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Mechanisms to Raise Awareness about Smartwatch Data Collection

Lab Course on Computer Security and Privacy

Summary

- Introduction
- Foundations
- Related Work
- Approach
- Demo
- Discussion
- Conclusion

Introduction

- Privacy paradox
  - Users have concerns about smartwatches [1],[2]
  - They do not act accordingly/misunderstand them [8]
- How do we raise awareness?
- Our solution:
  - Application that collects data in a transparent way
  - Shows feedback to the user when sensor data is collected

Foundations – Smartwatches

- What is a smartwatch ?
- Features
  - Have WiFi/Bluetooth connectivity
  - Support mobile applications
  - Have their own operating system
  - Peripheral devices (sensors)
- Our research: Samsung Galaxy Watch 3
- Uses Tizen OS

Source: https://commons.wikimedia.org/wiki/File:Samsung_Galaxy_Watch_3.png

Foundations – Tizen Applications

- .NET applications – C# based
  - Managed run-time
  - Safe code
  - Fast development
- Xamarin Forms
- TizenFX

Source: https://commons.wikimedia.org/wiki/File:Samsung_Galaxy_Watch_3.png

Related work

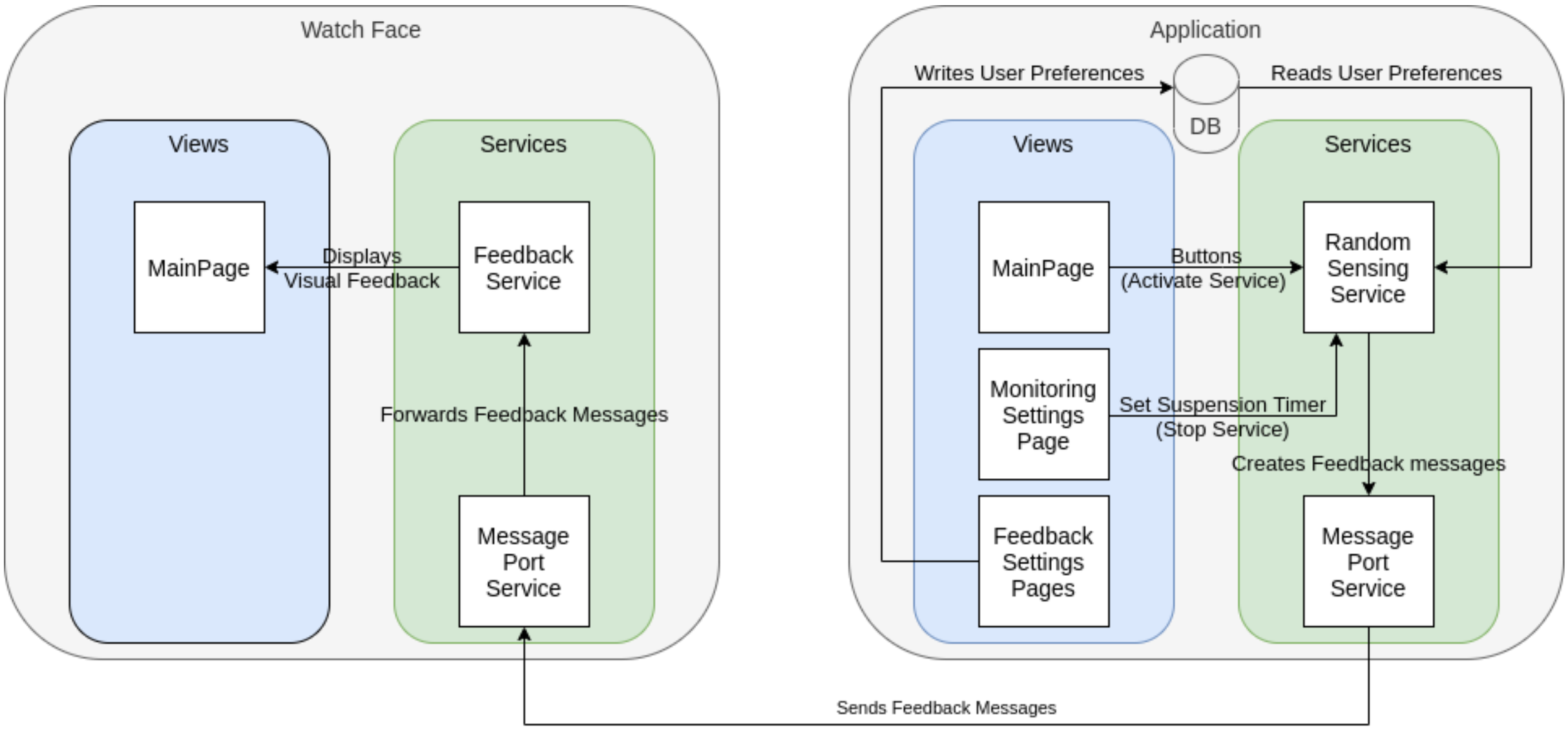
- Users have wearable privacy concerns [1], [2]
  - But also misunderstandings and false beliefs [8]

  → Important to raise awareness
- Various apps giving context-dependent feedback
  - Haptic feedback for pedestrian navigation [3]
  - Visual and haptic feedback to assist deaf people [4]
  - Visual feedback to assist rescuers during CPR [5]
- Both together?
  - Study to question the impact of timing of privacy feedback on UX [7]
  - Serious game to raise awareness [6]

Approach – System requirements

- System → Detect sensor accesses → Notify the user
- User → Suspend the sensor usage
- User Interface → Designed following the general principles
- Feedbacks → Adapted to the core settings of the device
- Communication → Minimal, fast and efficient
- User → Should feel comfortable and have control over their privacy

Approach – System Overview



Approach – Services I

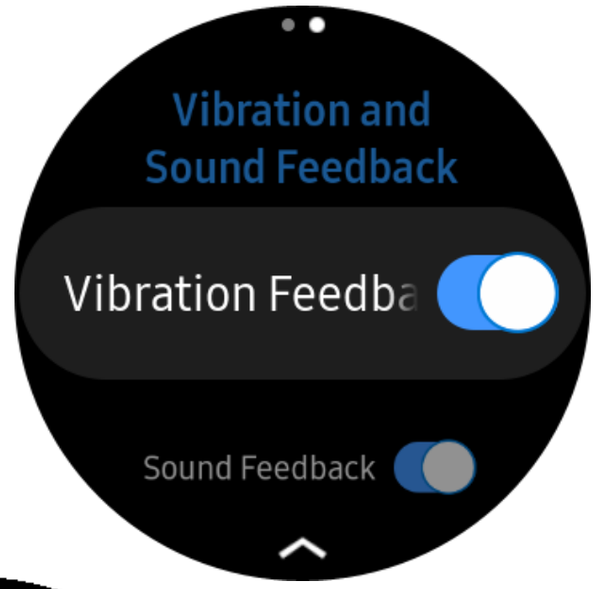
- Human activity services:
  - Health – Heart rate monitor
  - Location – GPS
  - Activity – Pedometer
- Privacy permission service
  - Checks and asks the user for privileges
    - E.g. Sensor access privilege

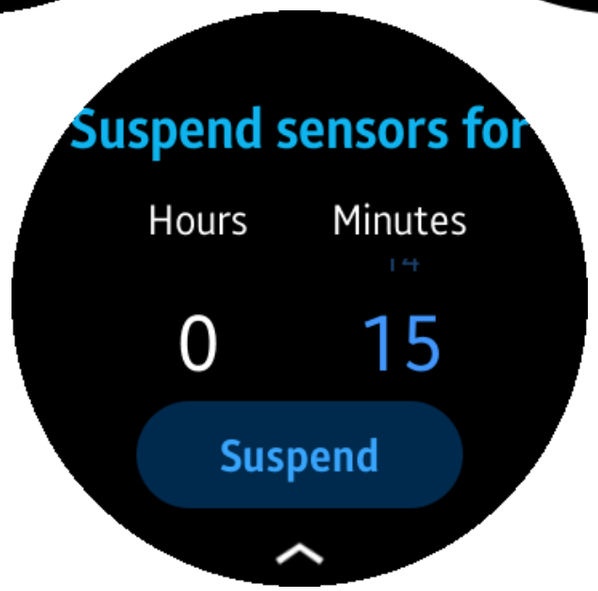
Approach – Services II

- Random sensing service – 4 different actions:
  - Start one random service
  - Start the max amount of services
  - Stop one random service
  - Stop all services
- Message port service
  - Creates a communication channel between Watch Face and Main App
- Feedback service
  - Receives feedback messages
  - Transforms them into actual feedback

Approach – Main Application

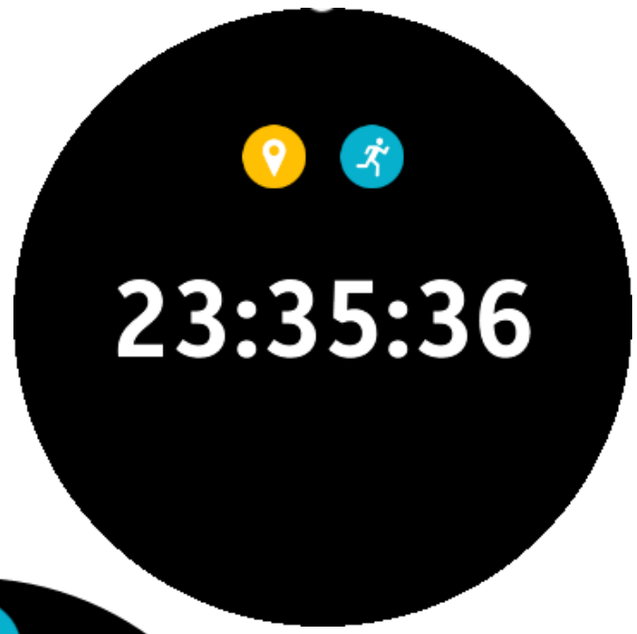
- Main page
  - Single button:
    - Triggers random sensing
    - For testing purposes
- Visual feedback settings
  - Radio box list to choose feedback
- Other feedback settings
  - Switches to toggle vibration and sound
- Sensors suspension setting

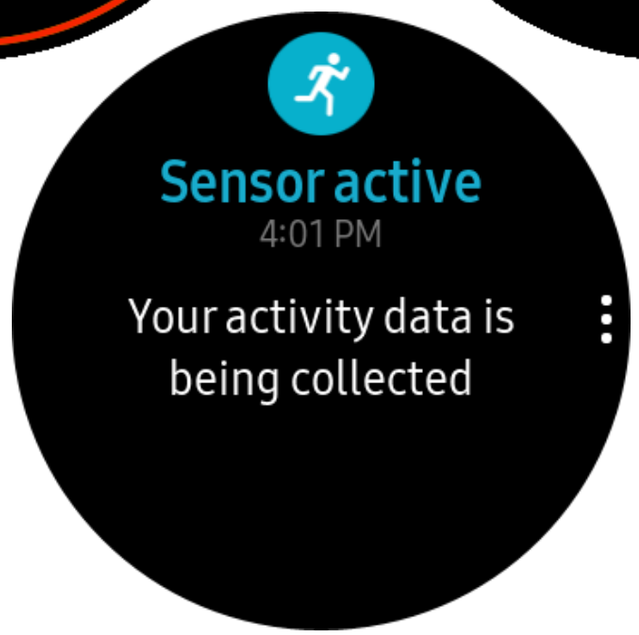




Approach – Watch Face

- Shows time
- Shows visual feedback:
  - Ring feedback
  - Icon feedback
  - Notification feedback
- Can trigger other feedback:
  - Vibration
  - Sound
- Ambient mode





Discussion - First approach

- Global sensor monitoring application
- Detects when a sensor is accessed by other apps
  - Triggers feedback
- **Not feasible**
  - No API to know if a sensor is being used outside of the app
  - Required info present in system log
    - But app has no read access

Demo

Discussion - Second approach

- Advantages
  - Good granularity of feedback
    - Different combinations/intensities of feedback
  - Gives control to user
    - Can suspend sensor access with timer
  - Designed to be shared
    - Separated Watch Face + Main App
- Limits
  - Less generic than first approach
  - Still only a prototype
  - Can be bypassed by user

Conclusion

- Lack of APIs to have global information about sensors
- Developers must implement transparency mechanisms themselves
- Our solution:
  - Aims to put users in control + raise data collection awareness

  → Case Study necessary to assess efficiency
  - To be shared to community?

Thanks for your attention!

Do you have any questions?

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