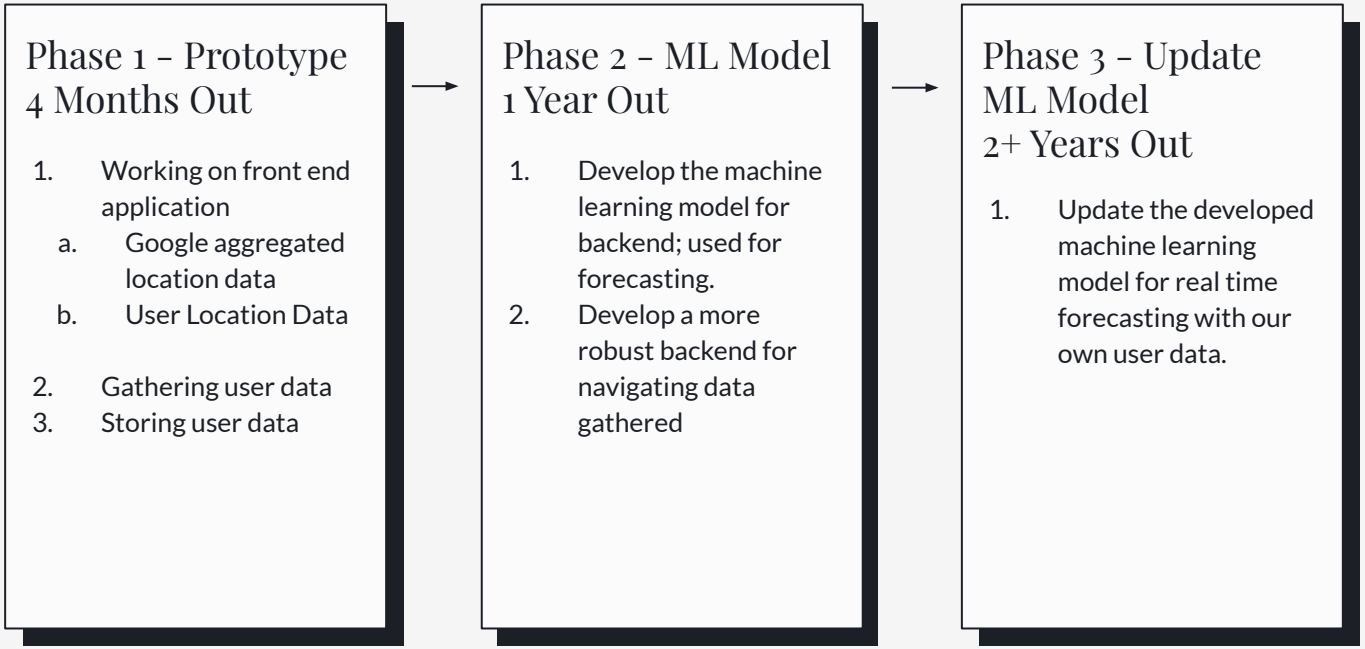
Smart City vs. The Competition

Feature	Smart City	Navigation Apps (Google maps, Citymapper)	City Platforms (IBM, Siemens, Microsoft)	Community Apps (Nextdoor, SeeClickFix)	Sector Specific Apps (HealthEngine, School Apps)
Multisector Coverage	✅	✖	✅	✖	✖
Predictive AI Suggestions	✅	✅	✅	✖	✖
Community Forum	✅	✖	✖	✅	✖
Privacy First Design	✅	✖	✖	✖	✖

Development Tools - Tech Stack

- Development: Visual Studio Code
- APIs: Google's Places Aggregate API, Heat Maps (Google)
- Frameworks: React Native, Expo
- Libraries: Gifted Chat (UI)
- Languages: JavaScript (Frontend), Java (Backend)
- Website: HTML, CSS, GitHub Pages
- Version Control: git through GitHub
- Database: Firebase

Project Roadmap



Glossary (Part 1)

Smart City — an innovative city that uses ICT and other means to improve quality of life and urban operations while advancing sustainability

Internet of Things (IoT) — systems that combine sensing, computing, communication, and actuation to connect physical/cyber objects

API (Application Programming Interface) — a set of features and rules that lets software interact with other software (a “contract” between programs)

Crowdsourced Reporting — gathering information by soliciting contributions from a large group of people, typically via the internet

Privacy-by-Design (“Privacy-First Design”) — building systems so that, by design and by default, only the personal data necessary for a purpose are processed

Glossary (Part 2)

Open Data (Open Data Access) — data anyone can freely use, re-use, and redistribute, with at most attribution/share-alike requirements

Predictive AI / AI-Powered Forecasting — using data, statistical algorithms, and ML to estimate the likelihood of future outcomes

Anomaly Detection — identifying data patterns that deviate from expected behavior

Access Control — controls that enforce authorized access to information and system resources in line with policy

Citizen Feedback Loop — a two-way process where institutions act on and report back about citizen input to sustain engagement and trust

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