

Front-End Development for AI-based Household Garbage Collection System

Capstone Design in Company's Project

Team GUI

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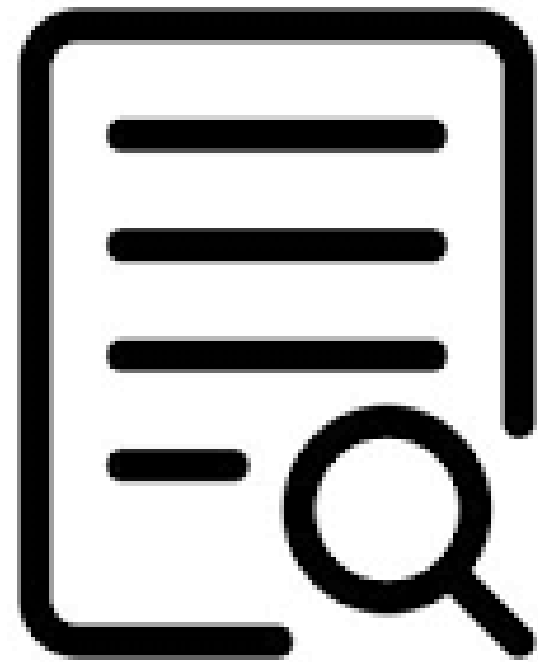
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Professor 김영일



Overview



- **Development of O&M Functions(including GUI)**
- **Development of the Display Function of Driving Path and O&M Information on Map(Kakao Map)**

Purpose



- Objective purpose is to enhance the efficiency of waste collection in South Korea by optimizing garbage truck routes
- Revolutionizing waste management through technology
- Enhancing operational efficiency of garbage collector truck

Motivation and Necessity

Motivation

- Addressing challenges in traditional waste collection
- Contributing to environmental sustainability

Necessity

- Increasing urbanization and the need for smarter waste solutions
- Demand for smarter, technology driven solutions
- Meeting the demand for more effective waste management systems



Technical Research

Technical Aspects

- Integration of GUI for garbage collector truck
- Incorporation of technologies for real-time data gathering

Research Objectives

- Enhance user interface for drivers
- Optimizing route planning and resource allocation



Differentiation

Comparison with Existing Technology

- User-friendly interface
- All in one:
- Counting collected garbage(type, size, weight, amount)
- Route setting and counting travel metrics

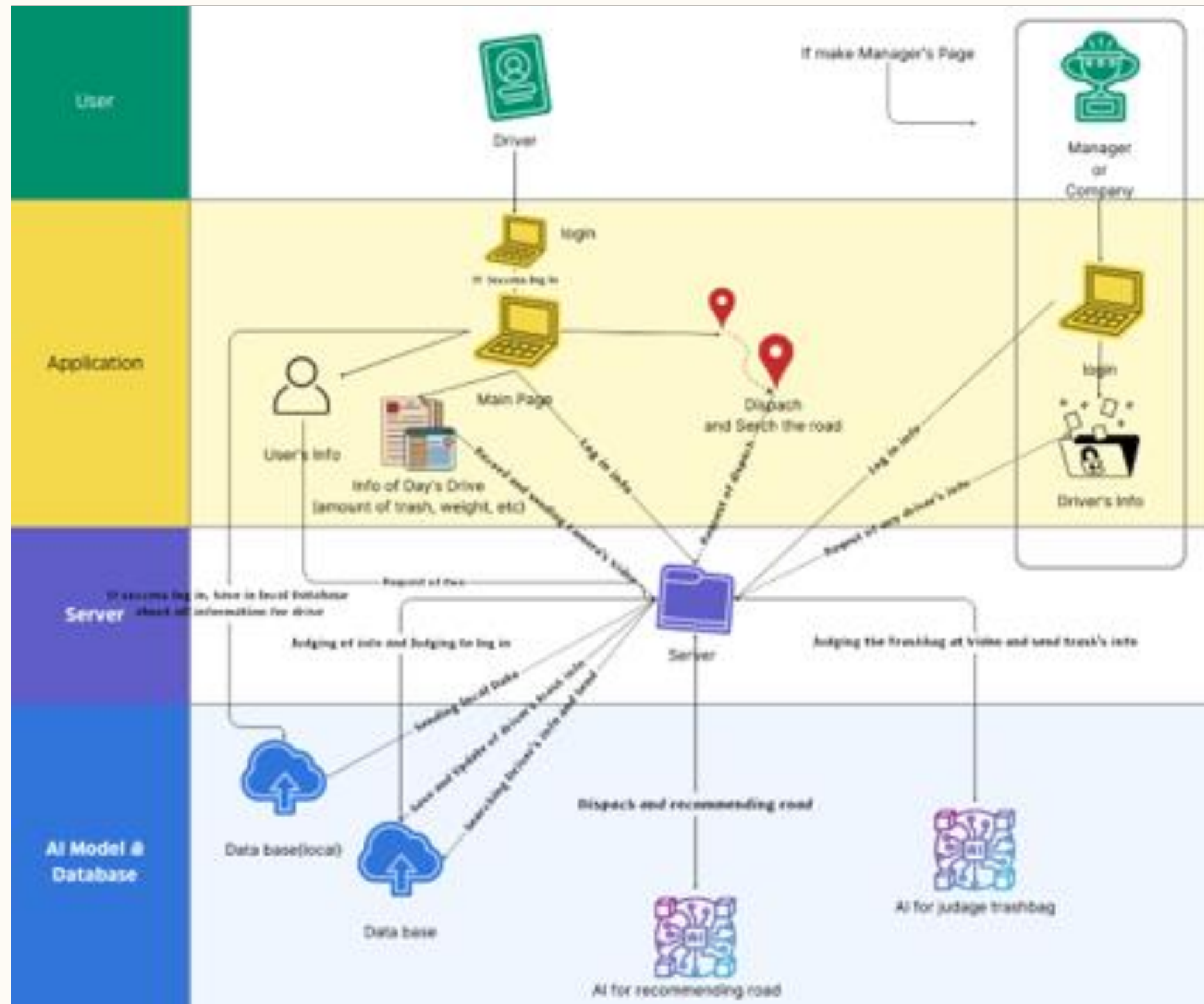


Development Environment

- **GitHub** – codebase version control
- **Google Docs** – shared documents
- **KakaoTalk** – communication channel
- **VS Code** – IDE for development
- **Google Calendar** – meetings schedule
- **Canva** – presentations creation



System Architecture



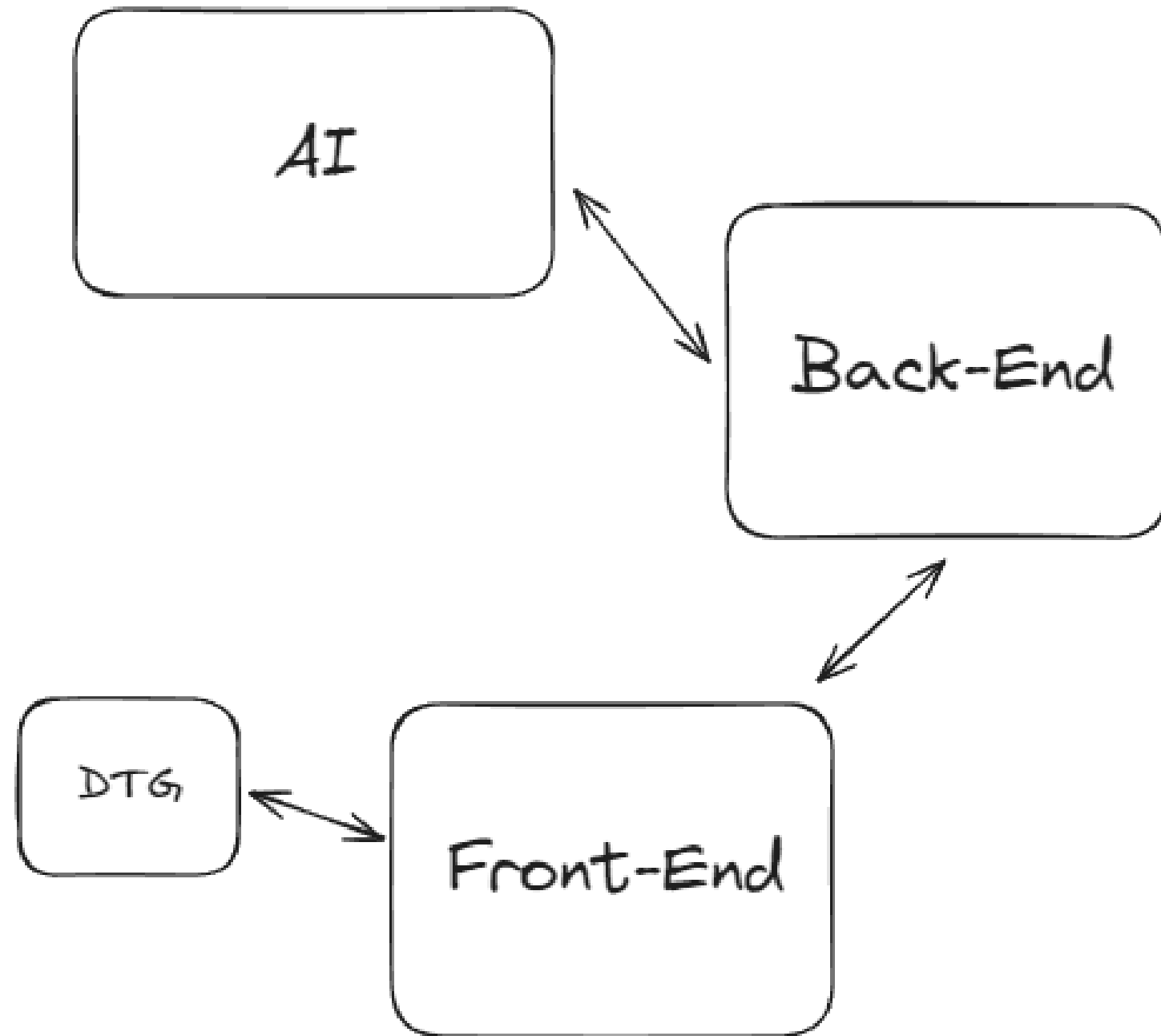
- The architecture of the entire application can be clearly divided into three main modules: frontend, backend and AI engineering

Development Contents and Scope

- Login page (form, buttons)
- Main page (trash bag counters, map, buttons)
- Records page (trunk state, collected garbage stats rendering)
- Trunk camera page (camera image transmission)
- Near-real-time fetching data from backend
- Driving data calculation
- KakaoMap integration with the API
- Responsive design
- Packaging and deployment with Electron

Project Contents

Theoretical & Technical Basis



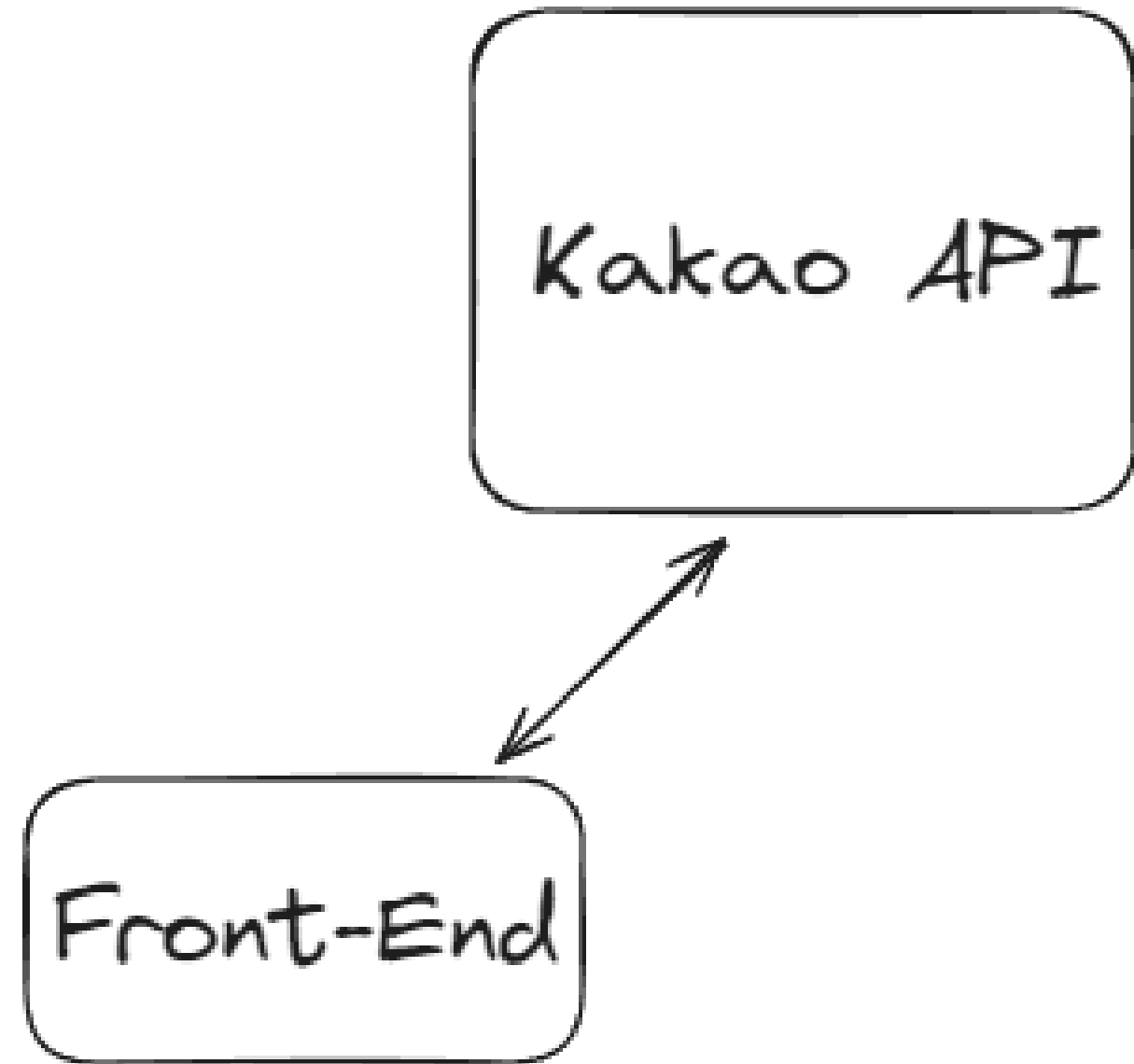
System

Architecture

- AI sends data to the Back-End
 - Front-End requests garbage related data from Back-End
 - Front-End requests vehicle related data from DTG
-
- User Authentication
 - Garbage Collection Information & Statistics
 - Vehicle Runtime Information

Project Contents

Theoretical & Technical Basis



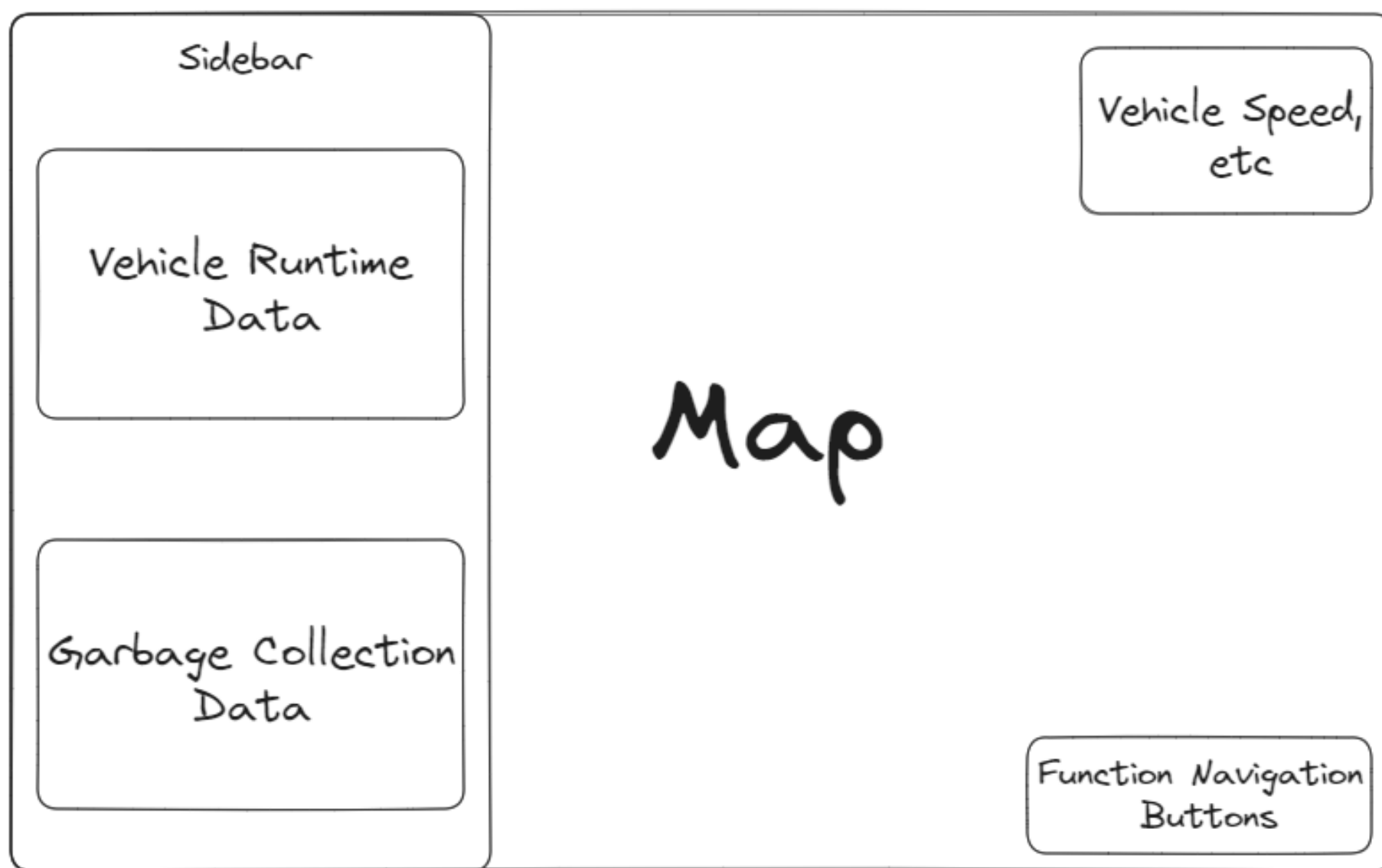
System

Architecture

- Front - End requests mapping related data from Kakao
- Mapping Service
- Location Information & Pathing Service

Project Contents

Conceptual Design



대전 동구 동대전로 171

97% ECO 35.4KM REMAINING DISTANCE

74분 30초	34.6KM	2.6KM
TOTAL RUNNING TIME	TOTAL DISTANCE TRAVELLED	OVERSPEED DISTANCE
28분	2x	1x
IDLE TIME	EXCEEDED SPEED LIMIT	SUDDEN BRAKES

551 ea	2,241 KG		
5L 34	10L 64	20L 112	30L 186
50L 24	75L 42	etc 34	!!! 15



Project Contents

Implemented Design

실시간 현황 BACK

배차 2023-0718-001 첨단1, 2 구역

ECO **97** 점

연속운전	이동거리	과속
0 분 0 초	0 km	0 km
공회전	급가속	급제동
0 분	0 회	0 회

0 ea	5 초	0 kg	
5L 0	10L 0	20L 0	30L 0
50L 0	75L 0	etc 0	!!! 0



The map displays a driving route in a city area. A blue line indicates the path, starting from a point near '운동장3' and ending near '자양치안센터'. Real-time driving data is shown in a green box: speed is 28 km/h, and engine RPM is 1564. The interface includes a search bar, a 'BACK' button, and various icons for navigation and information.

Project Contents

Features

광주85사1004

배차2023-0718-001자양동

Yura Khan

Joe Lee

Bob Kim

수정

확인

...배차정보가 맞으면 **확인** 을 클릭해 주세요...:

(**정정** 을 누르시면 배차정보가 갱신됩니다.)

 기타운영

Login
Page
Authenticated via Back-
End

Project Contents

Features



Main Page

- Connection to emulated DTG
- Garbage data from Back-End
- Map Service & Route Finder

Project Contents

Features

Records Page
File Edit View Window Help

실시간 수거용량

실시간 현황

배차 2023-0718-001 첨단1, 2 구역

ECO 97 점

연속운전	이동거리	과속
0분 47초	0.6km	0.5km
공회전	급가속	급제동
0분	1회	0회

314 ea 5초 32 51 kg

5L	10L	20L	30L
51	61	61	34
50L	75L	etc	!!!
21	22	31	33

차번: 92버 9267
모델: 5톤 덤프식 압착진개차
용량: 11m³ (최대: 5,600kg)

1차 수거



Oth 봉투	0.7 m ³	6%
Etc 봉투	0.53 m ³	5%
75L 봉투	1.88 m ³	17%
50L 봉투	1.75 m ³	16%
30L 봉투	1.35 m ³	12%
20L 봉투	0.7 m ³	6%
10L 봉투	0.6 m ³	5%
5L 봉투	0.78 m ³	7%
Mty 공간	2.71 m ³	25%

2차 수거



Oth 봉투	1.16 m ³	11%
Etc 봉투	1.09 m ³	10%
75L 봉투	1.65 m ³	15%
50L 봉투	1.05 m ³	10%
30L 봉투	1.02 m ³	9%
20L 봉투	1.22 m ³	11%
10L 봉투	0.61 m ³	6%
5L 봉투	0.26 m ³	2%
Mty 공간	2.94 m ³	27%

Records
Page

Expected Effects

Environmental:

- **Reduced carbon footprint: optimized routes can decrease fuel consumption and emissions, leading to a smaller environmental impact**
- **Improved waste management: accurate prediction of waste levels can optimize collection schedules, preventing overflowing bins and litter**
- **Enhanced recycling potential: data on waste composition can inform recycling initiatives and promote resource recovery**

Expected Effects

Social:

- **Improved public health: efficient waste collection reduces exposure to health hazards associated with overflowing bins and improper disposal**
- **Increased community satisfaction: residents benefit from cleaner streets, and improved overall sanitation**
- **Enhanced job satisfaction for waste management workers: optimized routes can decrease workload, reduce stress, and improve safety for drivers**

Expected Effects

Economic:

- **Cost savings for waste management companies: optimized routes can save on fuel, maintenance, and labor costs.**
- **Improved resource allocation: accurate data on waste generation can inform investments in infrastructure and waste management services.**

Utilization

1. Pilot Program:

- Implement the app on a limited scale to test its effectiveness and gather civilians' feedback
- Collect data on fuel consumption, route efficiency, and user satisfaction

2. Expansion and Refinement:

- Based on pilot program results, refine the app and address user feedback
- Partner with technology companies and data analytics firms to offer a comprehensive solution

3. Scalability and Sustainability:

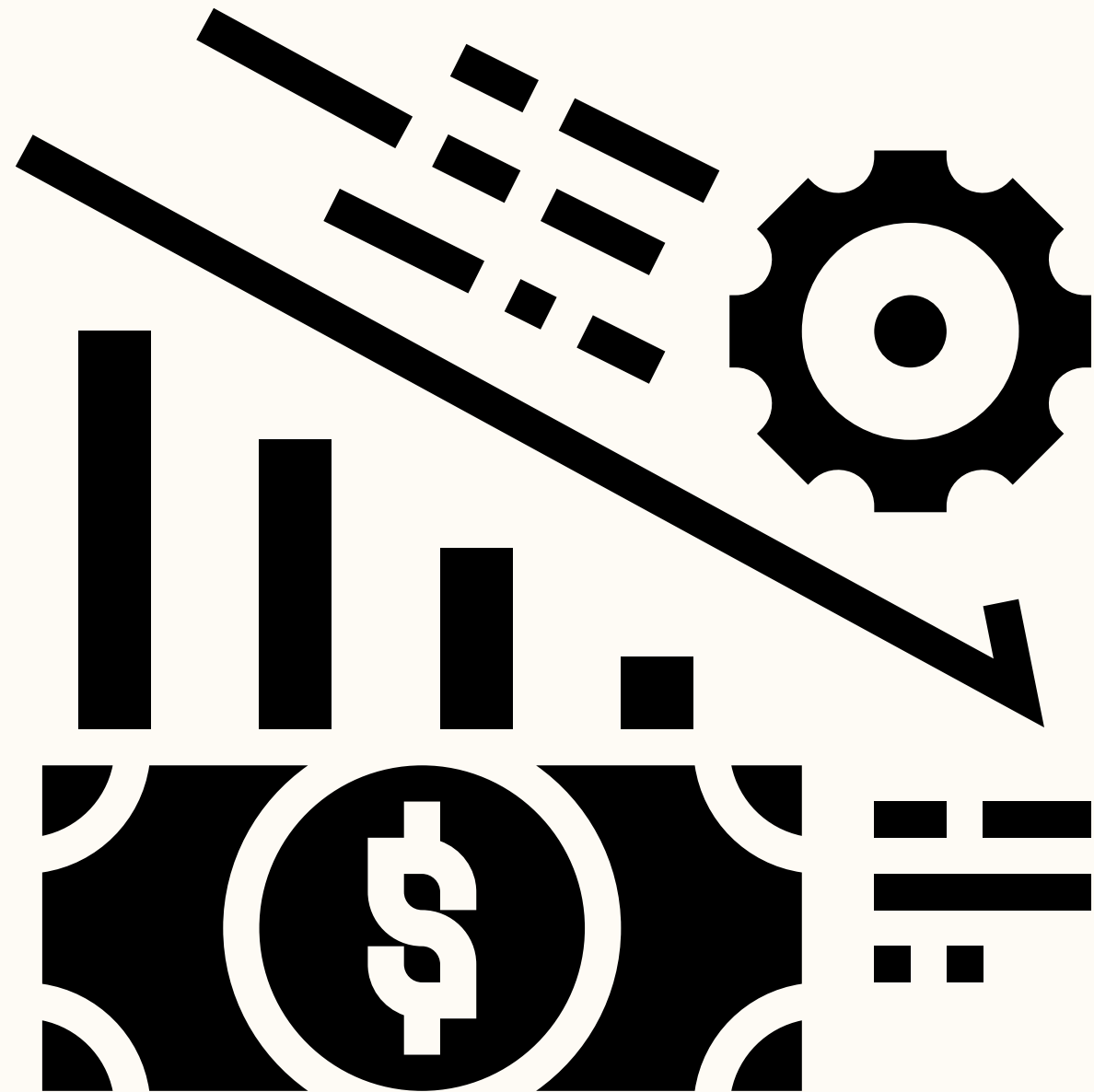
- Develop a scalable architecture to accommodate growth and integration with various waste management systems
- Develop a long-term strategy for continuous improvement and innovation

Challenges and Considerations

- **Infrastructure integration: compatibility with existing waste management systems and hardware needs to be established**
- **User adoption: convincing waste management companies and drivers to adopt the new technology might require training and incentives**
- **Regulatory compliance: adapting the app to meet local regulations and waste management practices is crucial**



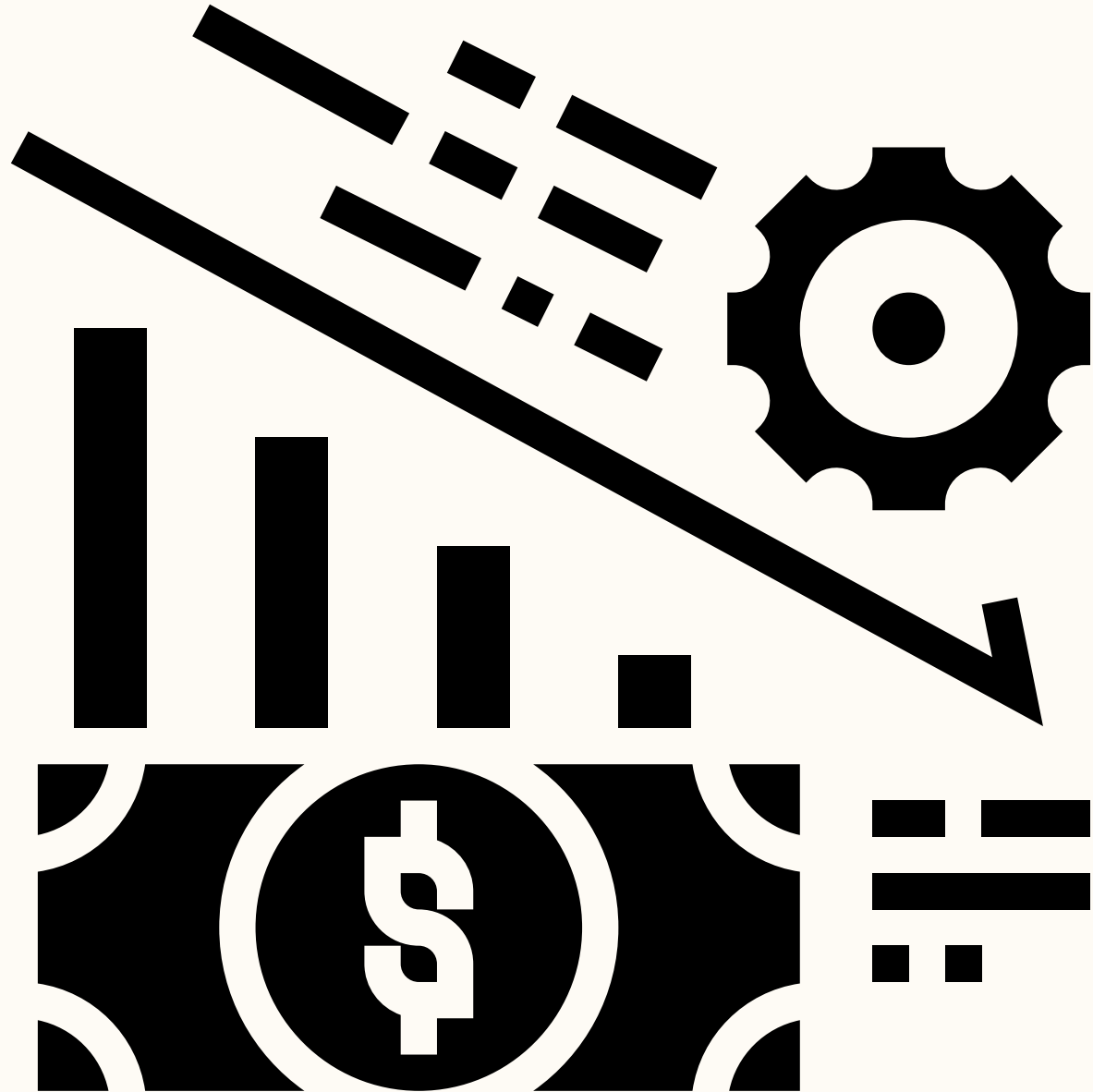
Cost Analysis & Role Distribution



Role Distribution:

- Aleskei (manage team and review code)
- Justin (integrate KakaoMap)
- Ali (apply css style)
- Akhmadjon (add dynamic with JS)
- 한승헌 (create HTML-markup)

Cost Analysis & Role Distribution



	Cost
ESG,00-2 Display	96,360원
Kakao API	—
Google API	—

*Kakao and Google API was free during development, costs are priced based on usage