Indoor Navigation
Indoor Navigation in the TU-Mensa

Lennart Oldenburg, Andreas Hechenberger, Jan Meznarič, Eridy Lukau
Department of Telecommunication Systems Service-centric Networking
Technische Universität Berlin

WS 2015/2016

Problem scenario & questions

Technology overview

Our approach

Timeline
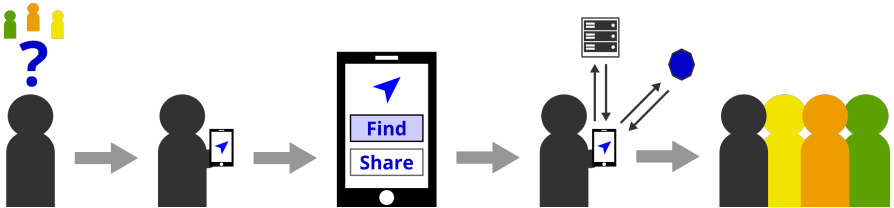
Problem scenario & questions

Find friends:

1 of **6** user stories.
Result in use cases which direct development steps.

- ► How to get own position inside buildings?

- ► How to find other people inside buildings?

- ► Which privacy and security concern can be addressed?

- No GPS signal inside buildings => topic **Indoor navigation**.

- Indoor maps are not as widely available as outdoor maps.

- Users don't want to interact with mobile device every time they go to mensa.

- Hard to determine accurate location. Is region based positioning enough?

- WiFi, Bluetooth, NFC, QR-Code, manual position pinning[BL09].

- todo: Add technology matrix (last meeting)

- ▶ With use of tubIT API.

- ▶ Provides building name, floor, coordinates.

- ▶ Problem: no coordinates in mensa and library, inaccurate coordinates elsewhere.

- ▶ Estimote beacons

- ▶ Possible positioning approaches
  - ▶ Indoor-Region Based Navigation
  - ▶ Live Indoor-Location Feedback Navigation
  - ▶ D2D Indoor-Navigation via Virtual Beacons

- ▶ Problem: possibly high battery usage

NFC

- ▸ Precondition: NFC tag on every table in mensa.
- ▸ Scenario: First group member that sits down puts phone on the table, phone reads tag and sends location to other group members.
- ▸ Cons: Requires user putting phone on table. High cost of initial NFC tags set-up. Requires NFC-enabled mobile device.

QR code

- ▸ Precondition: QR code on every table in mensa.
- ▸ Scenario: First group member that sits down scans QR code on the table, phone sends location to other group members.
- ▸ Cons: Requires user scanning codes; impractical, time-consuming.

► Fallback option, if no location can be received automatically.

► User will have option, to pin own location inside mobile application.

► Useful in cases of broken infrastructure (WiFi is down, dead batteries in Bluetooth beacons...).

► Provides alternative for users with high privacy concerns who don't want to automatically share their locations.

- Which **localisation technique** is the most **precise** one?

- How much will location tracking **drain** the **battery**?

- How can we ensure the **user's privacy** is **not violated**?

- How much **interaction** with mobile device are **users** willing to do?

	Accuracy	Battery Consumption	User Interaction	Platform Independency
iBeacon (Bluetooth LE)	👍	👍	👍	👍
Bluetooth/Pairing (Device to Device)	👎 (yellow)	👎 (red)	👎 (red)	👍
WiFi (Localization)	👎 (yellow)	👎 (yellow)	👍	👍
NFC (Check-In)	👍	👍	👍	👎 (red)
QR-Code (Check-In)	👍	👍	👎 (red)	👎 (red)

- todo: Add graphic - include (at least): Android app, iOS app, loca

Location technique

- ▶ Mixture between WiFi and BLE
- ▶ Rough: tubIT WiFi localisation
- ▶ Precise: Probably estimote beacons

Backend

- ▶ Handles user management
- ▶ Uses tubIT federation for authentication
- ▶ Provides REST API for clients

Mobile

- ▶ Android and iOS applications
- ▶ Using vendor and probably estimote's SDKs
- ▶ Only basic design

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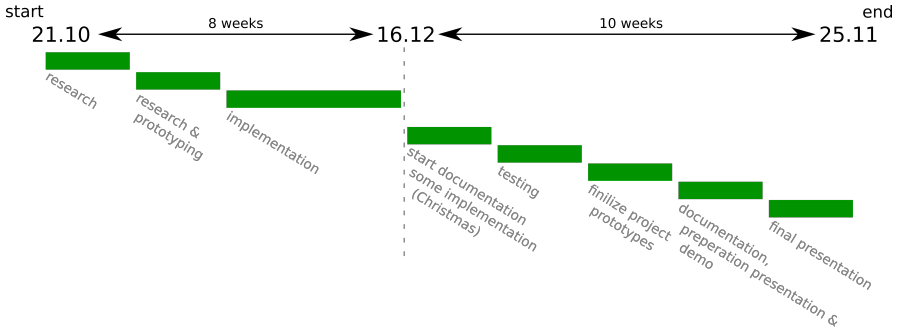
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start
21.10   8 weeks   16.12   10 weeks   end
                                                                                                         25.11

research

research &
prototyping

implementation

start documentation
some implementation
(Christmas)

testing

finilize project
prototypes

documentation,
preperation presentation &
demo

final presentation

Do you have questions?

If not - we have! :)

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WiFi (Localization)	✊	✊	👍	👍
NFC (Check-In)	👍	👍	👍	👎
QR-Code (Check-In)	👍	👍	👎	👎

- ▶ **Look** at the **matrix** above
- ▶ **Decide** which of the **properties** is the biggest disadvantage for you
- ▶ Vote for **2** properties

📄 Allan Brimicombe and Chao Li.
Location-based services and geo-information engineering,
volume 21.
John Wiley & Sons, 2009.

📄 Silke Feldmann, Kyandoghere Kyamakya, Ana Zapater, and Zighuo
Lue.
An indoor bluetooth-based positioning system: Concept,
implementation and experimental evaluation.
In *International Conference on Wireless Networks*, pages 109–113,
2003.