
STUDENT LIBRARY ASSISTANT
IOT DESIGN CHALLENGE
NCSU WOLVES
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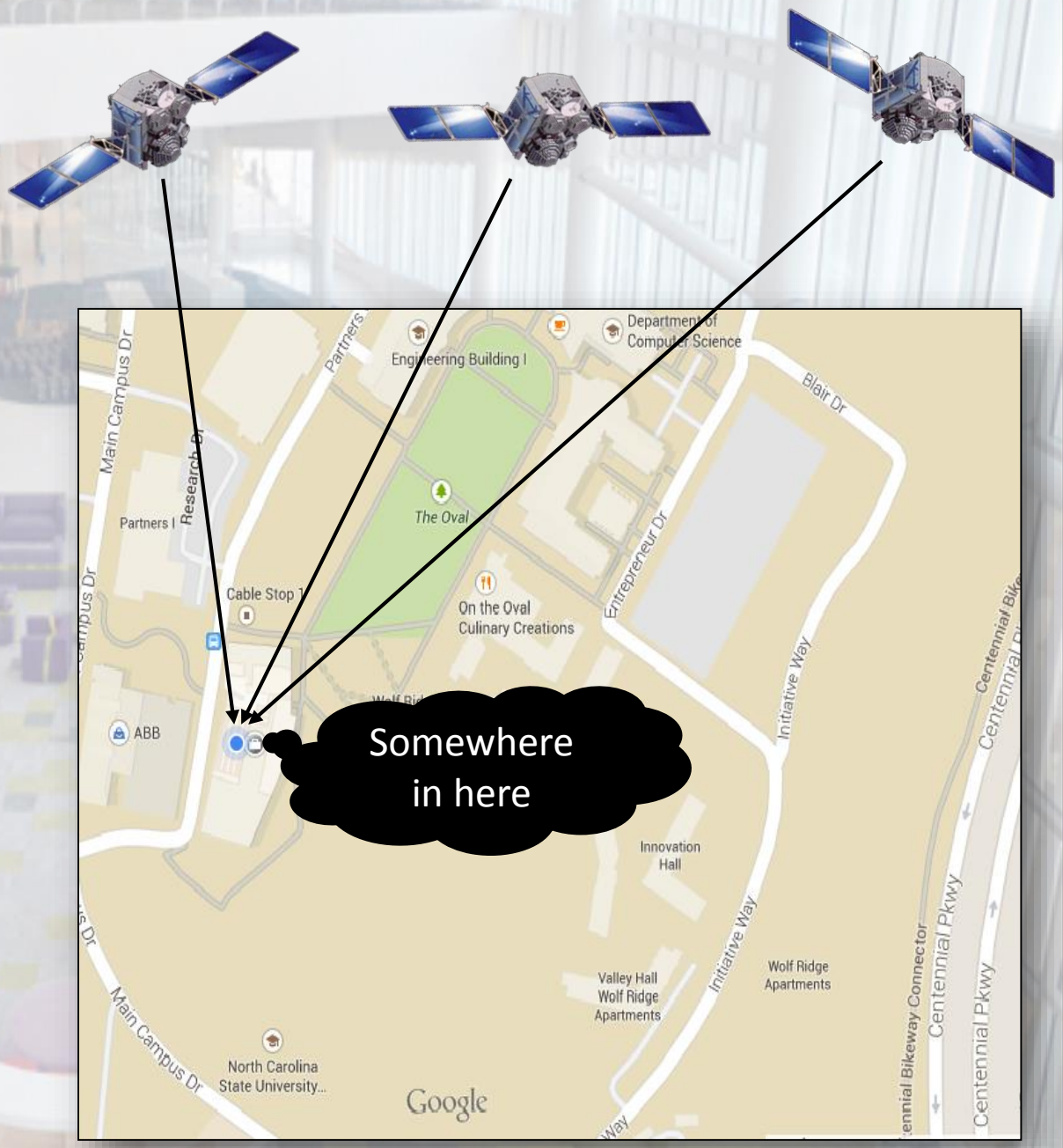
Mentor: Mihir Shah

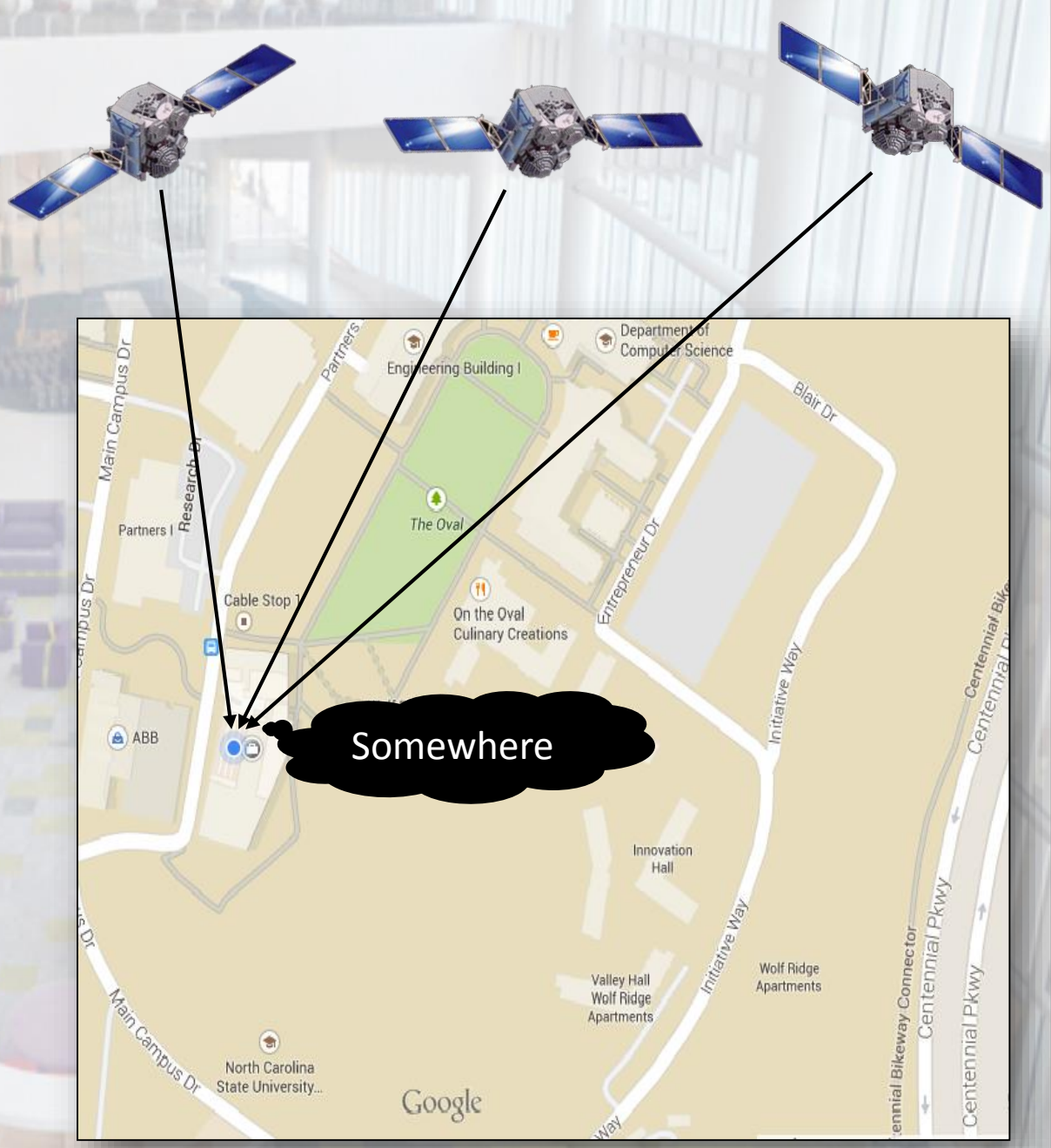
Application & Resources

- **Type of Application**
  - Android application supported by a web application and beacons
- **Resources used**
  - IBM Bluemix
    - NodeJS
  - BKON Beacons
  - Android
    - Native code
    - Bluetooth Low Energy
  - IBM DevOps Services (Jazzhub) repository

GPS System


Where am I?
Somewhere in here
Main Campus Dr
Partners
Engineering Building I
Department of Computer Science
Blair Dr
Research Dr
Partners I
The Oval
Cable Stop
On the Oval
Culinary Creations
Entrepreneur Dr
Initiative Way
ABB
Innovation Hall
Valley Hall
Wolf Ridge Apartments
Wolf Ridge Apartments
North Carolina State University...
Centennial Pkwy
Google

GPS System


Where inside the building?
Somewhere
Main Campus Dr
Partners
Engineering Building I
Department of Computer Science
Blair Dr
Research Dr
Partners I
The Oval
Cable Stop
On the Oval
Culinary Creations
Entrepreneur Dr
Initiative Way
ABB
Innovation Hall
Valley Hall
Wolf Ridge Apartments
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North Carolina State University...
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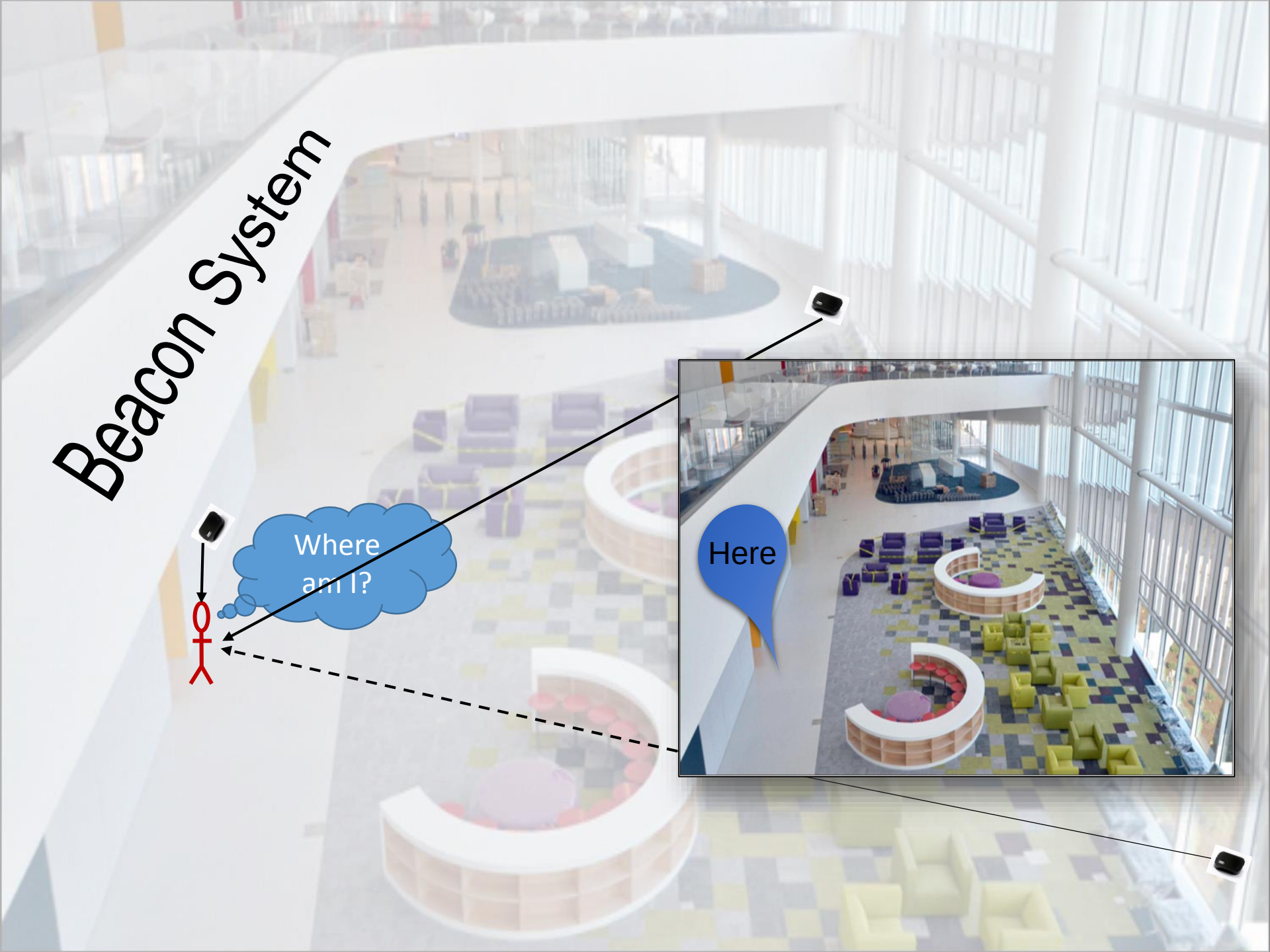
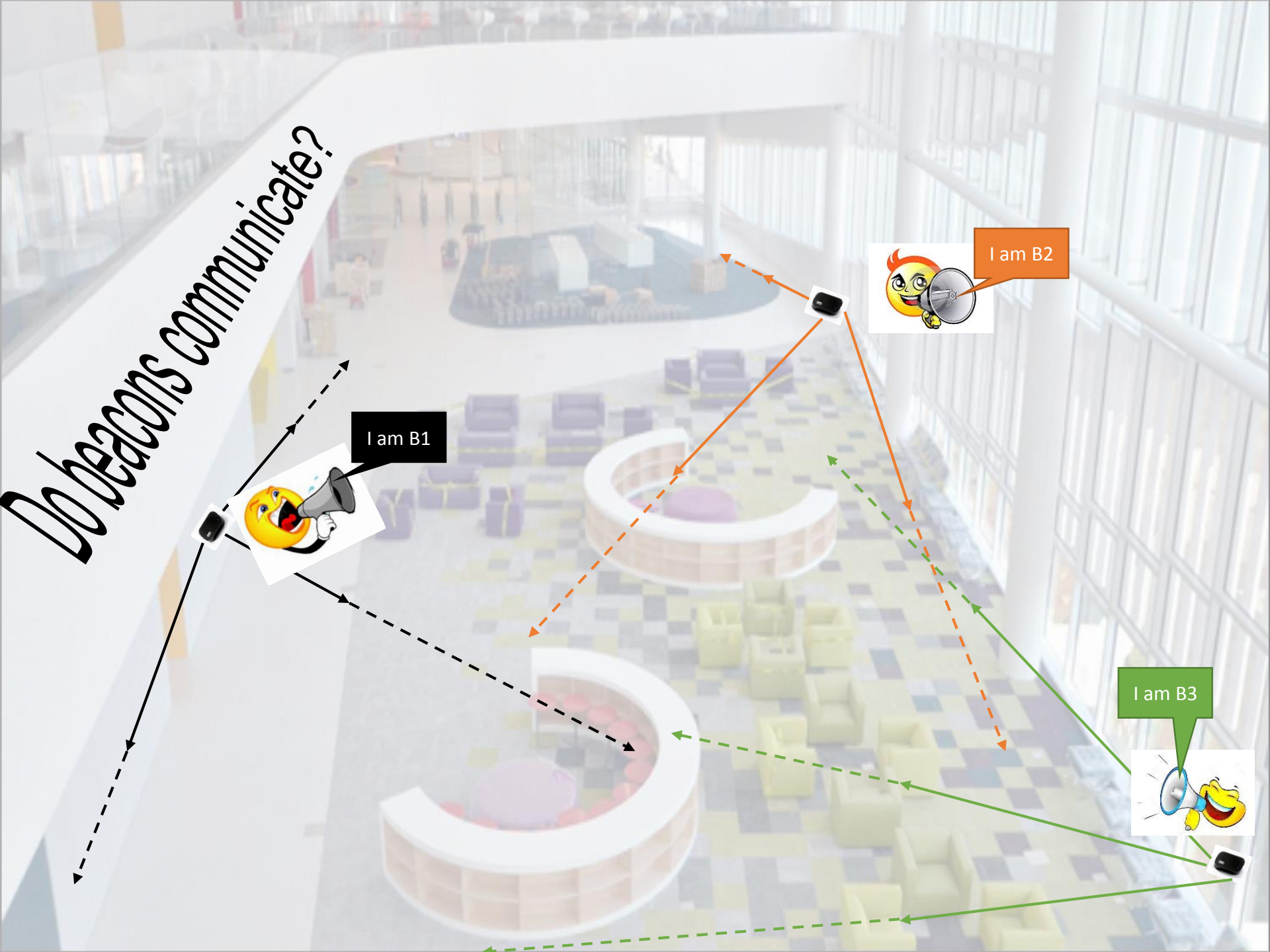
Google

Beacon System



Do beacons communicate?



Where am I?

B1 – left wall
B2 – 3rd pillar
B3 – 5th pillar

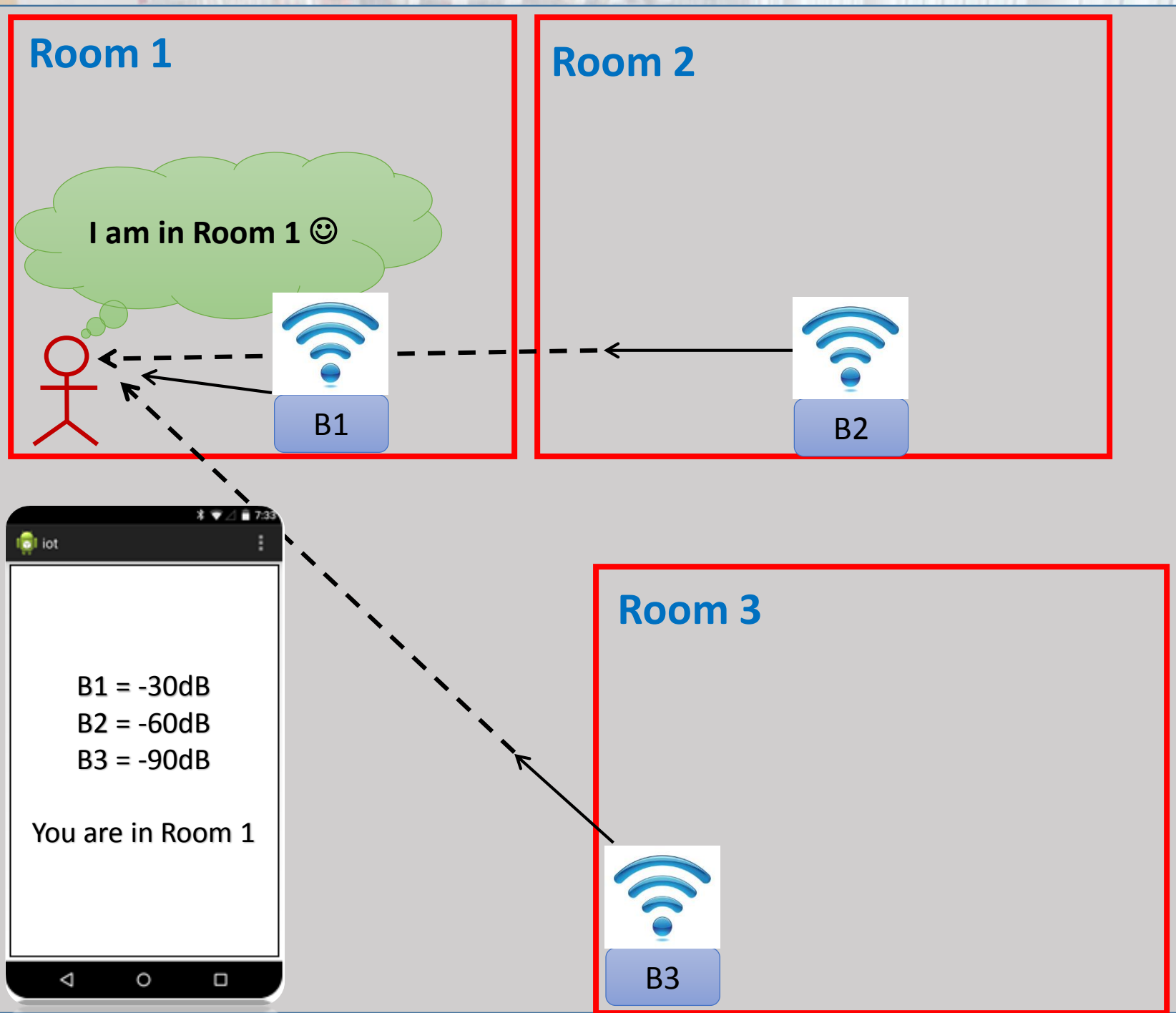
refer

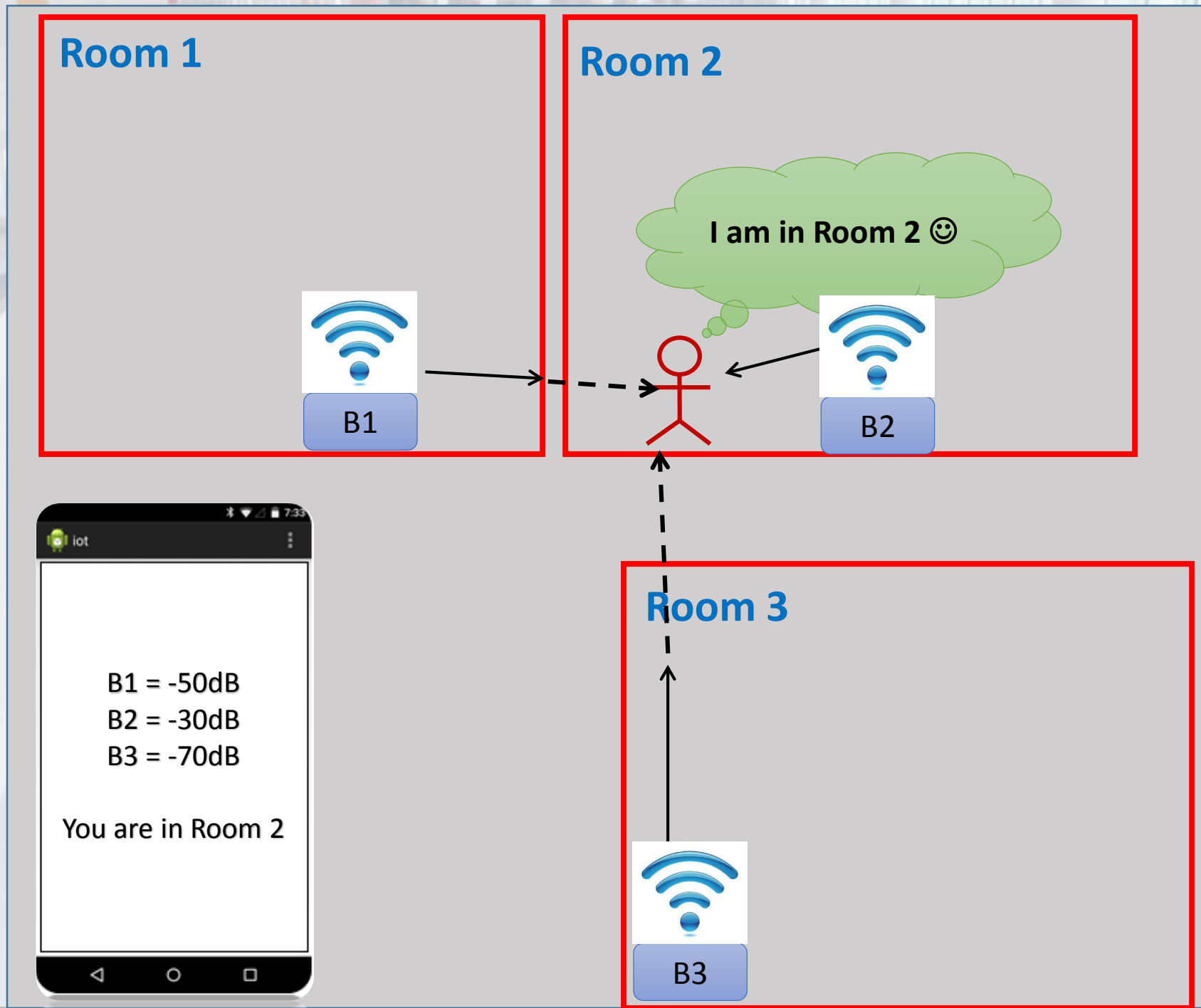
I am B1

I am B2

I am B3

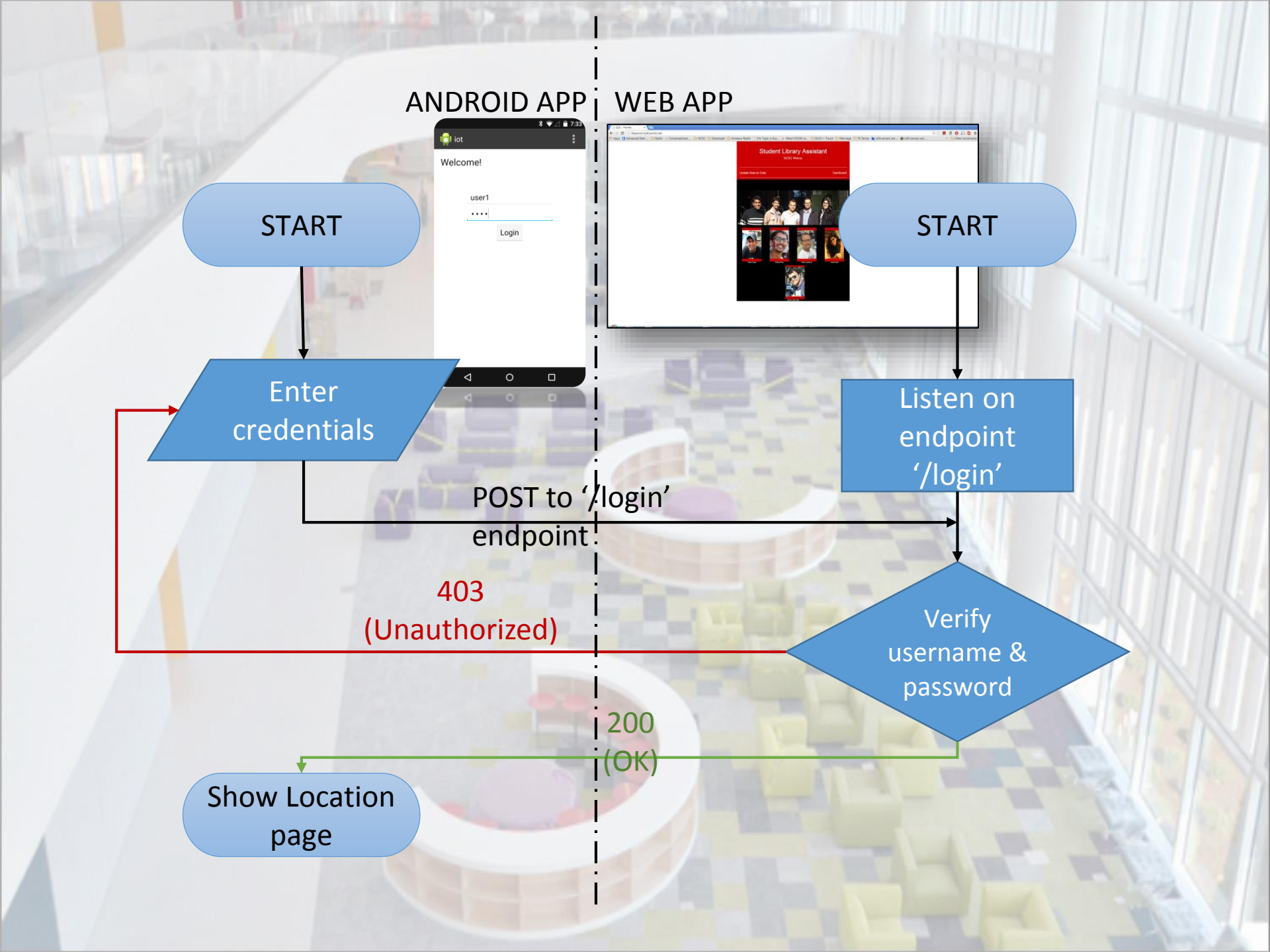
Hmmm..
I hear B1 louder. I am closer to B1, close to B3 but far from B2.
I should be near purple couch.

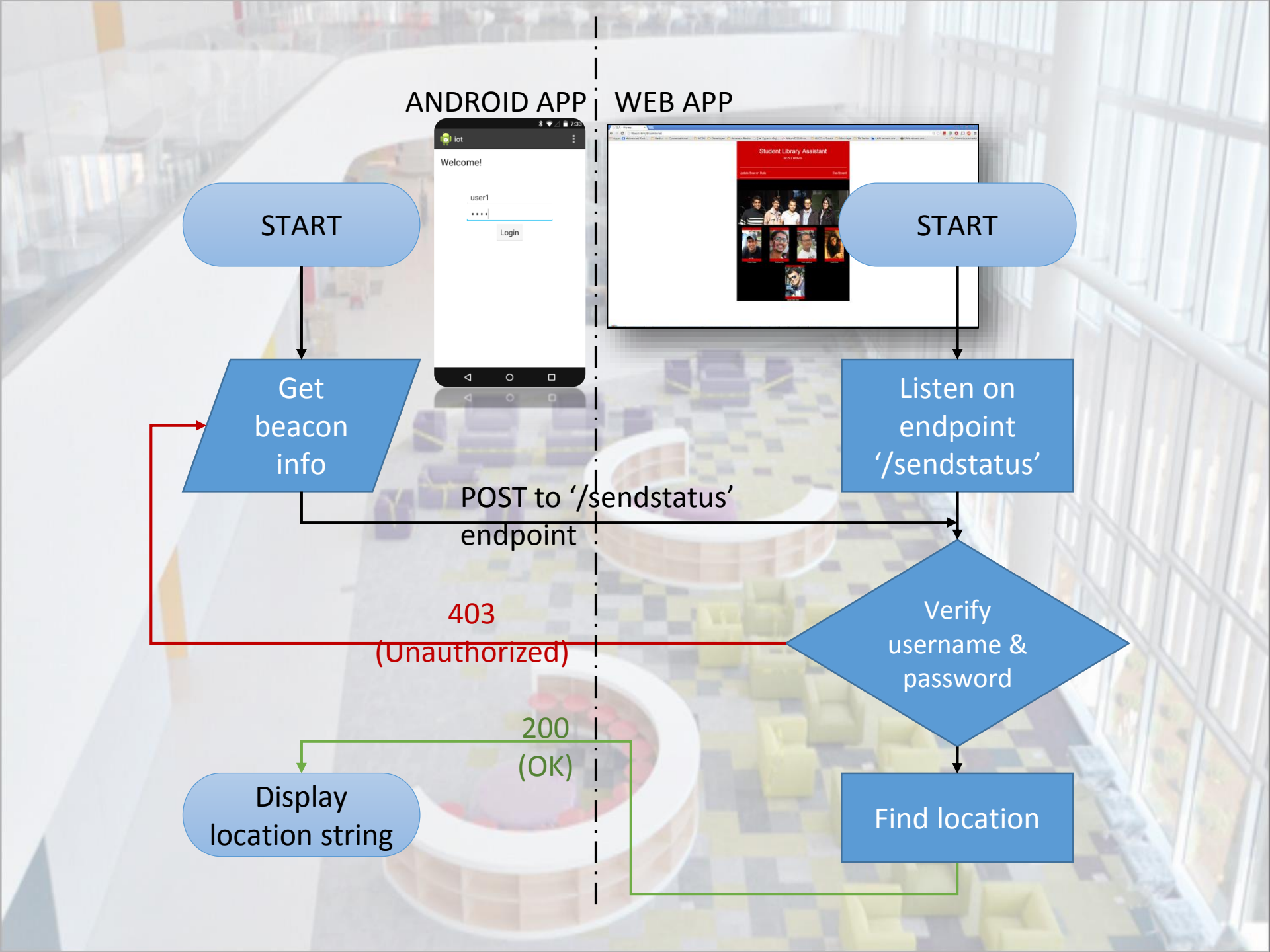

Room 1
Room 2
I am in Room 1 ☺
B1
B2
iot
B1 = -30dB
B2 = -60dB
B3 = -90dB
You are in Room 1
Room 3
B3


Room 1
Room 2
I am in Room 2 ☺
B1
B2
Room 3
B3
iot
B1 = -50dB
B2 = -30dB
B3 = -70dB
You are in Room 2

DEMO

- In case it doesn't work live, here is the video
  www.youtube.com/watch?v=WQ2irbf3-iE&feature=youtu.be


ANDROID APP
WEB APP
Welcome!
user1
Login
Student Library Assistant
START
START
Enter credentials
Listen on endpoint '/login'
POST to '/login' endpoint
403 (Unauthorized)
Verify username & password
200 (OK)
Show Location page


ANDROID APP
WEB APP
iot
Welcome!
user1
Login
Student Library Assistant
START
START
Get beacon info
Listen on endpoint '/sendstatus'
POST to '/sendstatus' endpoint
403 (Unauthorized)
Verify username & password
200 (OK)
Display location string
Find location

Outcomes

- **Total number of people** in library at a given time
- Number of people at any time **in a particular place** in library
- Users can know **crowded places** by android app
- Using main library database, **user can know specific books near-by**
- Available **study rooms** information

Audience

- Administration
  - Library Administration
- Development community
  - Beacon companies
  - Indoor navigation application developers
- Consumers
  - Students
  - Professors
  - Library staff

Extensions

- A very useful **user database** can be maintained along with common **library database**.
- Issue items, requested items, technology lending, user interest can be integrated in database.
- User can choose type of information he/she wants to receive
- Library administration can know the **times** when maximum people come into library
- Library administration can know which location or space is **utilized** the most
- In public library, it can help people to **navigate** between shelves

Market Opportunity

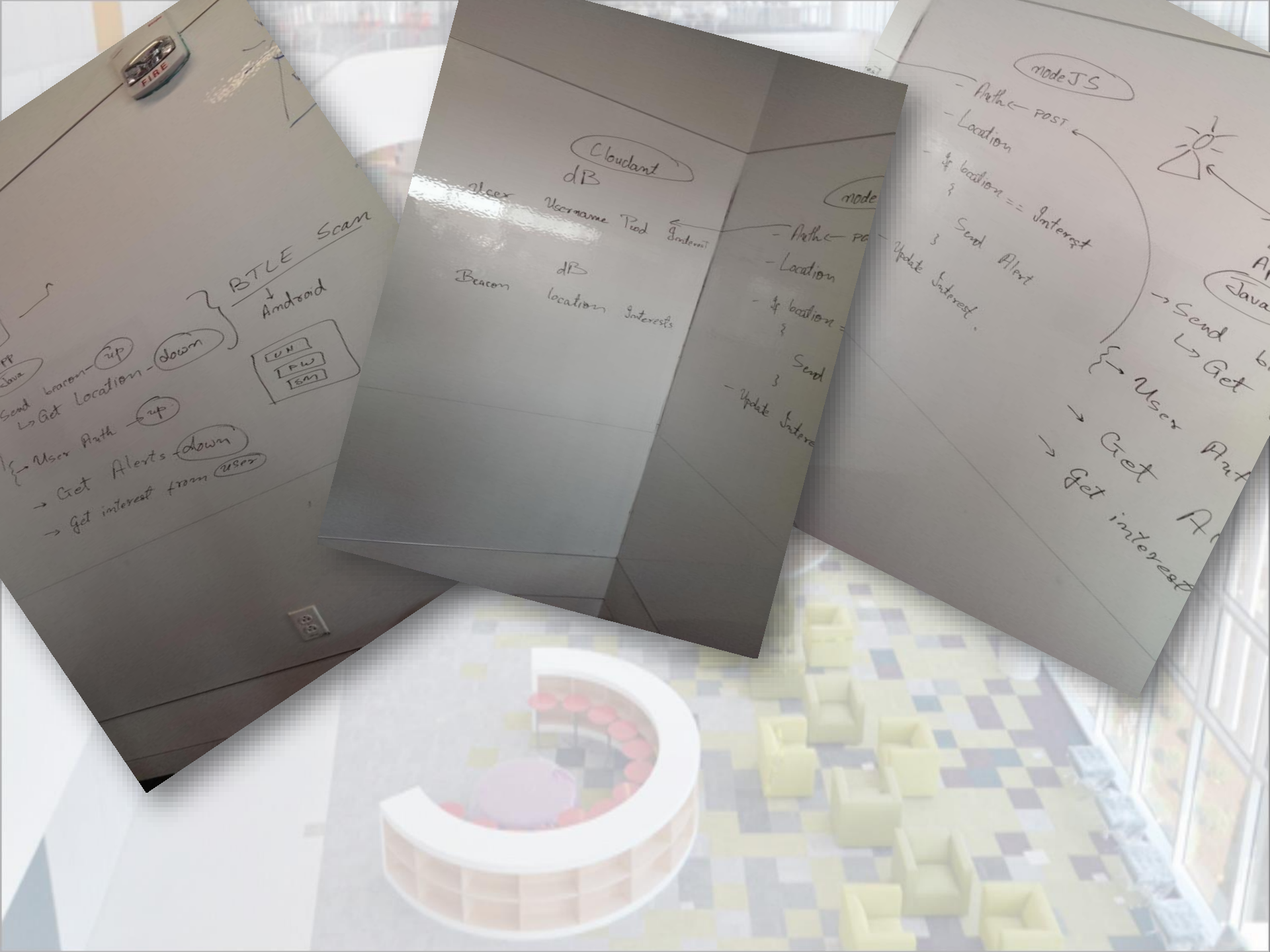
- **According to per-library use-case, database and required fields in the app can be modified and customized**
- **Placing BKONs in all libraries is not expensive**
  - **Cost of 1 beacon = ~$20-$30**
- **Number of beacons per library**
  - **If 1 beacon = ~10ft. Radius = ~314 sq.ft. area (bkon.com says ~330ft !)**
  - **Hunt library = ~221,000 sq.ft. = ~700 beacons**
- **Cost to cover Hunt library = ~(700x$25) = ~$17,500**

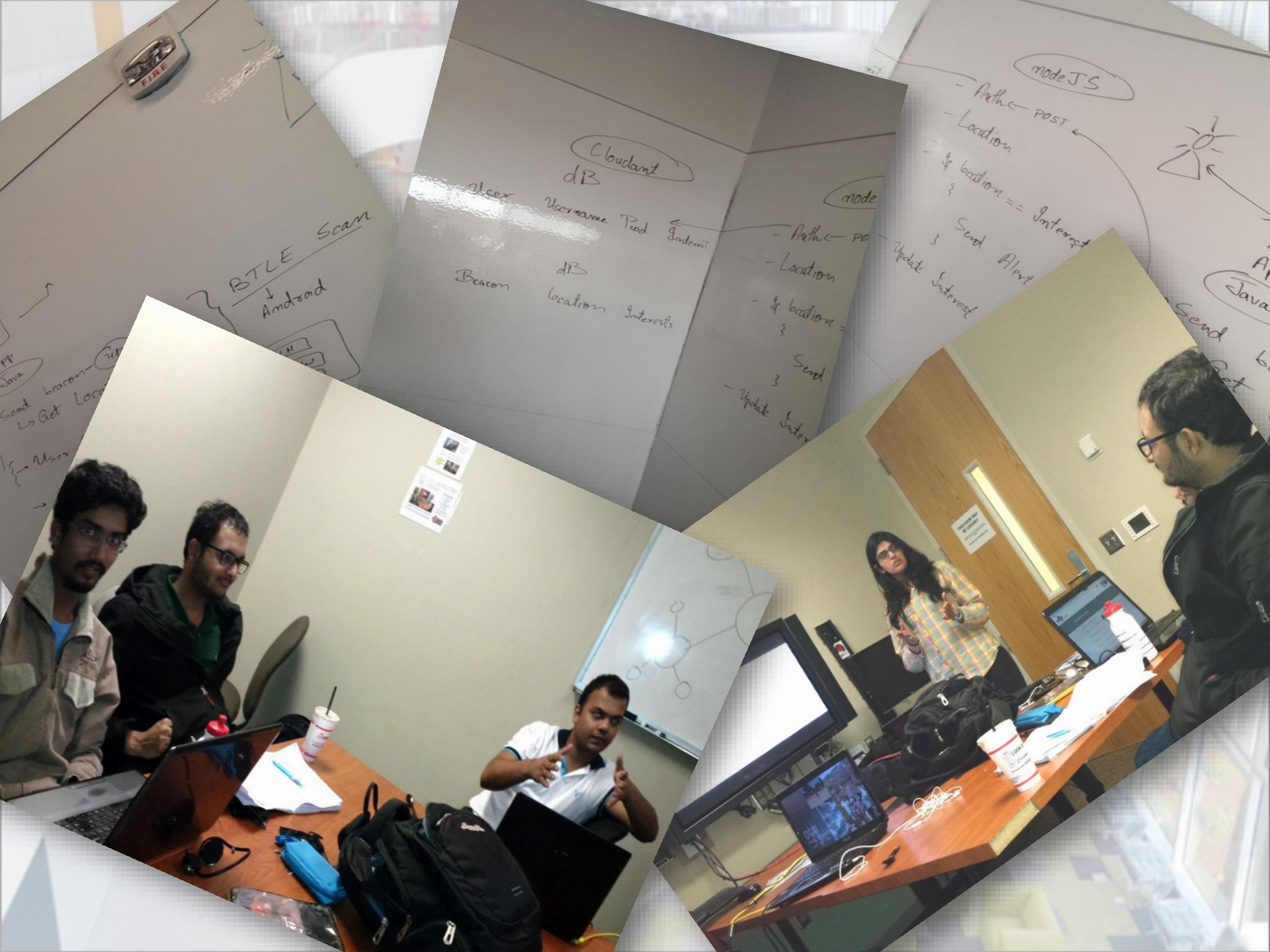
- **Future Markets:**
  - Retail stores
    - Eg. Foodlion and Walmart.
  - Hospitals
    - Track patients, doctors and nurses
  - Logistic Compaines
    - Track packages live
    - Eg. Amazon

- **Competitors:**
  - Estimote
    - Provides similar services and location navigation software

- **Uniqueness:**
  - No similar application for library use.

- **Immediate future steps:**
  - In future, Dashboard can be implemented to help library show live maps and help staff


BTLE Scan
Android
UN
PW
SN
Send beacon - up
Get Location - down
User Auth - up
Get Alerts - down
Get interest from user
Cloudant
dB
User
Username Pwd
Interest
dB
Beacon
location
Interests
Location
Send Alert
Update Interest
nodeJS
POST
Location
Send
Get
Get interest


BTLE Scan
Android
Cloudant
dB
Beacon
location
Interests
nodeJS
POST
Location
Send Alert
Update Interest
Java


Thank You…

What is a beacon?

- A Bluetooth device which broadcasts its ID
  - as part of its advertisement packet

- ID can be broken down into parts
  - iBeacons – UUID, Major No., Minor No.
    - UUID – 16 bytes
    - Major No – 2 bytes
    - Minor No – 2 bytes

- Also broadcasts its transmit power
  - Enables estimating distance from beacon based on received signal strength

Beacon - Example

- Example estimote advertisement packet:
  - 02 01 06 1A FF 4C 00 02 15 B9 40 7F 30 F5 F8 46 6E AF F9 25 55 6B 57 FE 6D 00 49 00 0A C5
    - 02 01 06 1A FF 4C 00 02 15: iBeacon prefix (fixed)
    - B9 40 7F 30 F5 F8 46 6E AF F9 25 55 6B 57 FE 6D: proximity UUID (here: Estimote's fixed UUID)
    - 00 49:major
    - 00 0A:minor
    - C5:2's complement of measured TX power

Use of Beacons

- Use RSSI to calculate distance from beacon
- Use distance from multiple (at least 3) beacons to estimate location