Empowered Mobility with DogeEye

Mobile and Ubiquitous Computing Project Proposal

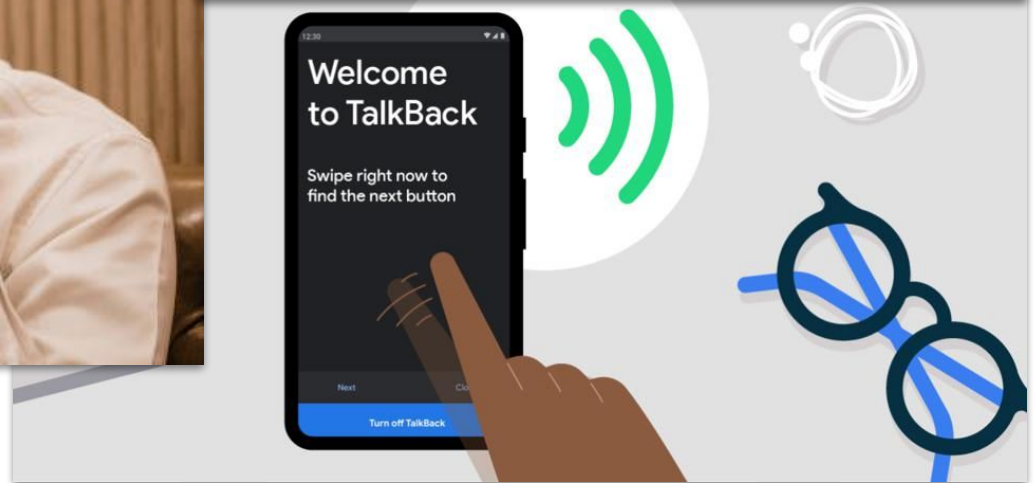# DogeEye

WOW

SUCH
SURPRISE

Team 7

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Yes, we use smartphones

- Visually impaired people are benefiting a lot from the recent technical advances, especially of smartphones

Can you see what's wrong?

Can you see what's wrong?

- **The mobility of visually impaired people** has always been an issue that was never properly dealt with

Problems Caused by Immobility

- (As we all know,) **lack of exercises** means higher (X3) risk of serious chronic conditions such as heart diseases, diabetes and cancers
- Visually impaired people are **more likely to experience mental issues** such as depression, anxiety and loneliness, etc. (1.6-2.8-times more likely to develop depression)
- Immobility itself can also cause mental problems.
- People with poor mental health are likely to become less active -> **vicious cycle**

Motivation

- Smartphones and recent technical advances empowered visually impaired people, but there is still room for improvement **regarding the mobility** of the visually impaired

- Moreover, immobility entailed by visual impairments also restrict them **mentally.**

- We need **a solution** that not only enhances the mobility **by helping them to move,** but also by giving them **motivations to move**

Existing Solutions

- BlindSquare: Voice Navigation
- OrCam MyEye 2: Accessibility device
- Seeing AI: Scene Detection

Existing Solutions: Limitations

Feature Side

- focuses only on the navigation
- or cannot be used while/with navigating
- **lack of motivation for travel**

Technical Side

- the navigation service doesn't make use of the **camera** on the phone
- relies on the **predefined inputs**
- or requires some **additional devices**

Key Solution

2 ways of enhancing mobility

- Helping
  - **Navigation**
  - **Obstacle alarm** while navigating
  - **Audio scene description** as a navigation

- Motivation
  - **Personal history** of photos with history and records
  - **Records** of quantified information on one's mobility
    - presented in the form of achievements, scoreboards, etc, …
  - **Daily summary** at the beginning / the end of a day

Usage Scenario

Usage Scenario

-   AM 7:30 wakes up, the app provides **today's summary** with weather reports and hints for the **possible achievement** of the day

-   AM 8:30 the app **sets the destination** to the workplace, and start navigating

-   AM 8:45 using the **real-time image captioning** feature, can **avoid the puddle** from the rain on the road

-   PM 12:15 while looking for a place for lunch, the app **automatically recommends nearby restaurants**
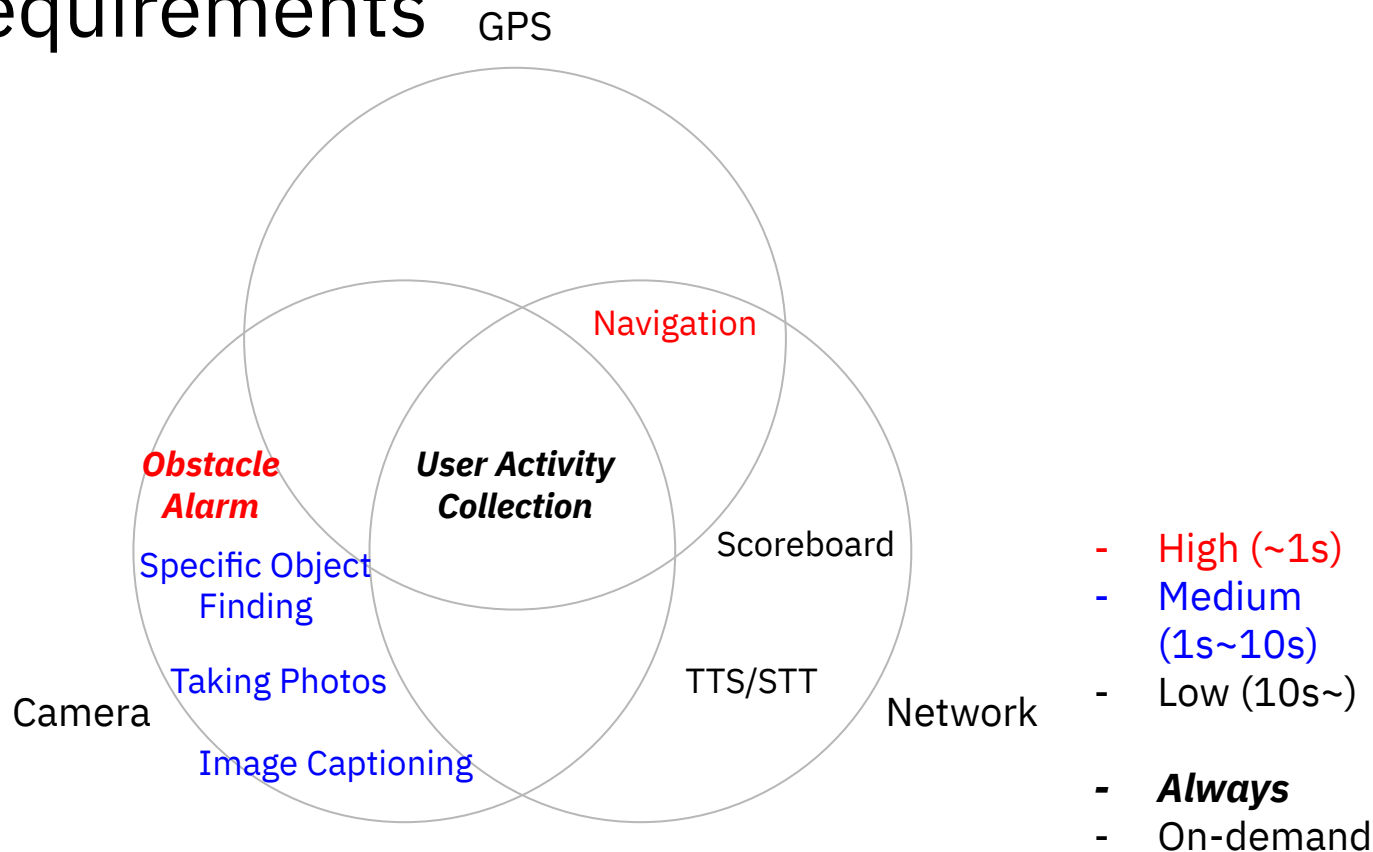
Usage Scenario

- PM 6:15 on the way home, the app, after seeing through the camera, **reports that the bus** is already full, so skips the bus and takes the next one

- PM 7:00 when got home, the app detects they're home, and notifies the user that **they unlocked the new achievements:** going to a new place for lunch and also that the total distance traveled reached 1,000km

System Overview

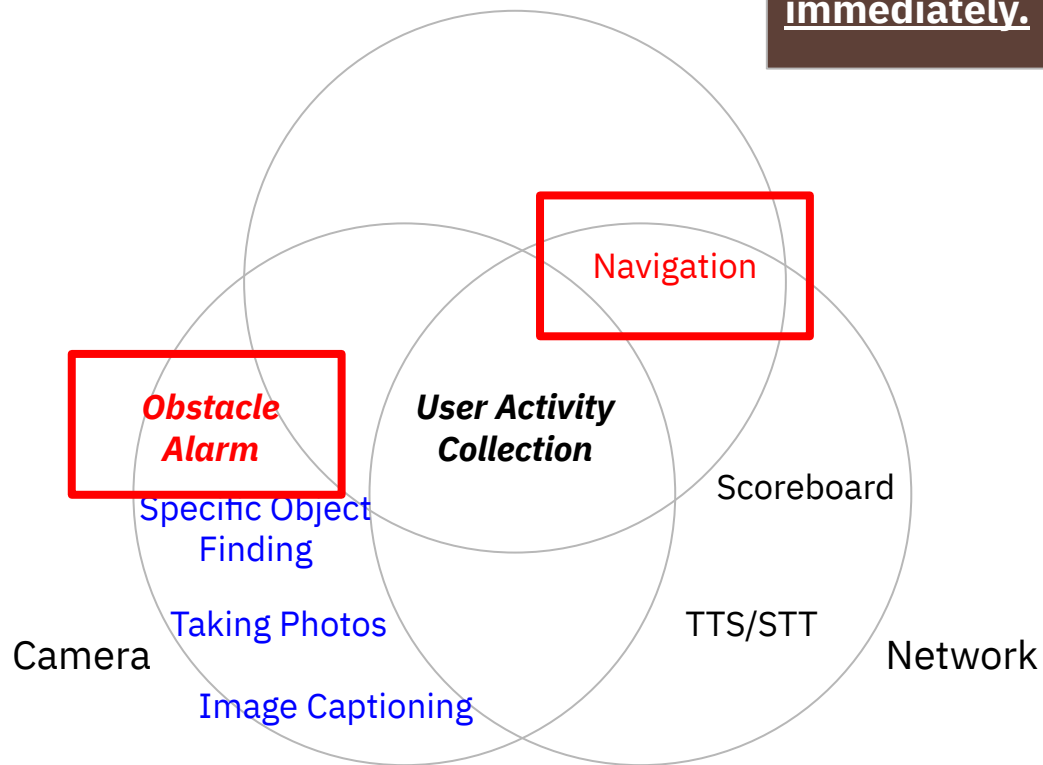# System Requirements

GPS

Navigation

Obstacle Alarm

User Activity Collection

Specific Object Finding

Scoreboard

Taking Photos

TTS/STT

Camera

Network

Image Captioning

- High (~1s)
- Medium (1s~10s)
- Low (10s~)

- *Always*
- On-demand

System Requirements

GPS

Navigation

Obstacle Alarm

User Activity Collection

Specific Object Finding

Scoreboard

Taking Photos

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Camera

Network

Image Captioning

Observation 1:

Some tasks need to be run immediately.

- High (~1s)
- Medium (1s~10s)
- Low (10s~)

- *Always*
- On-demand

System Requirements

GPS

Navigation

Obstacle Alarm

User Activity Collection

Specific Object Finding

Scoreboard

Taking Photos

TTS/STT

Camera

Network

Image Captioning

Observation 2:

The application we want to build is power-hungry.

- High (~1s)
- Medium (1s~10s)
- Low (10s~)
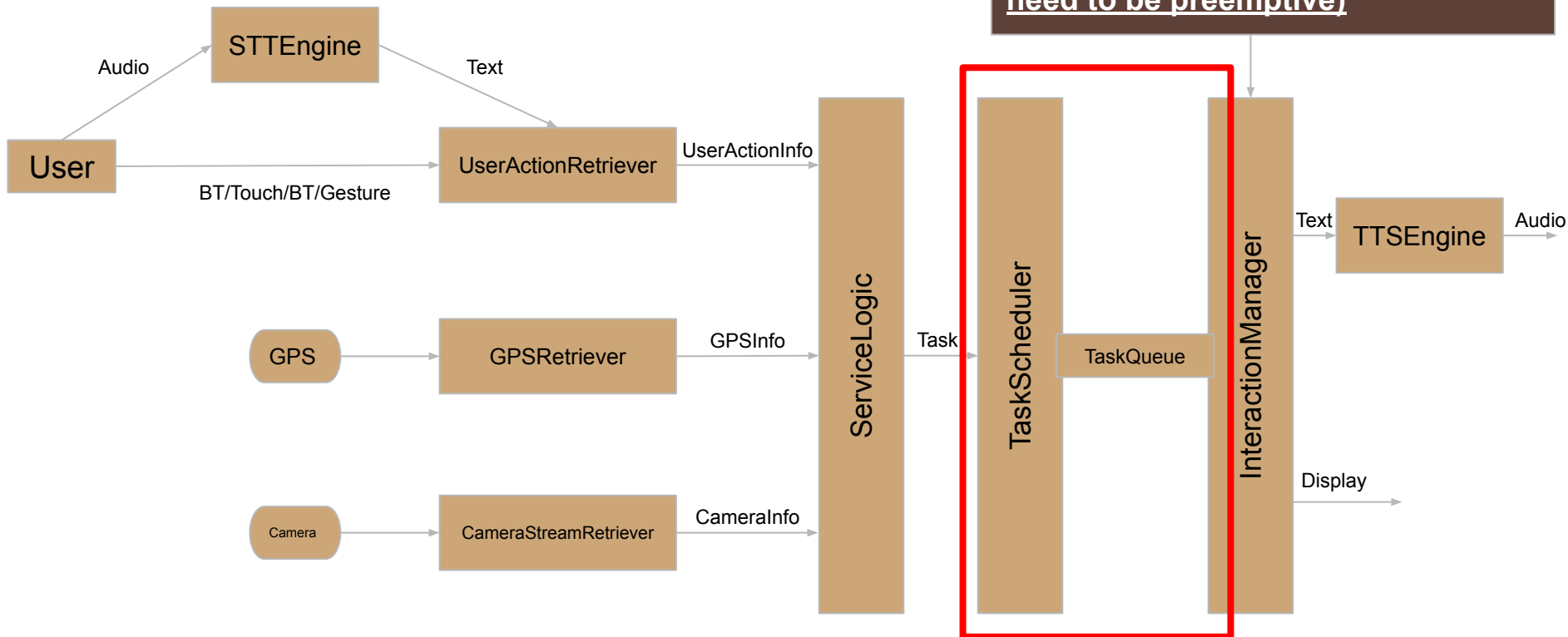
- *Always*
- On-demand
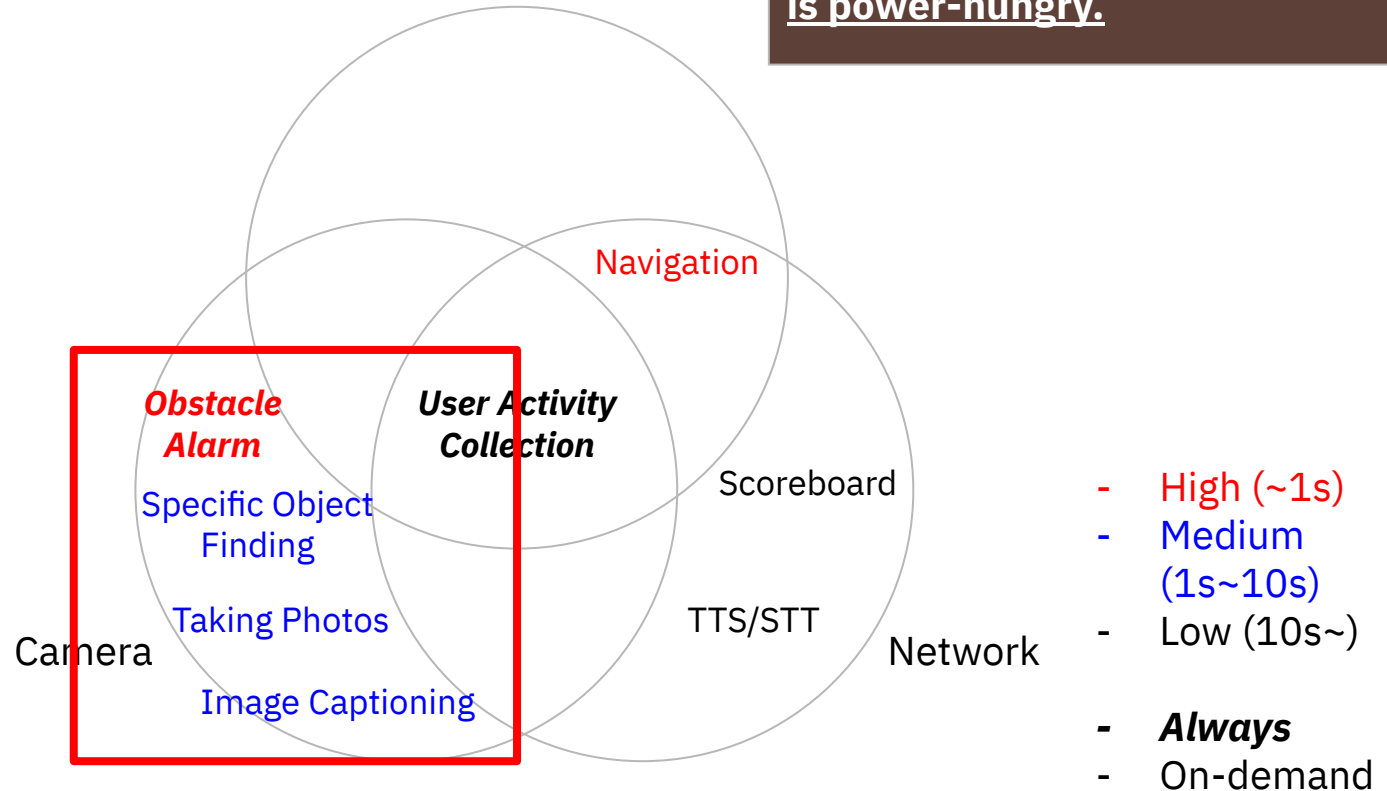
System Design Overview (Tentative)
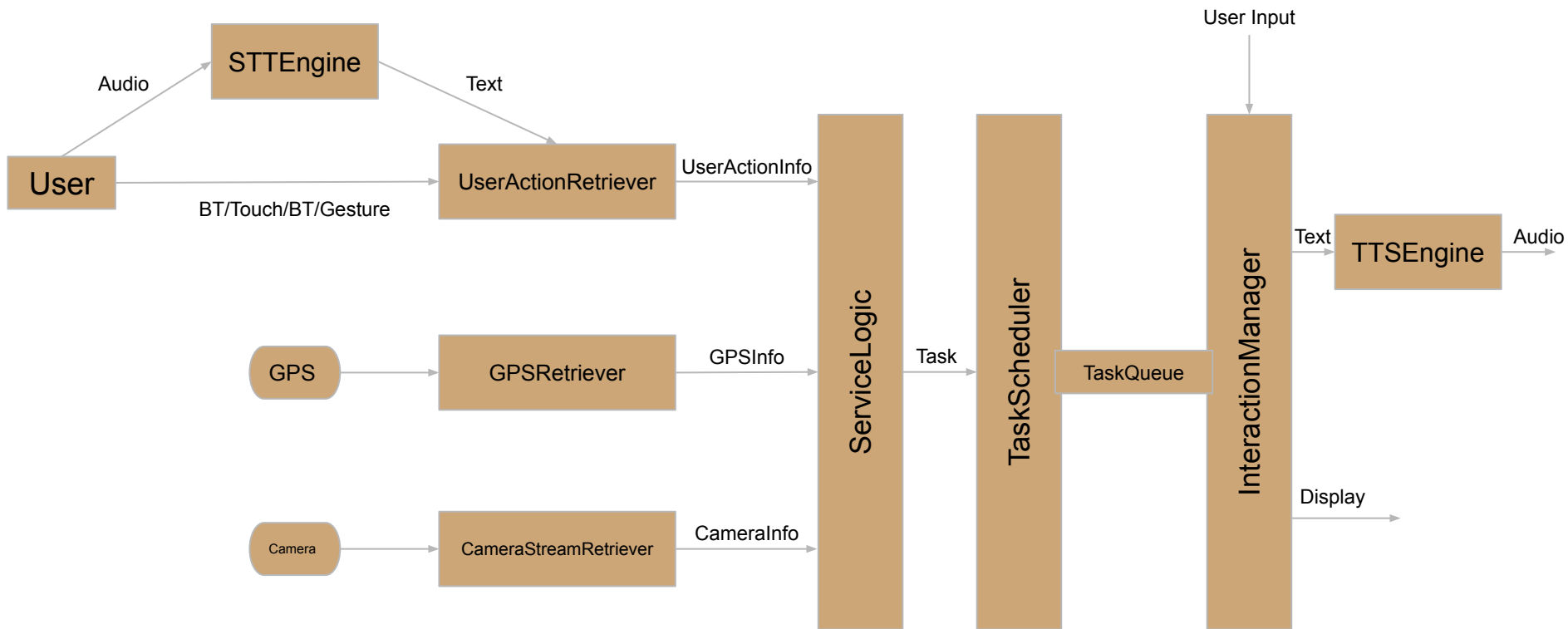
System Design Overview (Tentative)

Design Point 1:

Task scheduling scheme needed to tackle the Observation 1. (Maybe need to be preemptive)
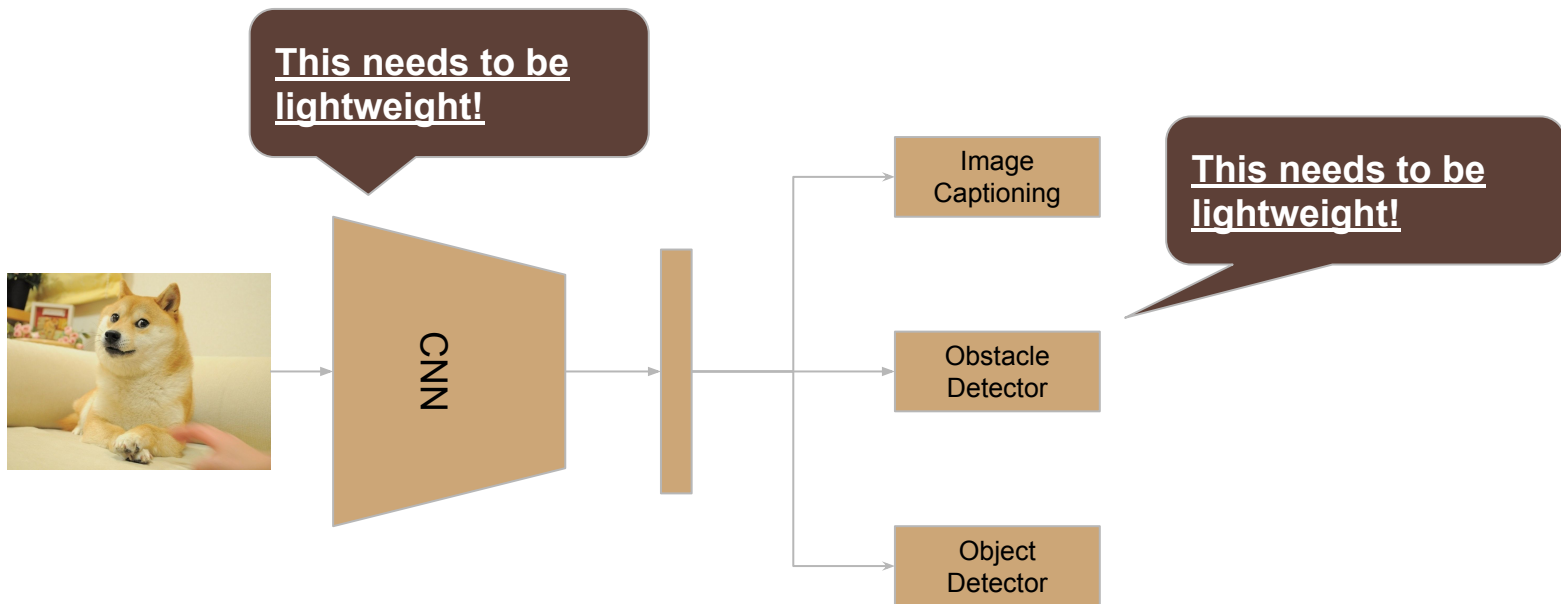
Evaluation Strategy

- **User Experience**
  - Evaluate how much relieved users feel on moving to an unknown destination
  - Evaluate motivation of users to collect achievement score

- **Feature Completion**
  - Accuracy of image captioning
    - Evaluate whether captions achieve a specific threshold of BLEU-score

  - Quality of daily summary
    - Evaluate whether we make up proper daily summary based on daily activity data

  - Quality of achievement detection
    - Evaluate whether we detect if users activities are involved as one of achievements correctly

  - Power usage of the application
    - Measure the available execution time of our application

Project Plan (1/2)

Task	Worker	3/28-4/3 W5	4/4-4/10 W6	4/11-4/17 W7	4/18-4/24 W8	4/25-5/1 W9	5/2-5/8 W10	5/9-5/15 W11	5/16-5/22 W12	5/23-5/29 W13	5/30-6/5 W14	6/6-6/12 W15
Set up development environment	All											
System design (use case & component)	All	▓										
Set up base application & basic GUI	CJ, MJ		▓									
Navigation function	BH, MH		▓	▓								
Attach TTS / STT models	BH, MH			▓	▓							
Implement Object Detection feature	CJ, MJ			▓	▓							
Image Captioning model exploration	CJ, MJ				▓	▓						
Prepare for mid-term presentation	All					▓	**5/2**					

Project Plan (2/2)

Task	Worker	3/28-4/3 W5	4/4-4/10 W6	4/11-4/17 W7	4/18-4/24 W8	4/25-5/1 W9	5/2-5/8 W10	5/9-5/15 W11	5/16-5/22 W12	5/23-5/29 W13	5/30-6/5 W14	6/6-6/12 W15
Implement Image Captioning	BH, MH											
Storing daily activity log and server setup	CJ, MJ											
Implement Daily summary feature	CJ, MJ											
Implement Achievement system	BH, MH											
Impelment Score board feature	BH, MH											
Prepare for final presentation	All											
Project Due	All											6/6

Final Deliverable

- Mobile Application
  - helps blind people to move around and be more active in their daily life
- Server
  - collects users achievement score and gives rank data for scoreboard module

Success criteria

- Does navigation module help users to arrive on their destination well?

- Does achievement/scoreboard module motivate users to be more active?

- Can image captioning module make meaningful feedback for users?

- Does this app have sustainable amount of power usage?

Thank you! 😃