

**University of Bamberg**



**Internship Report  
Mobile Software Frameworks and Object  
Oriented Programming  
at Favendo GmbH**  
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by

Chandan Sarkar  
MSc. International Software Systems Science  
University of Bamberg

Favendo GmbH  
An Der Spinnerei 15  
Bamberg, Germany 96047

Supervisor and Organization Contact:  
Christian Motz  
Director Legal-HR  
[christian.motz@favendo.com](mailto:christian.motz@favendo.com)

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**favendo**

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# **1 Acknowledgment**

I would like to thank Mr. Christian Motz, the Director Legal/HR at Favendo GmbH, for giving me the opportunity to do an internship within the organization.

# **2 Introduction**

I have participated in an internship program offered by Favendo GmbH [1] in Bamberg for four months starting from April 2018 and concluding on July 2018. Favendo is a software company established on 2014 with development sites mainly in Bamberg and Jena in Germany, provides cutting edge Location Based Services to its internationally spread customer base. Favendo is also part of Fewclicks corporate group [2] which closely deals with Web Application Services and Internet of Things based solutions. Favendo has provided location based services and solutions to customers from various demographics. Some of the prominent examples are Audi AG, SAP and Mediterranean Shipping Company cruise ships. This internship is part of my ongoing masters program at University of Bamberg in Germany.

Core services offered by Favendo can be divided into several categories as referred from the Favendo Official references [1]:

- **WayFinding**

Way finding and indoor navigation is one of the key services that is offered with the help of hardware components such as beacons and the Commander software framework, in conjunction with a highly available backend server component. This service helps the users in finding their navigation path from a given source to destination at the indoor venues such as airport, shopping malls or large cruise ships with hand-held smart devices. A high degree of accuracy helps in precisely locating a point of interest in large complex venues. Normally, a combination of several technologies such as low energy consuming crypto-beacons along with core development framework of popular software ecosystems are used to bring the solution to the customer.



Figure 1: Way Finding sample application from Favendo Official [1]

WayFinding carries value both for external visitors as well as the authority using the Favendo provided solution. On one hand visitors can find their way to desired destination in a large building or complex. On the other hand, respective authorities can use visitors data through analytics and use the same for proximity marketing and many other thoughtful purposes in order to boost the business.

- **Asset Tracking**

Asset Tracking was always been a challenge worth considering for large industries especially in sectors like construction, hospital management or large recreational venues like cruise ships. It is crucial to search items of interest in the hour of need and ensure security for them. Asset Tracking system developed by Favendo can be helpful in tracking the positions/potential utilizations of equipments or in certain cases even human beings. It is far more than just keeping track of matters. It could also be helpful in routing and smart arrival/availability predictions.



Figure 2: Asset Tracking concept from Favendo Official [1]

Favendo offers hardware/asset tags based on crypto-beacons and RFID

technology as well as software framework that goes hand in hand in order to create an Internet of Things based real time implementation of Asset Tracking. Use of bluloc [3] crypto-beacons makes a durable installation of signal radiators which are intercepted by beacon controllers and analyzed by the software systems to generate useful knowledge.

- **Proximity Marketing**

Proximity Marketing has introduced a new paradigm of customer engagement for the businesses in order to improve sales. The key idea of the proximity marketing often relies upon the accurate positioning systems in place and it exposes unprecedented opportunities to improve business as a whole. Proximity marketing can be utilized to reach customers with making venue-specific products or offers information available.

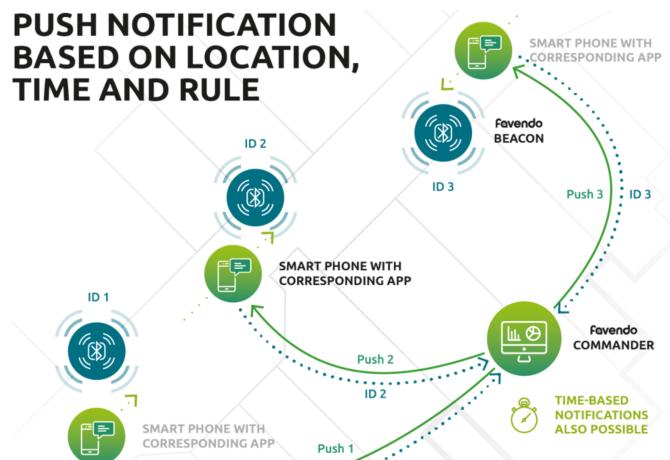


Figure 3: Proximity Marketing concept from Favendo Official [1]

We can assume a very simple use case of making the content or commercial offers available in mobile device of potential customers when they enter a specific zone or in close vicinity with the point of interest. The solution offered by Favendo is implemented with beacons making it independent of the network connectivity.

- **Analytics**

Analytics utility is built in within the web based dashboard application that Favendo offers to customers. This datasets covers a wide range such as the purchasing trends, navigation patterns or interactions with tracked objects or assets.



Figure 4: Analytics concept from Favendo Official [1]

This invaluable dataset could help customers with determining the possible optimization scopes in their product lines or services offered as well taking rational decisions improving the customer engagement. The image 4 shows a concept study made for an indoor shopping center to have an overall idea of visitors movement over a course of time.

## 2.1 Description

Efficient framework system plays a key role in the services that Favendo offers to its customers and works as the enabler and customization point for consuming location based service. It consists of several related subsystems and goes by the project name Commander [4]. Commander is executed with a highly available backend server side module that often securely hosts the classified information and a highly customizable mobile application SDK that is used to integrate location based services offered by Favendo to the mobile application developed for popular mobile software ecosystems such as iOS and Android. In order to provide the indoor navigation/positioning utility this framework comes with a map implementation customizable as per specific customer needs.

During my internship I was engaged with various enhancements and bug-fixes for this framework especially applicable for the iOS mobile platform. I have participated in the research and development efforts targeted towards the next major release of the commander mobile framework. I have learned a great deal about the iOS ecosystem in general and application programming constructs and relevant design patterns both with Swift and Objective-C as programming languages. I have participated in development efforts of reusable frameworks in the mobile application development. In the next

sections I have provide a vivid summary of the subject matters that I have learned or closely dealt with and my reflection of the same.

## 2.2 Key Concepts and Activities

This subsection will describe the key concepts developed during the internship and the activities performed.

- Object Oriented Design Patterns
- Delegate Pattern
- iBeacon Standard and Ranging/Positioning
- Object Oriented Programming with Swift, Objective C
- Cross platform research with C++
- Test Driven Development

### 2.2.1 Object Oriented Programming and Design Patterns

M. D. Smith et al. [5] have described the object oriented design paradigm as the specification of task to be performed in terms of the associated objects and properties/behaviors of the objects. They have further illustrated an object as an instantiated entity having some operations it is capable to respond. It has state which could be impacted by the associated operations. Objects can invoke operations of other objects by passing messages. Smith et al. [5] has also described a class as an interface specifying the properties and behaviors of an object. Properties defined inside the class determines the state of the object when instantiated. OOP paradigm provides abstraction and encapsulation contributing to security and modularity the real power of re-usability comes in the form of inheritance. OOP has contributed in developing maintainable code for many large and sophisticated software applications.

Despite the capabilities that OOP has offered, modern software development can not be realized without adherence appropriate architecture and design paradigm which needs us to adhere to certain disciplines while writing software application code. Erich Gamma et al. [6] have mentioned that design

patterns are the mechanism to identify, name and abstract away common themes in object oriented designs. They are generally based on the intent behind the design and they identify the collaboration, rolls and responsibilities of different objects in building a software application or solution. A very common frequently used example in mobile applications demographic is Model View Controller(MVC) design pattern which is often referred from the development of Smalltalk-80 programming environment as illustrated in the work of Krasner et al. [7]. The key focus of the MVC design patterns is to separate the functional units of an application for modularity and easier maintenance. It separates the class instances encapsulating data and operations related to the application domain as **Model**, the presentation and display of the application state as **View** and user interaction and response with the model and the view as **Controller**. MVC is one of the popular design patterns used in developing standalone mobile applications. While there are many popular design patterns, in my internship I have worked with three popular object oriented design patterns as briefly illustrated in the table 1 below:

<b>Design Patterns</b>	<b>Specification</b>
<b>Mediator</b>	Mediator Description
<b>Strategy</b>	Strategy Description
<b>Delegate</b>	Delegate Description

Table 1: Object Oriented Design Patterns dealt with

### 3 Reflection

This section will describe the reflection on the internship.

### 4 Conclusion

This section will have the conclusion.

## 5 References

### References

- [1] Favendo gmbh official. [Online]. Available: <https://www.favendo.com>
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