



Sinister Six

exposeum



Sinister Six

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Introduction

Team Sinister Six's project, Exposeum, aims to encapsulate the essence of a tailored, tour-guided visit to a museum into a mobile application. The project centers around the Musée des Ondes Emile Berliner, formerly the RCA Victor factory, which is host to a rich history and hundreds of audio artifacts.

Currently, visitors to the museum must always be escorted by tour guides due to the complex layout of the site. However, a lack of personnel and funds greatly limits the amount of tours that can be undertaken at any given time. Exposeum offers to visitors an enriched and more autonomous experience.

Exposeum addresses this by offering a mobile application which museum visitors can download and use. At a high level, the app will allow users to follow a guided tour throughout the museum, as well as locate all exhibits in a free visit. Through audiovisual media, quizzes and other interactive features, Exposeum will offer a richer, more engaging museum-going experience.

The purpose of this document is as follows:

- Outline the requirements of the project
- Provide a detailed release plan from one iteration to the next
- Enumerate the risks at large and strategies to curtail their impact
- Showcase UI prototypes of the project as it develops
- Detail how features of the project will be tested

The intended audience of this technical document consists of the primary stakeholder Dr. Anja Borck, our course instructor Dr. Nikolaos Tsantalos, and our course tutors Jean Amirian and Davood Mazinianian. Furthermore, this document is intended for any future developers that may wish to research or continue the project after the term's completion.

While Exposeum is targeting the Musée des Ondes at present, it is being developed to be adaptable to other museums and venues.

1. Project Description

Exposeum is a Xamarin project initially slated for release on the Android platform. Although technologies and external libraries used in the course of development may be subject to change, here are a few that we are sure to use:

iBeacon protocol (with Estimote beacons): iBeacons are low energy bluetooth devices that broadcast universal unique identifiers.

Estimote SDK for Android: The manufacturer of the iBeacons (Estimote) provides a library for Xamarin projects which allows us to search for and gather data from iBeacons.

SQLite: The internal database structure and its corresponding ORM (Object relational mapper) in an Android application consists of SQLite. With it, we will be able to easily store and retrieve persistent data.

Android Canvas: This built-in display method is similar to its HTML5 counterpart, and provides a method for displaying shapes and raster images.

NUnit (see 8. Testing Plan & Report): NUnit is a popular unit testing framework for the .Net / C# environment, and comes bundled with the Xamarin framework.

Xamarin UITest: Xamarin UITest is an automated mobile application testing framework which allows for system testing of the application's user interface.

Quickgraph: The project relies heavily on points of interest and traversable paths between them, therefore making a directed graph data structure the ideal choice as a model. Quickgraph happens to be the most used and recommended C# graph library for this purpose.

Because Xamarin is a cross-platform mobile solution, it would be possible to create a version of the app for iOS device, provided the appropriate resources are made available.

Project Development Methodology

The Agile software development methodology is a popular approach to software development. Built into the core of this outlook are four key tenets: Individuals and Interactions, Working Software, Customer Collaboration, and Responding to Change.

The lifecycle of the project's development is structured into iterations, which are short timebox periods (2 weeks in our case), where selected tasks must be completed and a working prototype can be presented to the stakeholder.

We will follow the Agile methodology because its iterative nature allows for flaws or misunderstandings in the software requirements to be uncovered early on, given that each iteration is followed by a meeting with the stakeholder. Furthermore, retrospection about work completed and trouble encountered during a completed sprint allows for better cost and duration estimates.

The sprint schedule will be as follows:

Sprint	Date
0	11/01/2016-25/01/2016
1	26/01/2016-08/02/2016
2	09/02/2016-22/02/2016
3	23/02/2016-07/03/2016
4	08/03/2016-21/03/2016
5	22/03/2016-04/04/2016

2. Requirements

The following requirements were elicited from the product owner and have been turned into user stories approved by the product owner. ~~18~~ **16 user stories** have been elicited for a total of ~~71~~ **62 user story points**.

USP priority labels:

- High
- Medium
- Low

US-1	As a Visitor, I want to specify my preferred language (english or french) at any time, so that I get information in a language I understand.
USP	2
Priority	Medium
Description	

US-2	As a Visitor, I want to view a list of up-to-date storylines available, so that I select the one that is most interesting to me.
USP	3
Priority	Medium
Description	

US-3	As a Visitor, I want to preview a selected storyline before starting it, so that I have an idea of what the story is about before I start it.
USP	1
Priority	Medium
Description	

	The preview will include: number of points of interest, intended audience, estimated duration, etc.
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US-4	As a Visitor, I want to specify my age group (child or adult), so that I have a narrative appropriate for my age. REMOVED: Obsoleted by requirements from stakeholder.
USP	1
Priority	Medium
Description	

US-5	As a Visitor, I want to follow guided tours (storylines), so that so that I can get contextual information in the form of a narrative.
USP	2
Priority	High
Description	

US-6	As a Visitor, I can engage a free tour mode of the building, so that I can visit all points of interest in an unrestricted way.
USP	2
Priority	High
Description	

US-7	As a Visitor, I can select any point of interest and view its summary when in free visit mode, so that I know if the POI is of any interest to me.
USP	3
Priority	Medium
Description	

US-8	As a Visitor, I can stop a storyline in progress and begin a new one so that I am not forced into completing a storyline if it does not interest me.
USP	3
Priority	High
Description	

US-9	As a visitor I want to receive push notifications when the app is not in focus so that no POIs go unnoticed.
USP	3
Priority	Medium
Description	

US-10	As a visitor I want to pause a storyline in progress and resume it at a later time so that I can complete a storyline at my own convenience.
USP	1
Priority	High
Description	

US-11	As a visitor I want to see which points of interest I have already visited so that I don't visit the same POI twice.
USP	3
Priority	Medium
Description	

US-12	As a visitor I want to view a progress map when in guided tour mode so that I know how many POIs are left in my guided tour.
USP	5
Priority	High
Description	

US-13	As a visitor I want to receive full contextual information about a point of interest in my proximity so that I get more educated about each POI I visit.
USP	8
Priority	Medium
Description	

US-14	As a visitor I want to view the entire map of every floor with all points of interest when in free visit mode so that I can choose which POI to visit.
USP	8
Priority	Medium
Description	

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US-15	As a visitor I want to hear ambient or audio in between POIs so that I get more immersed in the storyline.
USP	8
Priority	High
Description	Stakeholder indicated that this feature is undesirable

US-16	As a visitor I want to scan QR codes so that I have more information about certain POIs
USP	3
Priority	Medium
Description	

US-17	As a visitor I want to be presented with a game/quiz during my guided tour so that I test my knowledge and make my visit more engaging and fun.
USP	2
Priority	High
Description	

US-18	As a visitor I want to be given directions for the shortest path between two POIs so that I can quickly travel from one POI to another.
USP	13
Priority	High Low

	Priority lowered: Stakeholder indicated this feature is of low concern.
Description	

Backlog

ID	Name	USP	Priority
US-1	As a Visitor, I want to specify my preferred language (english or french) at any time.	2	Medium
US-2	As a Visitor, I can retrieve a list of up-to-date storylines.	3	Medium
US-3	As a Visitor, I want to preview a selected storyline before starting it.	1	Medium
US-4	As a Visitor, I want to specify my age group (child or adult).	1	Medium
US-5	As a Visitor, I want to follow guided tours (storylines).	2	High
US-6	As a Visitor, I can engage a free tour mode of the building.	2	High
US-7	As a Visitor, I can select any point of interest and view its summary when in free visit mode.	3	Medium
US-8	As a Visitor, I can stop a storyline in progress and begin a new one.	3	High
US-9	As a visitor I want to receive push notifications when the app is not on focus.	3	Medium
US-10	As a visitor I want to pause a storyline in progress and resume it at a later time.	1	High
US-11	As a visitor I want to see which points of interest I have already visited.	3	Medium
US-12	As a visitor I want to view a progress map when in guided tour mode.	5	High
US-13	As a visitor I want to receive full contextual information about a point of interest in my proximity.	8	Medium
US-14	As a visitor I want to view the entire map of every floor with all points of interest when in free visit mode.	8	Medium
US-15	As a visitor I want to hear ambient or audio in between POIs.	8	High
US-16	As a visitor I want to scan QR codes.	3	Medium
US-17	As a visitor I want to be presented with a game/quiz during my guided tour.	2	High
US-18	As a visitor I want directions for the shortest path between two POIs.	13	High Low
Total		62	-

4. Release Planning

Sprint 1 Summary

This first sprint focused on addressing our highest risk-highest value user stories first. We decided to deliver the user stories with highest USPs, so that if we were to fail, we would do so at an early stage.

These features included the ability to display and support user interaction in the map, to support english and french, and finally to detect iBeacons. We managed to complete all user stories, however we did encounter some problems along the way.

First, some small technical issues related to the Xamarin framework were encountered for a few team members, but this was resolved by everyone switching to using Visual Studio instead of using the Xamarin IDE (see TL01 in 6. Risk Management).

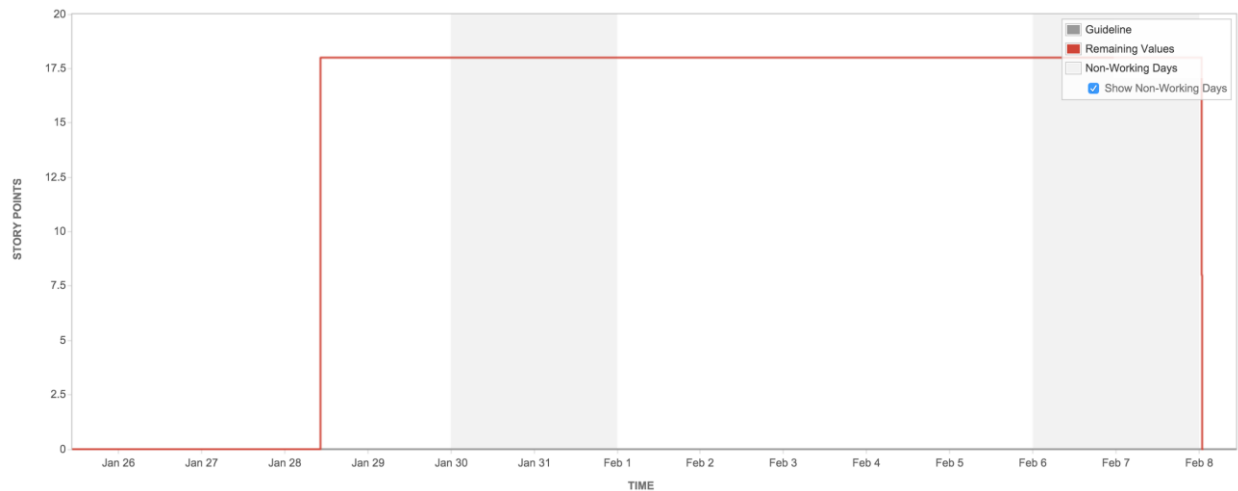
Some bugs were found and documented as well, and one remains open, to be transferred over to the next sprint.

Story ID		USP	Status
US-1		2	DONE
US-13		8	DONE
US-14		8	DONE
Total		18	18

Project velocity after 1 sprint: 18

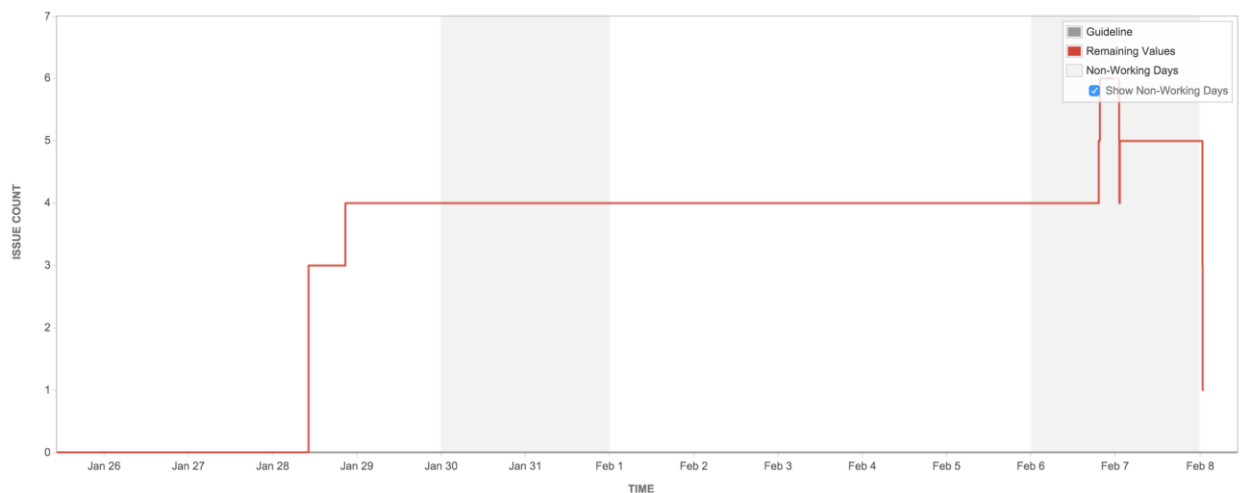
Sprint 1 Burndown charts

EX Sprint 1 Story Points ▾



This is the user story points burndown chart. As is displayed, all user story points were completed in Sprint 1.

EX Sprint 1 Issue Count ▾



The above represents the Sprint 1 issue burndown chart (user story subtasks and bugs). The final value is not at zero due to a pending bug which has not been yet resolved. Furthermore, near the end, the issue count was increased because bugs were uncovered and documented, and a tasks was put back into the 'in progress' state from the 'finished' state.

Sprint 1 Retrospective

Keep doing:

- **Weekly complete meetings:** Since the entire team can seldom meet due to work and class schedules, these weekly meetings are extremely helpful in unifying the team's vision of the project, its requirements and the sprint document.
- **Biweekly sub-team meetings:** The decision to conduct sub-team meetings was a good one, this allows for more frequent meetings not subject to the entire team's schedule constraints.

Start doing:

- **Daily 15-min scrum-style meetings:** It is easy to get distracted by other classes, projects and life outside of school, so having a quick daily meeting to ask how things are going in regards to tasks related to Exposeum is vitally important.
- **In-depth overview of the upcoming Sprint:** It helps to get a breakdown of sprint requirements as early as possible, and delegate tasks to sub-teams and their members.

Stop doing:

- **Duplication of effort:** The two sub-teams managed to write essentially the same Point of Interest data class due to a lack of communication, that time and effort could have been spent fulfilling another sprint requirements.

Do more of: Updating JIRA tasks (this was part of the template, but it also applies to us), adding more granular JIRA sub-tasks, informing team members prior to modifying their code or documentation, maintaining orderly meetings that do not devolve into social gatherings.

Do less of: Waiting too long to review sprint sections and requirements as a team and underestimating the size of the documentation.

Sprint 2 Planning

In this upcoming sprint, we will focus on continuing map-related work as well as beginning to incorporate the beacons into the map as per US-6, US-7, and US-11. With US-9, we are beginning a new user story where we must research and implement how to display a notification even while the application is not in focus.

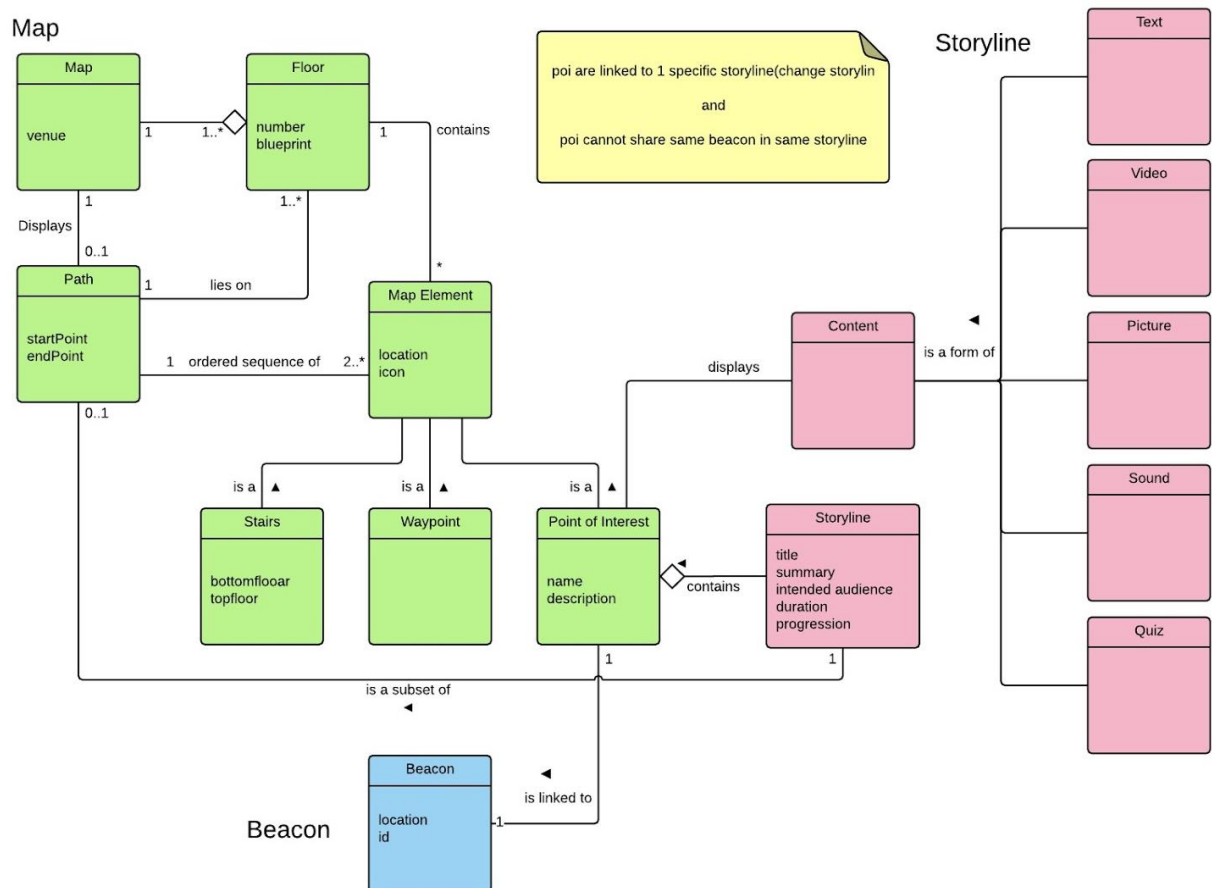
The problems we might face are related to the team's unfamiliarity with the Android Activity lifecycle. The business logic does not represent as big of a challenge as the actual understanding of the specifics of the Android user interface structure.

In terms of catching up from the previous sprints, a single bug remains to be resolved (EX-53 in JIRA). This bug highlights defects in the current database structure. Although the bug has been addressed by the developer it has yet to be reviewed, hence it is still open.

Story ID		USP	Status
US-6	As a visitor I can engage in a free tour mode of the building so that I can visit all POIs in an unrestricted way.	2	
US-7	As a Visitor, I want to select any point of interest and view its summary when in free visit mode.	3	
US-9	As a Visitor, I want to receive push notifications when the app is not in focus.	3	
US-11	As a Visitor, I want to see which points of interest I have already visited.	3	
US-19	As a Visitor, I would like to get a brief intro about the app.	3	
US-20	As a visitor, I would like to choose between a guided and an explorer tour	3	
Total		17	

5. Architecture

Domain Model

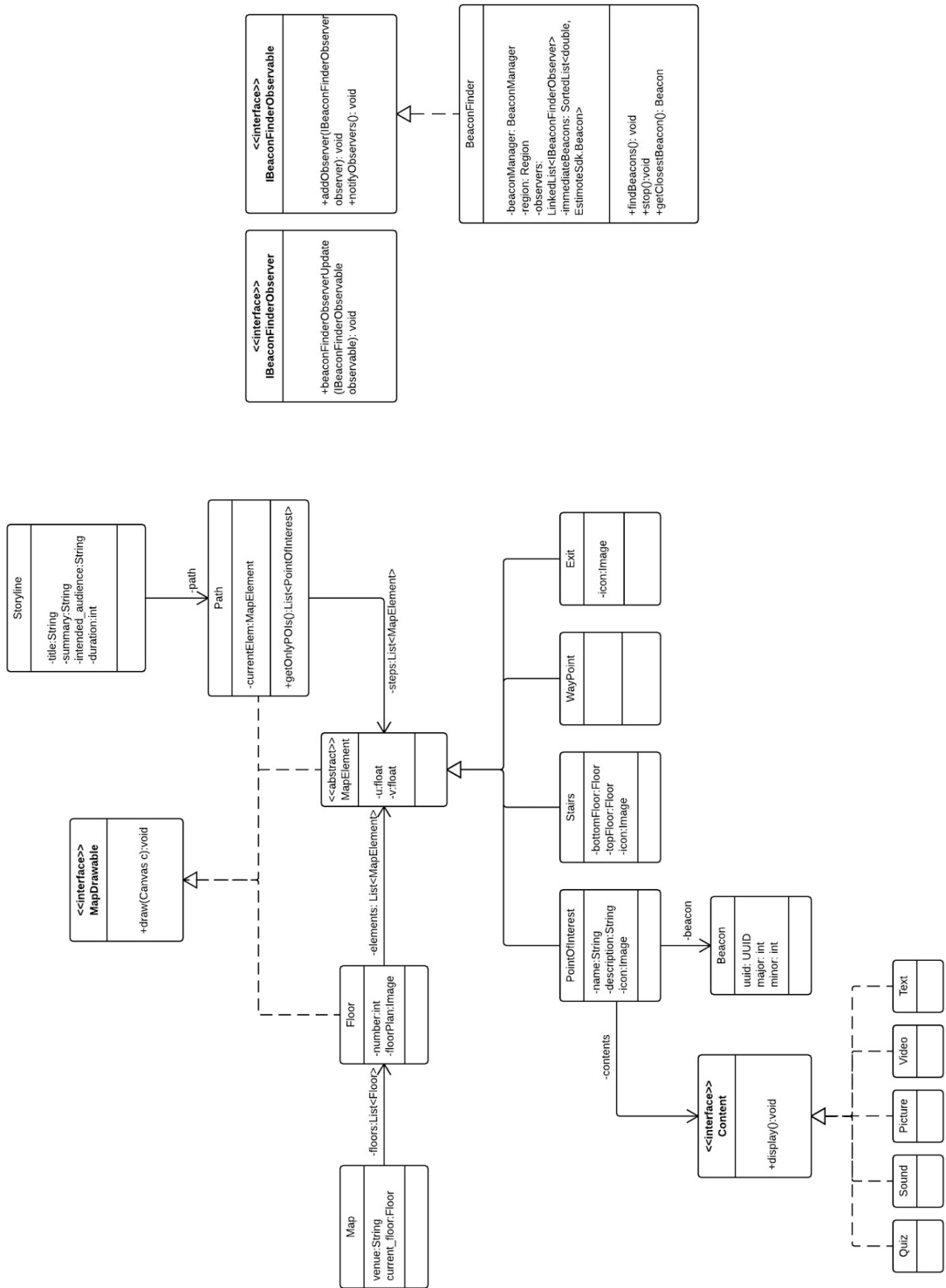


Domain Model overview:

Our domain diagram consists of three distinct conceptual packages. The Map package concerns itself with the modeling of the venue or building into a map, its constituent floor plans and map elements (POIs, stairs, etc.) located within. Paths as conceptualized are ordered sequences of map elements which allow visitors to go from the start of the path to its end.

The Storyline package relates to the narrative intended to be shared with a visitor undergoing a walking tour of the museum. A storyline is an ordered sequence of Points of Interests that pertain to the narrative. A POI contains story content to be displayed to the visitor. Albeit small, the Beacon package is an integral part of our domain. It is solely responsible for linking the real world beacon hardware with our conceptual interpretation of the museum and storyline paradigm.

Class Diagram



Class Diagram overview

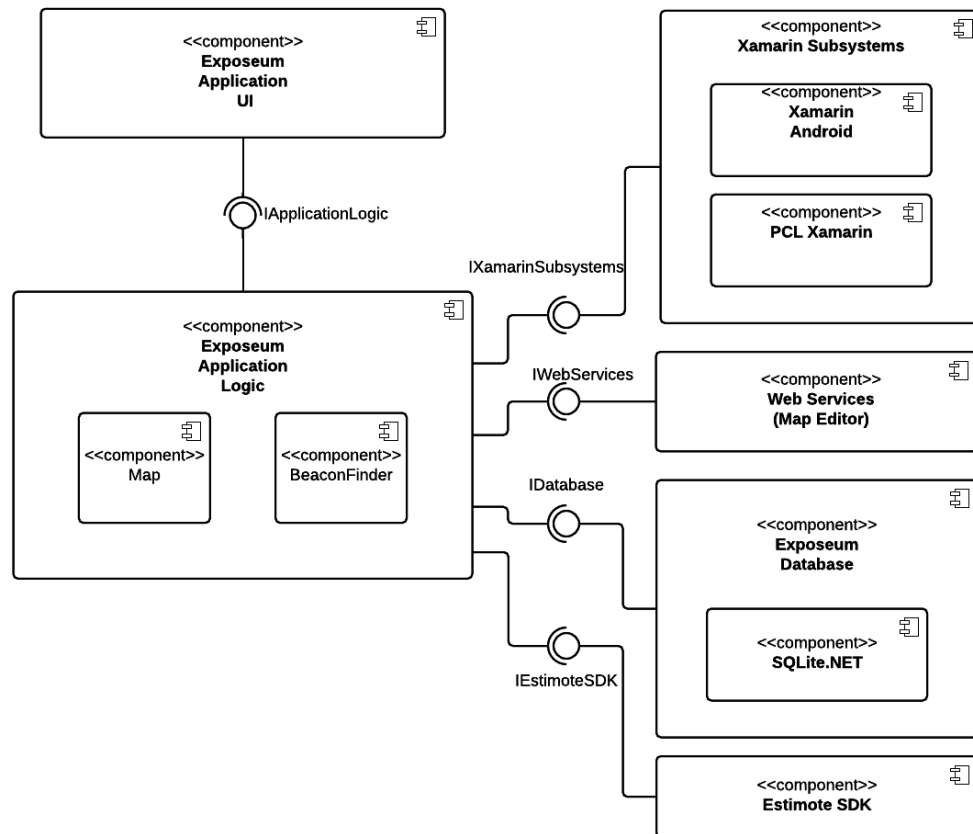
The representational gap between our domain model and actual class diagram is relatively small, with the primary differences due in part to purely object-oriented programming concepts.

First, the Map class contains a collection of Floor objects. Floor objects have a floorPlan image as well as a floor number. Each floor contains a collection of MapElements, which may be of 4 types: PointOfInterest, Stairs, WayPoint, and Exit. A PointOfInterest map element is associated with 1 Beacon, as well as some content, which can be a Quiz, sound, a picture, a video, or some text.

Storylines have a title and a summary, and contain a Path object, which itself contains a pointer to the latest visited MapElement, and an ordered collection of MapElements which the storyline's path traverses.

Finally, the BeaconFinder class implements the IBeaconFinderObservable interface, and is used to detect and enumerate nearby detected beacons through the observer pattern.

Component Diagram



The Exposeum Application UI component is in charge of displaying visual elements and contextual information. It receives data through the **IApplicationLogic** interface from the Exposeum Application Logic component. This component is in charge of the core computation and application specific logic such as finding the beacons (done through the BeaconFinder component) and drawing the map (done through the Map component). The Exposeum Application Logic is dependent of the following components:

- Xamarin Subsystems component: low-level compatibility of Xamarin C# with native Java Android layer.
- Web Services component: retrieval of external map and beacon data destined for local persistence.
- Exposeum Database component: Allow for data persistence and object serialization and deserialization.
- Estimate SDK component: interfacing with physical iBeacons via Bluetooth.

6. Risk Management

The table below identifies the risks, their probability & their impact as well as the strategy that Sinister Six will adopt to tackle each risk. The risk is assessed in qualitative manner following the criteria below:

High: Extremely likely to occur / Represents a High adverse impact

Significant: Very likely to occur / Represents a significant adverse impact

Moderate: Somewhat likely to occur / Represents a moderate adverse impact

Low: Unlikely to occur / Represents a low adverse impact

Impact	High	PE02, PE03	PE04, RE01, RE02	PE04	TE02, TL01, TL02, PE02
	Significant			PE01	
	Moderate	TL03	TL03		
	Low				TE01, TL01, TL02
		Low	Moderate	Significant	High
		Probability			

Risk Assessment				Risk Management	
Risk ID	Description	Probability	Impact	Resolved In Sprint	Strategy & Effectiveness
Technology Risks					
TE01	Team Sinister Six has no experience with the use of beacon technology (such as Estimote iBeacons).	High	Low	0	<p>The team has purchased an extra set of Estimotes with which to practice prior to Sprint 0.</p> <p>Strategy: Mitigation Effectiveness: High</p>
TE02	The format of the map data is yet unknown and team Sinister Six must wait for consensus to be reached.	High	High	-	<p>The class as a whole plans to tackle this risk promptly by discussing a standard schema which will be used by all teams producing a 390 project.</p> <p>Strategy: Elimination Status: Will be eliminated post-Sprint 1 (when the chosen schema is adopted by the team)</p>
Tools Risks					
TL01	Some members of team Sinister Six are unfamiliar with Visual Studio (one IDE option for Xamarin development).	High	High Low	0	<p>The team has practiced with visual studio, installed helpful extensions (ReSharper) and has subscribed to an online tutorial website using our academic accounts (PluralSight)</p> <p>Strategy: Mitigation</p>

					Effectiveness: High
TL02	All members of team Sinister Six are unfamiliar with Xamarin Studio (the other IDE option for Xamarin development)	High	High Low	0	<p>The team has agreed to use Visual Studio for development.</p> <p>Strategy: Avoidance Effectiveness: High</p>
TL03	Using both Visual Studio and Xamarin Studio for app development concurrently may lead to incompatibility and/or communication issues amongst team members	Low Moderate	Moderate	0	<p>The team has agreed to use Visual Studio for development.</p> <p>Strategy: Mitigation Effectiveness: High</p>
People Risks					
PE01	Personnel conflict / conflicting personalities	Significant	Significant	1	<p>Implementing open dialogue between team members and ensuring the hierarchical structure of the team is always respected.</p> <p>Strategy: Mitigation Effectiveness: High</p>
PE02	Scheduling conflicts leading to limited time slots in which the team can meet to work in tandem.	Low High	High	0 1	<p>Work around everyone's schedules, using different scheduling technologies like Doodle to help find a common free slot to all team members.</p> <p>Update: We have split into subteams where</p>

					<p>each subteam member is able to meet weekly.</p> <p>Strategy: Acceptance Effectiveness: Low (the problem persists and we must accept its impact).</p>
PE03	Team member dropping class.	Low	High	0	<p>Redistribute the workload between remaining team members.</p> <p>Strategy: Acceptance Status: Ongoing (although this will always remain a risk, the probability of it occurring is negligible) Effectiveness: High</p>
PE04	Sub-par team member performance as compared to other team members.	Significant Moderate	High	0	<p>Team leader addressing team members performance on a weekly basis.</p> <p>Strategy: Avoidance Effectiveness: Moderate</p>
Requirement Risks					
RE01	The stakeholder's experience with technology and vision of the product is not firmly set thereby leading to unclear and volatile requirements.	Moderate	High	1	<p>Personal in-depth interview conducted with the primary stakeholder clarified and solidified much of the remaining unclear requirements.</p> <p>Strategy: Mitigation Effectiveness: High</p>
RE02	Familiarity with some technologies (QR, AR, etc.) is low amongst	Moderate	High	-	<p>The team will conduct in-depth research and determine if the technologies are required</p>

	the team members and the stakeholder				<p>in the project.</p> <p>Strategy: Mitigation Status: Ongoing, effectiveness will be determined upon completion of research and clarification of requirements</p>
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Sprint Risk Overview:

Resolved risks

PE01: Despite having a diverse range of personalities and opinions about how the project should be managed, engaging in frank discussion has helped the team to greatly mitigate this risk. Although it is an ongoing risk, we anticipate that this strategy will be effective throughout the project.

RE01: During sprint 1, conducting an in-depth personal interview greatly mitigated the impact of this risk to our project. The requirements are now much clearer, and we plan to re-employ this strategy in subsequent sprints as needed to clarify requirements.

Updated Risks

TL03: We have retroactively upgraded the probability of this risk from occurring, from low to moderate, upon realizing that our attempt to use both IDEs concurrently resulted in numerous communication and technology conflicts. From now on, each team member is required to use Visual Studio exclusively.

PE02: Unfortunately, despite our initial optimistic assessment of this risk occurring, scheduling conflicts have negatively impacted the progress of this project numerous times. This necessitated upgrading the risk's probability to high. While not each of us will be available for each meeting, we have split up into smaller sub-teams where each team member is available for a weekly meeting.

PE04: Having completed our first sprint, we now assess our previous estimate of probability to be too pessimistic. We now view the probability of this risk to be only moderate.

Added Risks

RE02: Having met with the primary stakeholder this sprint, we now understand that the stakeholder is not fully aware of the possibilities of QR codes, AR, and other technologies available to enhance the application, and nor are we.

7. User Interface Design

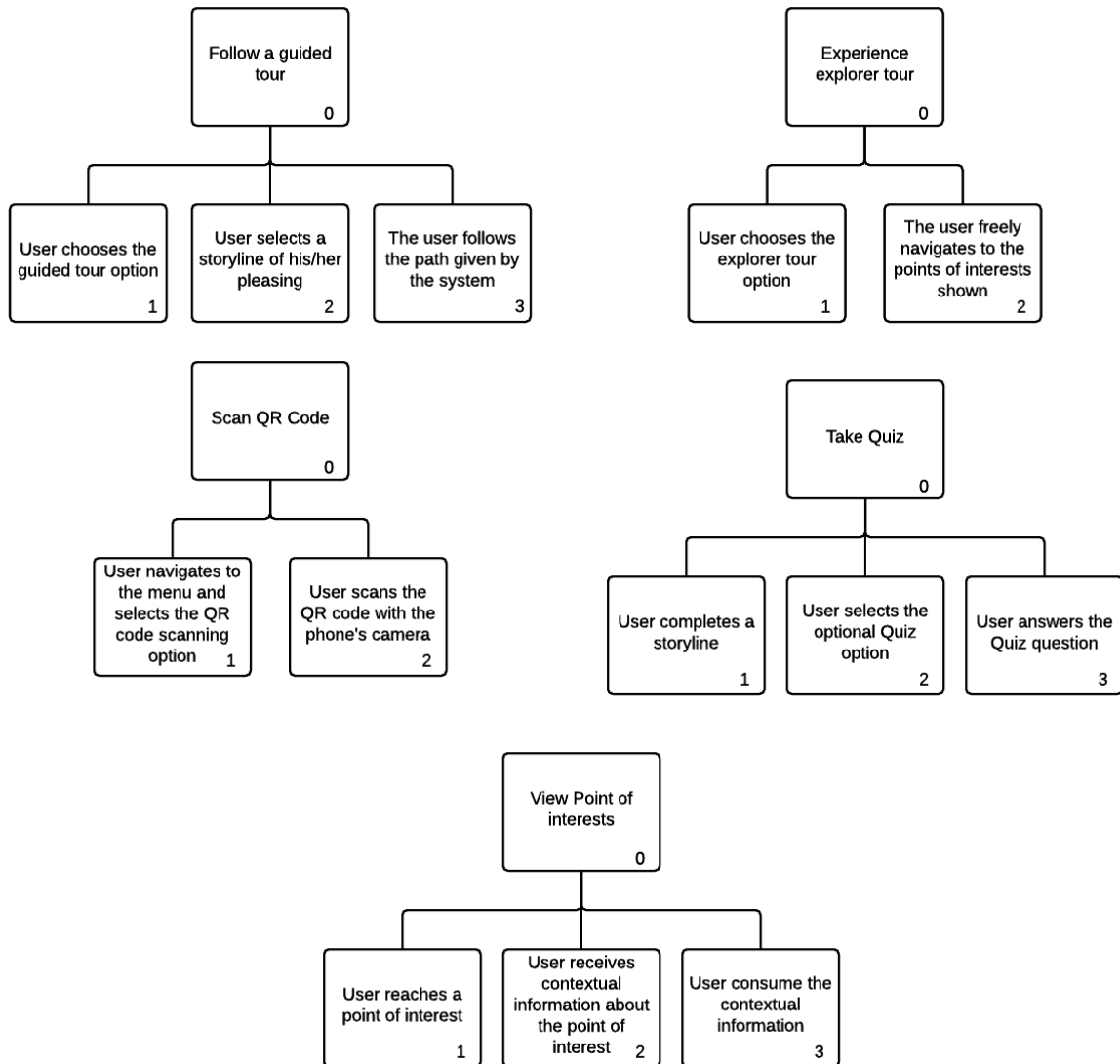
According to our stakeholder, the museum's most common demographics are students that visit the museum as part of school trips and elders. The following personas are precise descriptions of typical users of the product:

Stephanie is a 10 year old student. During the school year, she and her classmates have the opportunity to go on field trips to nearby museums. Due to the volume of students who enter the museum, they are split into groups. Exposeum allows Stephanie's group to guide themselves through the museum on a storyline designed for their age group, thus eliminating the need for a human guide for each student group. Stephanie also appreciates that she can complete a short quiz at the end of the storyline; she finds these quizzes fun and likes to compete with her friends.

Pierre is a retired audio engineer originally from Lyon, France. He considers himself a history buff and loves exploring the origins of modern day technology. To occupy his free time, Pierre enjoys visiting museums but doesn't like following a tour because he is already knowledgeable in the domain. Exposeum offers him a free exploration mode whereby Pierre can freely explore and locate only the sites and exhibits that interest him. He also finds it exciting that Exposeum notifies him when he stumbles upon an exhibit he might have otherwise missed. Because his english is not very strong, he appreciates that he is able to change Exposeum's interface to his native tongue of French.

Hierarchical Task Diagram

The tasks the user can perform with the system are represented by the following hierarchical task model diagrams:



Scenarios

These tasks can also be reflected in scenarios, which describe tasks through informal narrative, while also capturing the context of the tasks.

Scenario 1:

Pierre is a retired audio engineer from France who was visiting his family in Montreal. He considers himself a history buff and loves exploring the origins of modern day technology so he thought that today is the day to visit the Musee des Ondes. He arrived at the building, and not wanting to have a guided tour, he decided to explore the building on his own. He loads the first floor plan in Exposeum and looks at all the different points of interest displayed on the screen. He starts heading to each one of them, and wherever he finds a QR code, he scans it and is given more information and pictures about the location. Some points of interest didn't have any QR codes to scan, but a page would open while he was in the beacon's vicinity to give him contextual information.

Scenario 2:

Mrs Robinson is a history teacher that loves field trips. She has decided to take her class to visit the Musee des Ondes, however she understands that most of her students get bored pretty easily and will not be focused all along the visit. Even though she's not a big technology fan and she normally doesn't allow her students to use their cellphones, she allows them to use Exposeum so they can follow one of the different storylines targeted to kids. As soon as the visit starts, all the kids become engaged, listening to the noises of people walking, Nipper the dog, the main actor in that storyline, barking, and some very fun and interesting information showing at different stages of the visit. Near the end, each students was presented by Exposeum with a quick pop quiz which allows Mrs Robinson to know what the students had learned from their visit.

Scenario 3:

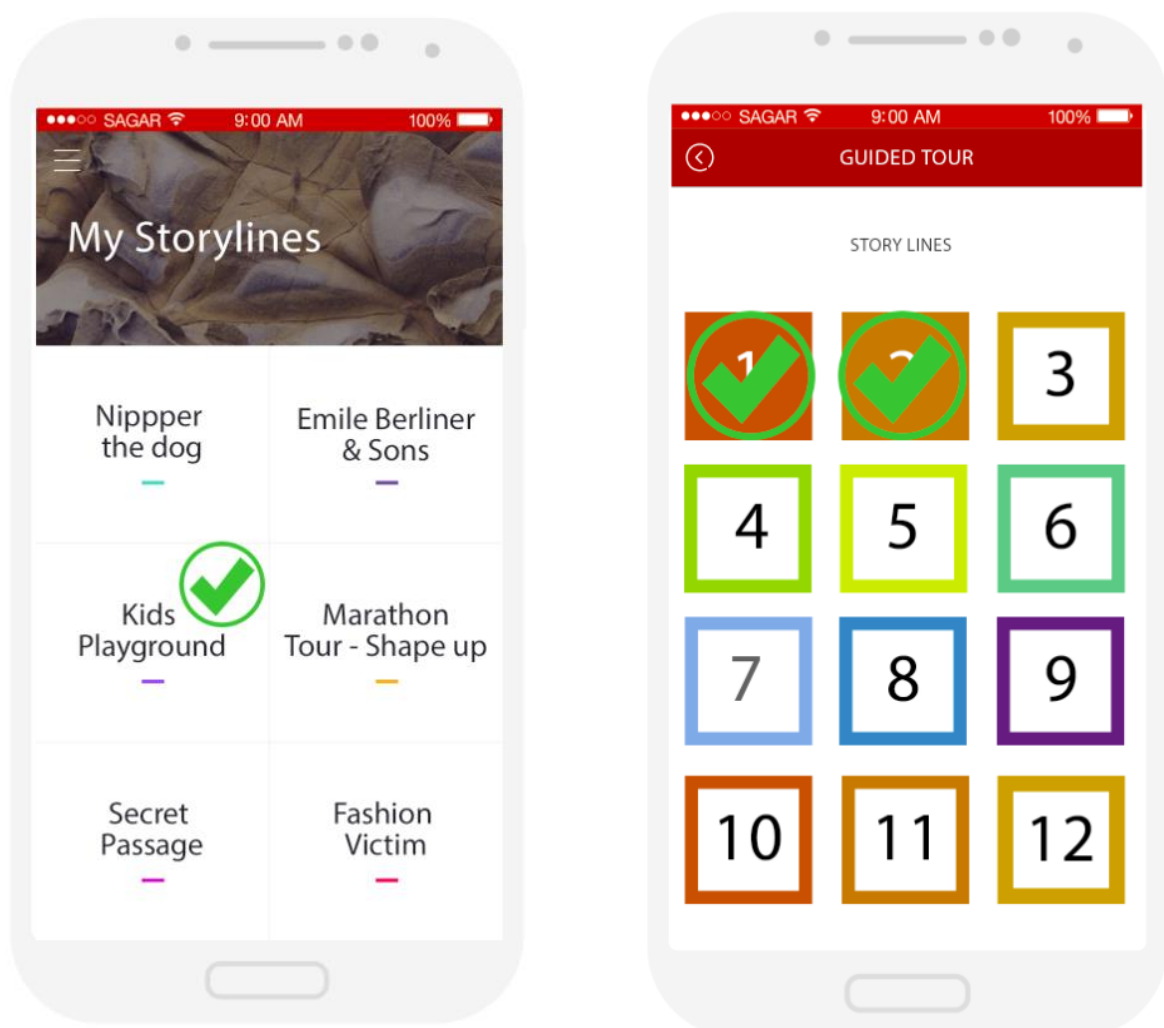
Mr. and Ms. Smith come from out of town to visit their son who happens to be a student at a Montreal University. They decide to pass the time by visiting the Musee des Ondes while their son is in class. Once they arrive to the museum, they open the Exposeum app, and pick one of the storylines that fit with their schedule and is for an adult audience. The storyline they choose guides them through different points of interest, providing them with its history put into a storytelling context. As promised, within less than 50 minutes, the storyline guided tour is over, giving them enough time to go back and meet their son.

UI Prototype

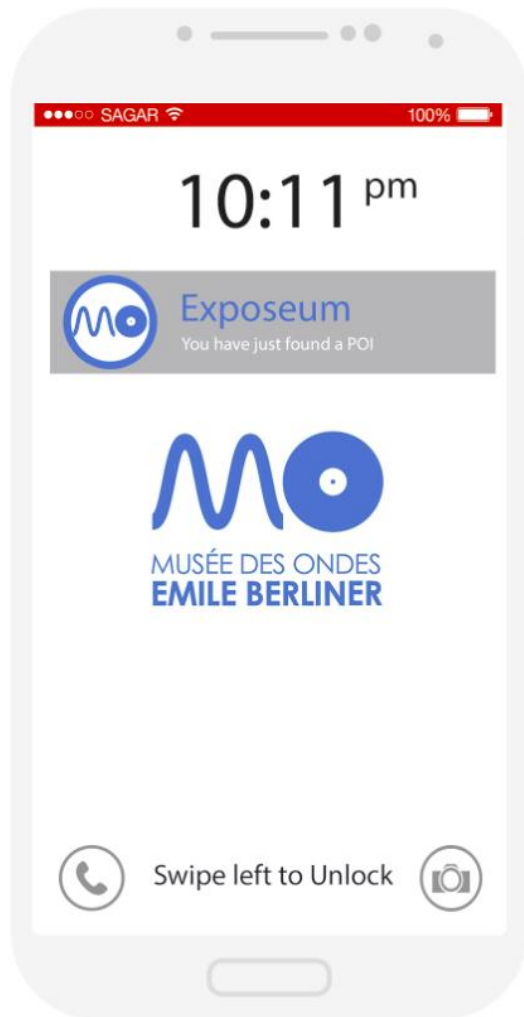
The quality standards for the ease of use and error tolerance used to develop and design these prototypes are all based on SOEN 357 (User Interface) guide lines. People have developed habits over the years in regards to where they expect a back button to be, a menu and more.

When a prototype is ready, to evaluate the ease of use we showcase it to friends, families and anyone with relevant input to give. Note that we do not provide no guidelines to what is this view. This will allow the design team to get a sincere reaction from the user in regards to the UI.

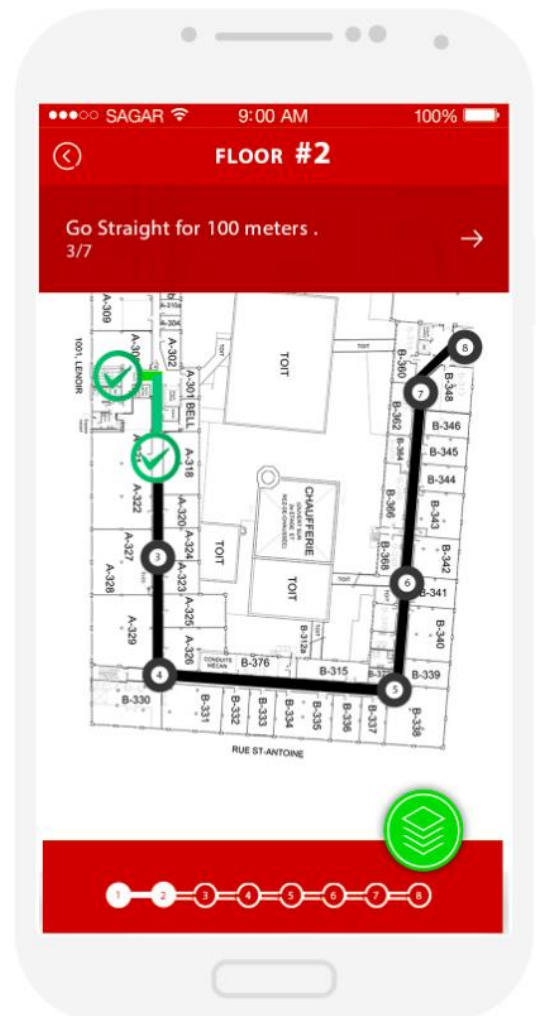
7.1 : As a user I would like to see a full list of all the storylines.



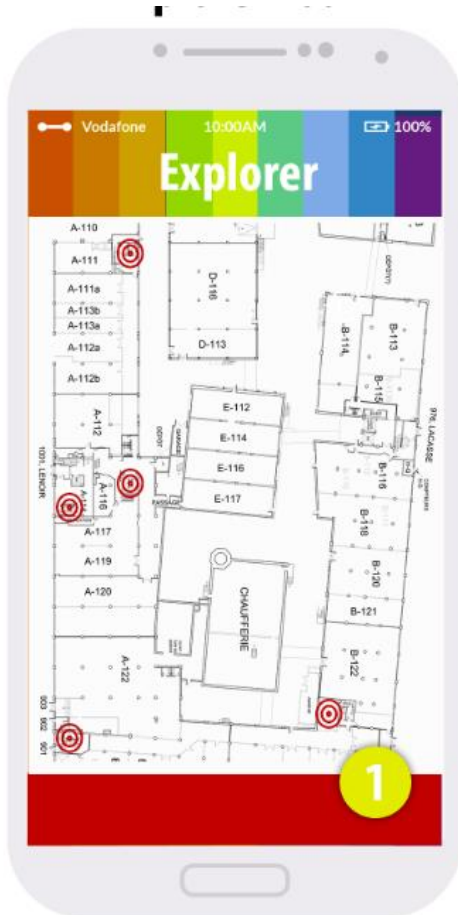
7.2 : As a user I would like to get Push notification, tour when screen is out of focus.



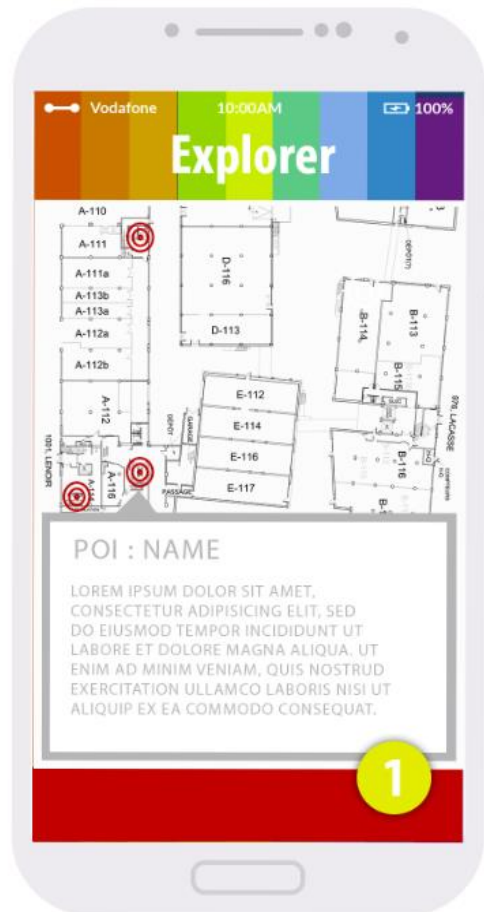
7.3 : As a User I want to see the guided



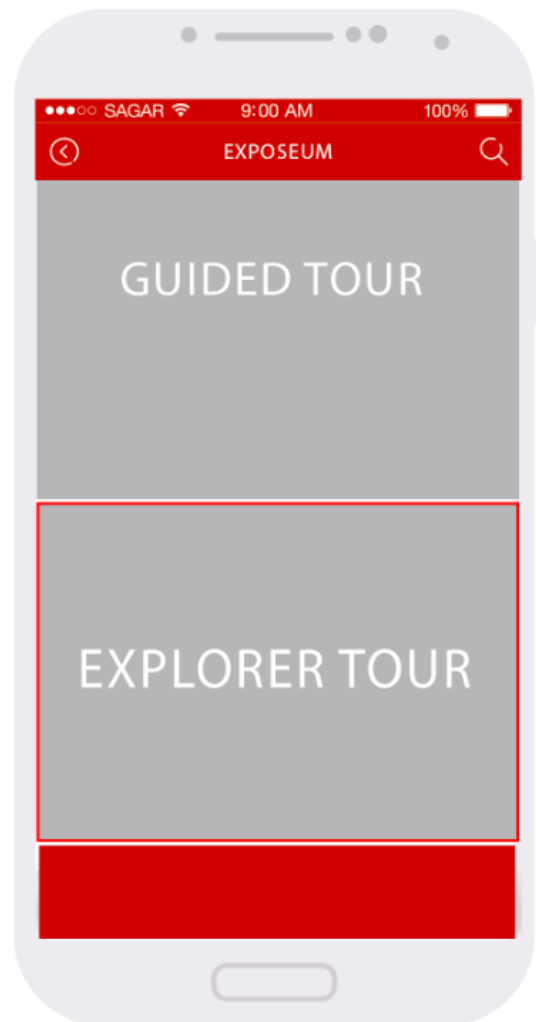
7.4 : As a user I want to see all of the Poi's info.
(explorer Mode)



7.5 : As a user I want to select a POI and get

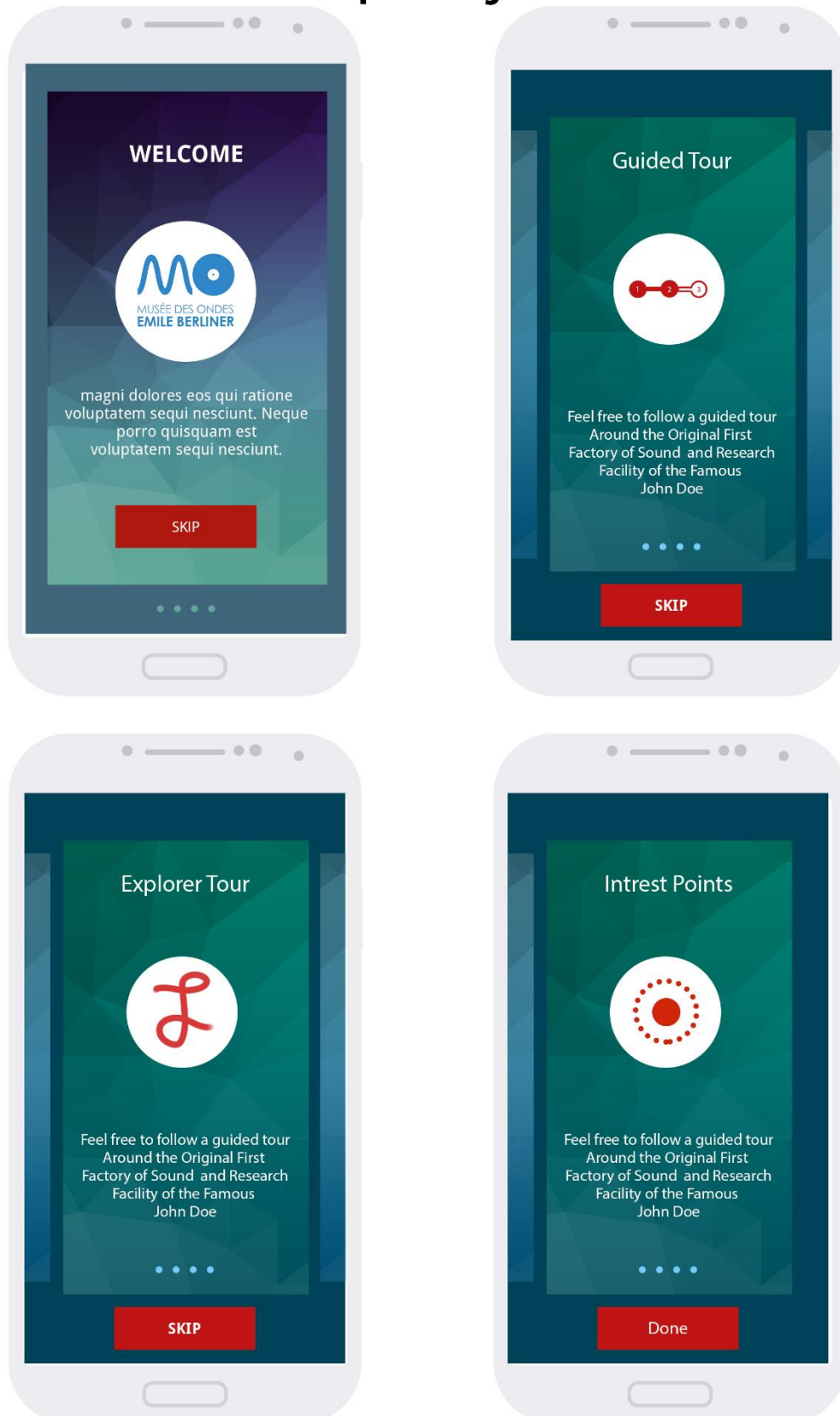


7.6 : As a user, I want to choose
Between a guided and an explorer tour.



7.7 : As a User I would like to get a intro tutorial about this app (Splash page – not yet part of backlog)

Splash Page



8. Testing Plan and Report

Unit Testing

Unit testing tools

Unit testing will be performed using NUnit. NUnit is a lightweight unit testing framework which comes bundled with Xamarin.

A separate project called Exposeum.Tests was added to the solution in order to isolate unit testing code from the core application code.

We currently observe the following convention for the unit tests found under this new testing project: Each user story has its own testing folder, under this folder we find all the unit tests related to the implementation of the user story. Every unit test class under each folder corresponds to a testable class found in the main project, ensuring clear and proper testing of testable classes.

Relevant units to be tested

All core modules and their constituent units will have at a minimum one unit test. The map module will be tested to ensure that the app responds correctly to the user's interactions and that different map elements are clickable. The interaction between the application and the various iBeacons setup on-site will also be tested. The user's language preference and the persistence thereof will too be verified. Beacon database retrieval and persistence will be ensured, including CRUD operations and object serialization and deserialization.

Currently, we have not identified any units which cannot be tested in some significant manner by way of unit testing.

Acceptance Testing

When all the tasks associated with a particular story are completed, a corresponding acceptance test outlining the acceptance criteria is demonstrated to the stakeholder and signed off on.

Sprint 1

AT-1	US-1 - As a Visitor, I want to specify my preferred language (english or french) at any time.
Acceptance Criteria	Given that I am in the application, the user interface matches the device's language. If I modify the device's language, then the interface of the application matches the new device language.
Result	TO BE TESTED
Comments	

AT-1	US-13 - As a Visitor, I want to receive full contextual information about a point of interest in my proximity.
Acceptance Criteria	Given that I am in the application, and then I enter the proximity of a beacon (within 0.5m), the interface displays contextual information about the associated POI.
Result	TO BE TESTED
Comments	

AT-1	US-14 - As a Visitor, I want to view the entire map of every floor with all points of interest when in free visit mode.
Acceptance Criteria	Given that I am in the opened the application, and that I have selected free visit mode, then I can view the points of interest in the map,

	and I can change floors in the map.
Result	TO BE TESTED
Comments	

System Tests

Because no amount of unit testing can replace the need to perform a system interaction test, such as simulating a real user interacting with the app directly, further testing is needed in the form of system testing.

In our application, for example, this would be testing that pinching over the map results in the zoom level being increased or decreased, for instance. For this, Xamarin offers a solution called Xamarin.UITest which allows for the programmatic simulation of user interaction events directly with the interface of the application.

For this, a new project was added to the solution called Exposeum.UITests. There, a sequence of user interactions on specific UI elements can be specified, and the prescribed outcome can be asserted. Using this project, entire user stories can be tested in one shot.

In fact, Xamarin.UITests can model most of our system tests in a 1-to-1 manner, because user interaction events can be sequenced programmatically, replacing the need for a human user.

Sprint 1 System Testing

ST-1	US-1 - As a Visitor, I want to specify my preferred language (english or french) at any time.		Expected Output	Result
Steps to reproduce	1	Open the application	The language of the application matches the language of the phone	Pass
	2	Navigate phone system settings and switch language	-	Pass
	3	Go back to application	The language of the application matches the new selected language	Pass

Result		Pass
Comments		

ST-2	US-13 - As a Visitor, I want to receive full contextual information about a point of interest in my proximity.		Expected Output	Result
Steps to reproduce	1	Open the beacon activity	Beacon activity is displayed	Pass
	2	Get within 0.5 meters of a beacon	Information associated with the beacon is retrieved from the database and displayed	Pass
Result				Pass
Comments				

ST-3	US-14 - As a Visitor, I want to view the entire map of every floor with all points of interest when in free visit mode.		Expected Output	Result
Steps to reproduce	1	Open the map activity	Map is displayed at the 1st floor with corresponding POIs	Pass
	2	Select the 'floor up' button	Second floor map is displayed with corresponding POIs	Pass

Result		Pass
Comments		

Sprint 2 System Testing

ST-4	US-6 - As a Visitor, I can engage in a free tour mode of the building so that I can visit all POIs in an unrestricted way.		Expected Output	Result
Steps to reproduce	1	Open the map activity	Map is displayed at the 1st floor, with its corresponding POIs	To be tested
	2	Select any floor	Selected floor, with its corresponding POIs, is displayed	To be tested
Result				To be tested
Comments				

ST-5	US-7 - As a visitor, I want to select any point of interest and view its summary when in free visit mode.		Expected Output	Result
Steps to reproduce	1	Open the map activity	Map is displayed at the 1st floor, with its corresponding POIs	To be tested
	2	Select a given POI	The summary of the selected POI is displayed	To be tested
Result				To be tested
Comments				

ST-6	US-9 - As a Visitor, I want to receive push notifications when the app is not in focus.		Expected Output	Result
Steps to reproduce	1	Start the application	Application opens to the main view	To be tested
	2	Minimize the application or lock the device	Application not in focus	To be tested
	3	Get within 0.5m of a beacon	Application sends push notification to the user	To be tested
Result				To be tested
Comments				

ST-7	US-11 - As a Visitor, I want to see which points of interest I have already visited.		Expected Output	Result
Steps to reproduce	1	Start the application	Application opens to the main view	To be tested
	2	Get within 0.5m of a beacon	POI is displayed as visited	To be tested
Result				To be tested
Comments				

9. Defect Tracking and Report

Sprint 1 report:

In this sprint two out of three reported bugs were resolved. EX-53 was addressed but not reviewed, hence it was not marked as resolved.

Defect ID	Description	Discovered	Resolved	Status
EX-51	Wrong beaconid type	Sprint 1	Sprint 1	RESOLVED
EX-52	Name of POI_insertion.cs POI_ListDisplay.cs does not follow the naming convention	Sprint 1	Sprint 1	RESOLVED
EX-53	Improper Database Structure	Sprint 1	-	IN PROGRESS