

DogeWalk: a companion

Final Presentation



Team 7

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MOTIVATIONS

MAIN MOTIVATIONS

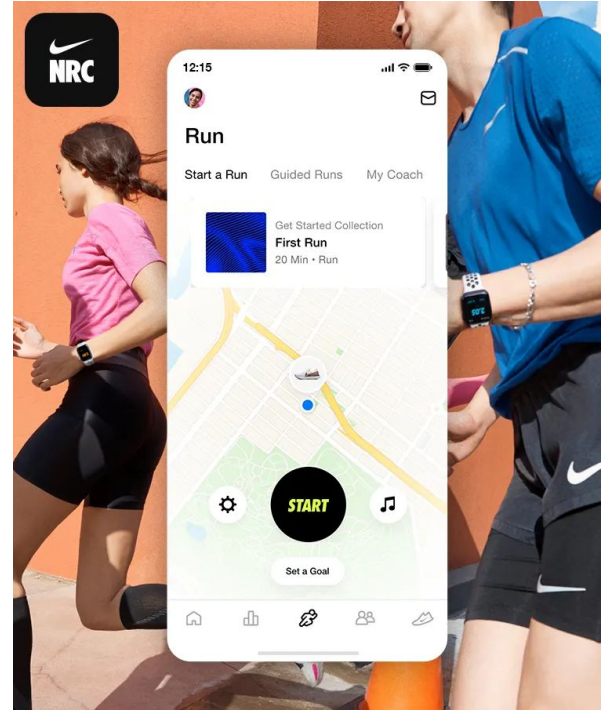
- Limited mobility of the visually impaired people
- Immobility also restricts them mentally (depression, anxiety or loneliness)

CHALLENGES

- We cannot change the physical world
- What would be the best way to encourage them?

PROPOSED IDEA

- What would be the best way to make visually impaired people go out?
 - Usual **gamification**
 - The gamified way of assistant
 - Share their progress with friends
 - Guided photo taking features
 - Automatic image captioning
 - Recommendation for good locations
 - More accessible places for users
 - “Barrier-free” courses



INTERVIEWS WITH TARGET USER

To further refine our project and find right direction, we had interviews with target users

Interviewees:

3 partially blind people

- 2 men in 30s, 1 woman in 20s
- Uses Android phones
- Participated as interviewees for some similar projects in the past

INTERVIEWS WITH TARGET USER

EXPECTED

- They prefer a **simple UI** with big fonts
- They experience difficulties with services of complex UI which only takes normal people into account
- They prefer to go places already familiar

UNEXPECTED

- Majority of the visually impaired people are **partially blind**, they use their phone with “eyes” (with some aids)
- They also **take photos**, though they can't clearly see
- Even completely blind people already enjoy **taking selfies** and sharing them to friends(!)

DEMO

ANDROID TALKBACK

What is TalkBack

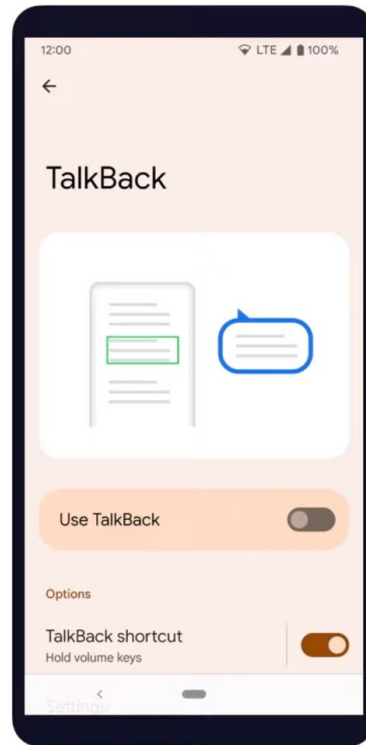
- Provides spoken feedback so that users can navigate their devices without looking at the screen

How to use TalkBack

- Swipe right or left to move between items
- Double-tap to activate an item
- Drag 2 fingers to scroll

How useful

- All our interviewees are using TalkBack and said that it helps a lot!



MAIN SCENARIO DEMO



TECHNICAL DETAILS

Technical Challenges

Challenge #1: GPS location fluctuation leads to

- Distorted total distance
 - Accumulated noises
- Inaccurate initial position
 - Quantum jump from out of sense location
 - Waste of computing on the useless data
- Providing strange information
 - When the walk starts, the location information could mislead the user

Technical Challenges

Challenge #2: Real-time image captioning consumes a lot of power

- Simultaneously using camera and running DNN model is required
- Although lightweight DNNs are used, continuous executing DNN pipeline consumes a significant amount of power

Solution Approaches

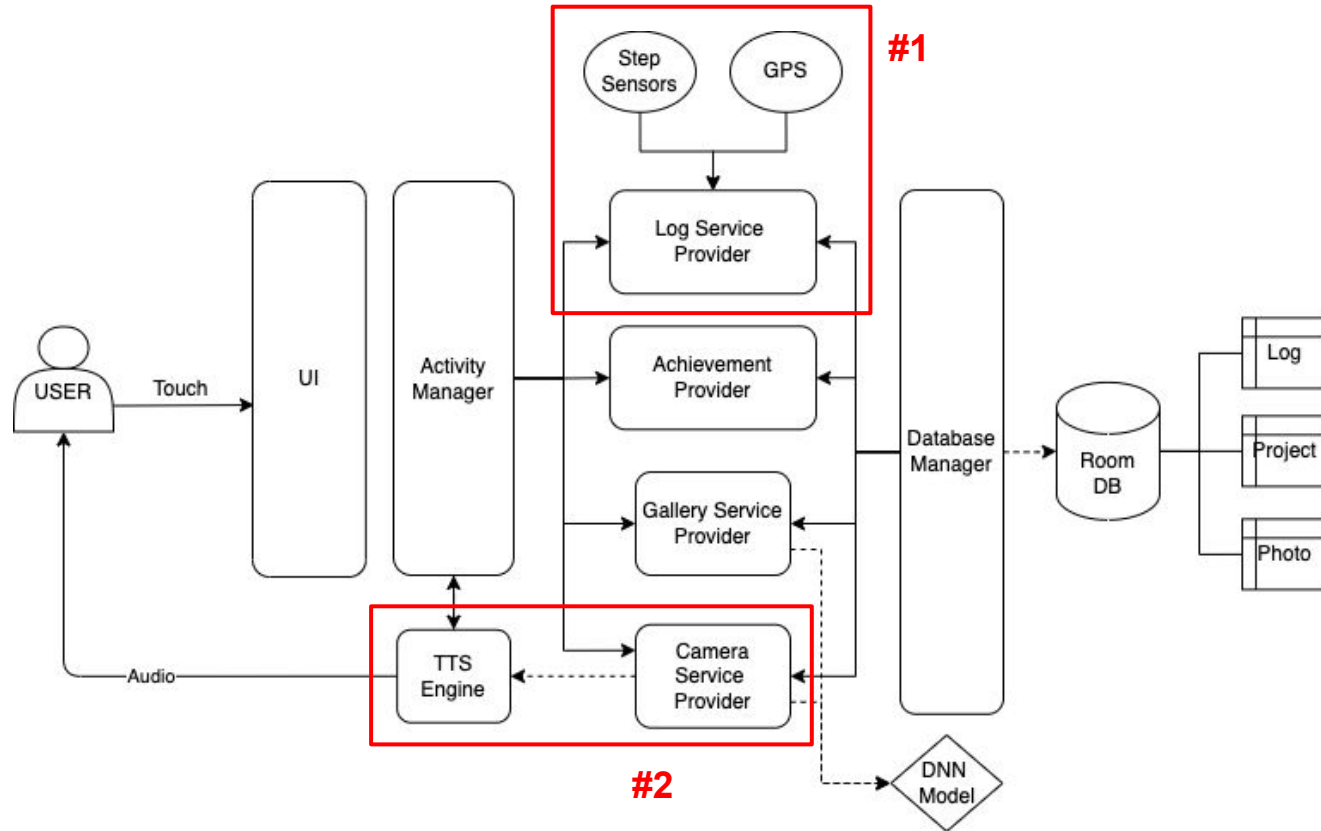
Solution #1: Buffering and Adaptive Update

- Filtering initial unreliable values
- Buffer location log and average them to mitigate the noises
- Update only when step count increases
 - Can reduce thread work and save battery usage

Solution #2: Don't think when I talk

- Uttering about every frame rather hinders the user
- Inference when TTS is not speaking, disable otherwise

System Architecture Overview

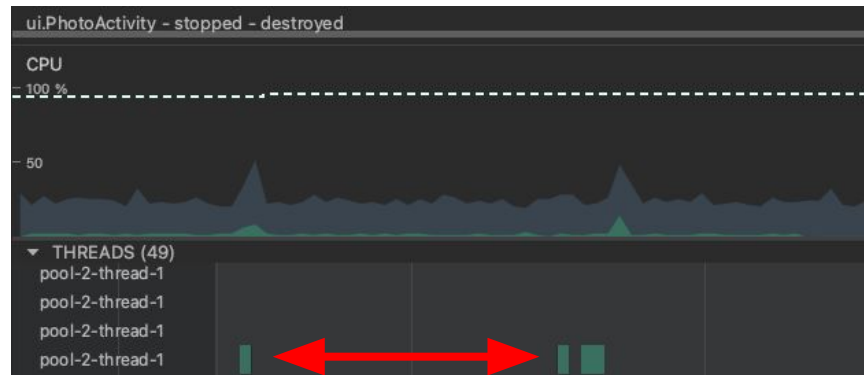
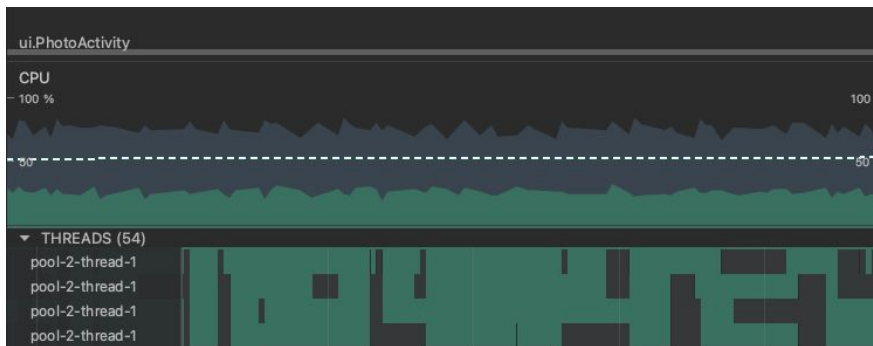


Key Techniques

- Image Captioning
 - Android CameraX API / TensorFlow Lite
 - To notify the content of photo
- Recording
 - GPS & Step Counter / Google Maps API / RoomDB for storing logs
- Social Media Posting
 - An image with summary can be shared to other apps
- TTS / TalkBack Screen Reader
 - Google TTS engine / Android's Built-in Accessibility Feature (TalkBack)
- Achievements & Leaderboard
 - Google Play Game Services API

Technical Evaluation

- Dropping frames while the TTS module speaking significantly reduces the system-wide CPU utilization from $<90\%$ to $<50\%$, resulting in less power consumption



TTS Speaking

FINAL DELIVERABLE & SUCCESS CRITERIA

FINAL DELIVERABLE

- Mobile Application

DogeWalk: Encourages visually impaired people to move around and to be more physically active in their daily lives

SUCCESS CRITERIA

- General **satisfaction** from the users (based on visually impaired interviewees)
- Can image captioning camera capture **meaningful memory** for users?
- Does achievement/leaderboard module motivate users to **communicate**?
- Does this app have sustainable amount of **power usage**?

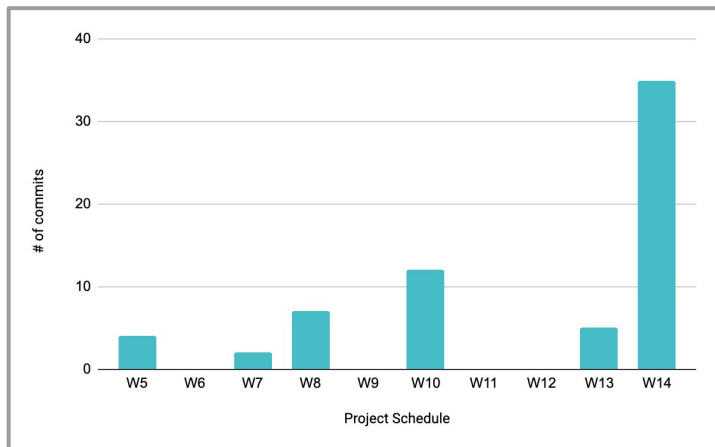
PROJECT MANAGEMENT

TIMELINE: ROLES & CONTRIBUTIONS

Week	Major Task
W6	<ul style="list-style-type: none">• Record GPS, step count sensing (BH)• TTS and STT module (MH)• PlayStore achievement api check (CJ)• Image captioning model exploration (MJ)
W7	<ul style="list-style-type: none">• Achievement system (CJ)• Camera, personal photos feature (MJ)• Setup database for record (BH)
W8	<ul style="list-style-type: none">• Frontend user interface (MH)
W12	<ul style="list-style-type: none">• Quest planning (All)• Target user interview (MH)
W13	<ul style="list-style-type: none">• Daily summary feature (CJ)• Selfie feature (MJ)• User log screen (BH)
W14	<ul style="list-style-type: none">• Share to SNS (CJ)• Place recommendation (MH)• User log detail screen (BH)• Build custom gallery (MJ)

GIT USAGE

WEEKLY COMMIT BREAKDOWN



LINES OF CODE

Language	files	blank	comment	code
Java	36	787	173	3432
XML	49	315	82	2016
Gradle	3	14	1	104
ETC
SUM	93	1164	312	5747

LESSON LEARNT & REFLECTIONS

LESSON

- Visually impaired people's environment worse than thought
- Difficult evaluation of overall quality
- Evaluation metrics in the paper does not represent the performance in the real world

REFLECTION

- Time management
- Work distributions for developers
- Importance of code reviews
- Lack of understanding of minorities in society

THANK YOU 😊