

Positioning Mini Project

Where the SDU* am I?

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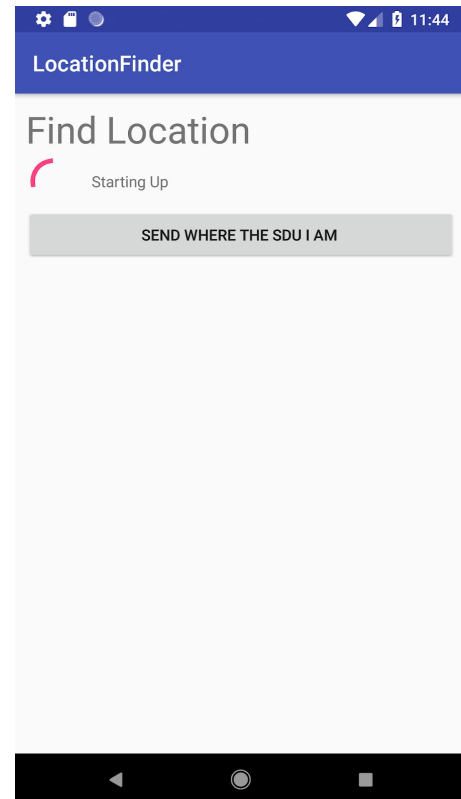
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Overview / Sales pitch

"Where the SDU* am I?" is the hottest new app in location sharing services, focused around the SDU campus! You have experienced this too many times to count. You go to SDU, to work on a group project. You or one of your mates finds an open workspace, and now you/they have to communicate where they are. This means getting up, finding the rooms nameplate, and writing the long descriptive name of the room. "Where the SDU* am I?" says no more! You instead open the app, which will find your location and then the room you are in. You then just press the share button, to inform your workmates of where you are! Easy, smooth, and to the point. "Where the SDU* am I?", your newest favorite app.

In short, the app is supposed to find your location, using the smartphones GPS and then Bluetooth, enabling you to share this information with the press of a button.



Delimitation

As the kontakt.io beacons are not deployed all over the campus, the app is limited to only locate you in rooms within Building 44.

Analysis

Actors

There is only one actor in our application. User doesn't have to be registered to have the complete functionality at their disposal. Students, staff and guests can all use the application on the same level.

User – any current user that has the app installed in their device

Use Cases

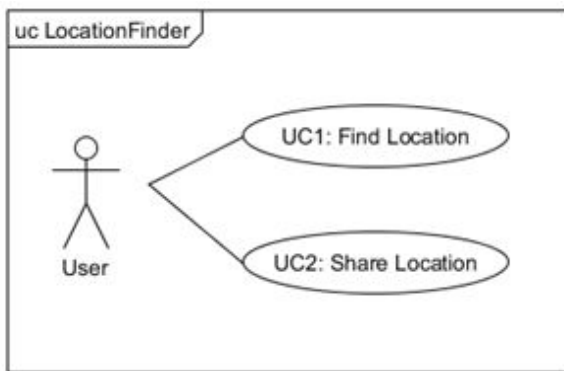
From the initial idea of the application outlined in the overview section, we created use cases in order to help us visualize what our prototype should offer.

Use Case 1: Find Location

Use Case 2: Share Location

Use Case Diagram

With the analyzed actor and use cases of the system, we have drawn UML diagram showing the relation between actor and use cases.



Requirements

Functional requirements:

- User is able to see the room he is in/nearby
- User is able to share this location with friends via external applications, like Messenger, SMS, Gmail

Non-functional requirements:

- Ability to find the location of the room you are in/nearby if you are inside the building number 44 at SDU campus Odense

Implementation

GPS

As the app is only able to locate the room within Building 44 a geofence is used. The geofence is defined by the boundaries of the building. Before trying to retrieve the users current room the app will retrieve the GPS position of the user using `getLastLocation` in order to be as energy efficient as possible (line 121 in code snippet 1). The position is then used to determine if the user is actually within the building by checking if the position is within the geofence, as seen in line 125, and the method for it in code snippet 2. It uses two points that represents a corner of the building 44 area, and determines if the position of the user is within this area. If the user is within the are the `getBLELocation` will be called to determine the current room position.

```

110 private void getLocation() {
111     if(Build.VERSION.SDK_INT >= 23 &&
112         checkSelfPermission(Manifest.permission.ACCESS_FINE_LOCATION)
113         != PackageManager.PERMISSION_GRANTED) {
114         requestPermissions(new String[]{Manifest.permission.ACCESS_FINE_LOCATION}, PERMISSIONS_REQUEST_LOCATION);
115         return;
116     }
117     Log.d("Request", "Requesting location...");
118     locationCallback = new LocationCallback() {
119         @Override
120         public void onLocationResult(LocationResult locationResult) {
121             Location l = locationResult.getLastLocation();
122             if(l != null)
123             {
124                 fusedLocationProvider.removeLocationUpdates(locationCallback);
125                 if(checkGeoFence(l)) //Are we at building 44?
126                 {
127                     getBLELocation(); //Then we go to Bluetooth
128                 }
129                 else
130                 {
131                     location_status.setText("fail"); //Shit went wrong
132                 }
133             }
134         }
135     };
136     fusedLocationProvider.requestLocationUpdates(createRequest(), locationCallback, null);
137 }

```

Code snippet 1 - getLocation()

```

174 private boolean checkGeoFence(Location location) {
175     return geoFP1.getLatitude() >= location.getLatitude() && location.getLatitude() >= geoFP2.getLatitude()
176         && geoFP1.getLongitude() >= location.getLongitude() && location.getLongitude() >= geoFP2.getLongitude();
177 }

```

Code snippet 2 - getGeoFence()

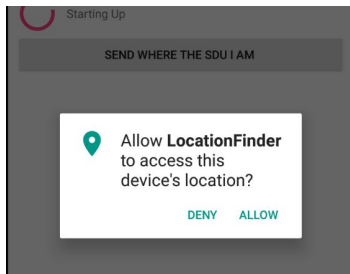
BLE Beacon

If the user is within the boundaries, the phone can continue to use BLE to pick up one of the many BLE Beacons placed in the building. In Building 44, every room have one beacon that contains a unique alias for that room. Once a beacon has been detected, the phone knows the exact location of the user within the building.

Android Permissions

Android application using API level 23 or higher requires applications to ask for permissions during run-time instead of during installation. With this way permissions are

asked when the application need them instead of allow all permission before the installation of the application.

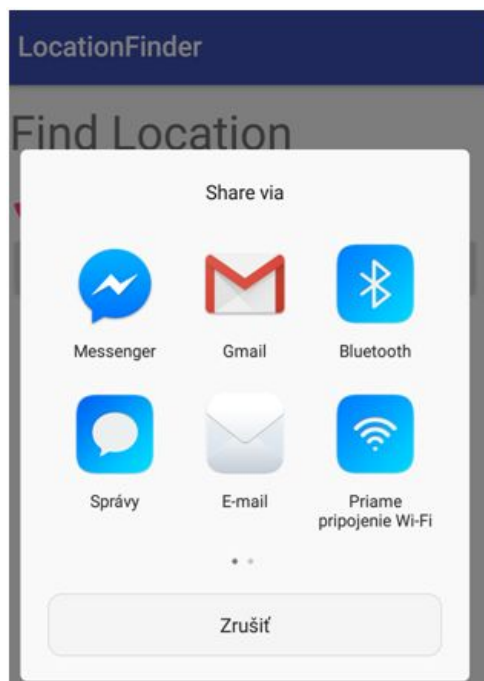


The permissions that we need are :

1. BLUETOOTH
2. BLUETOOTH_ADMIN
3. INTERNET
4. ACCESS_FINE_LOCATION
5. ACCESS_NETWORK_STATE

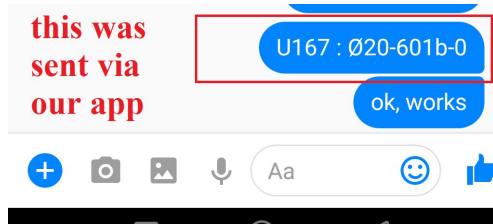
Share the Position

After acquiring the location, the app will enable button to allow the user share their location. The type of the sent object is set to *"text/plain"* to indicate that only plain text is sent and to show only application that can share this text elsewhere.



Discussion

After properly testing our prototype, a few minor issues were found in finding the location of the room using bluetooth beacons. However, when found, the information is easily shareable.



Known issues

- Only usable on the bottom floor of the building, as the beacons have battery power there
- Some problems in the study rooms with overlapping signal or missing signal strength.

Conclusion

The GPS and Bluetooth sensors with the android platform, enables us to locate you within SDU buildings that have working Kontakt.io beacons. This eases a small, but recurring task for the user, without requiring more from the user than they would already be doing, which is the goal when developing ubiquitous computing / IoT applications.