# Alli Gator Tours Final Report

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**Abstract:** Considering the popularity and academic standing of the University of Florida, a vast group of people visit the campus year-round with the objective of learning more about the university and what it has to offer, but they are faced with obstacles such as lack of availability or poor schedule flexibility when it comes to physical campus tours. The objective of this report is to go over a proof-of-concept technology project that integrates low-energy Bluetooth beacons and artificial intelligence chatbot agents to explore the optimization of the valuable hospitality resource that are campus tours. The project consists of an android mobile application that gives users the ability to participate in hybrid virtual-physical tours, thus avoiding the aforementioned obstacles. Furthermore, the application allows users to customize their own tours and only visit the locations they desire. The integration of the proposed technologies in the application were considered based on peer-reviewed research that evaluates their potential impacts in the consolidation of virtual and physical learning spaces as well as the optimization of communication between customers (campus visitors) and stakeholders (University of Florida) in the hospitality industry.

## 1. Introduction

The interactive Alli Gator Tours would be a reliable tool in the domain of information and hospitality at the University of Florida (UF). They would provide opportunities for visitors to learn more about UF while actively engaging with the campus community and the best-informed, digital tour guide.

Alli Gator Tours allow for increased accessibility to UF tours. Official tours of the UF campus are usually fully booked and do not accommodate everyone's schedules. With these self-guided tours utilizing the conversational AI, Alli Gator, people can tour and learn more about UF at their own pace and in accordance with their own schedules. Moreover, with the integration of low energy Bluetooth beacons around campus, users would be motivated to interact with the physical space of the university.

## 2. Background

### 2.1. Theoretical Background

The scientific background of this project focuses on the impact that integrating low energy Bluetooth beacons and artificial intelligence in technology has in physical learning spaces and the hospitality industry, respectively.

First considering the integration of artificial intelligence chatbots in the tourism and hospitality industry, a book written by Stanislav Ivanov on the impact of robots, artificial intelligence, and service automation in these industries dedicates a whole chapter to the discussion of chatbots, specifically. Ivanov explains in his chapter that "the information-intensive nature of the tourism and hospitality industry demands regular communication" between customers and stakeholders, mainly because customers want to be up to date with what the stakeholders have to offer [2]. For this reason, the integration of chatbots in hospitality-based technology opens the door for ease-of-access and efficient communication opportunities between customers and stakeholders. In the case of the University of Florida, there exists a constant flow of campus visitors that schedule campus tours with the Cicerones with the objective of learning more about the university, and what it has to offer to its students. Such a situation brings forward the ideal setting for integration of AI chatbots in technologies for information sharing. The project discussed in this document is an instance of a hospitality-focused technology that could benefit UF by optimizing communication and reducing necessity of expenses in physical hospitality resources.

Shifting attention to the promises of low energy Bluetooth beacons, there is literature that explores the potential these beacons could have in learning experiences seeking to integrate digital and physical learning spaces. For instance, the article *Exploring*

*Bluetooth Beacon Use Cases in Teaching and Learning: Increasing the Sustainability of Physical Learning Spaces*, evaluates beneficial applications of beacons, particularly in educational institutions, taking advantage of the proliferation of mobile devices over the last 10 years [1]. The mentioned article goes over the specific sustainable practice of using beacons for the dissemination of electronic teaching material by "spatially divide[-ing] physical learning spaces and providing pertinent information in the associated sub-space" [1], which is exactly the principle we implemented in this project.

### 2.2. Prior Art

The existing art mainly consists of chatbots and AI that help answer questions. This includes things like Siri, Google Assistant, and Alexa. Additional prior art includes but is not limited to:

- Harn Museum uses beacon technology to figure out where in the museum users are located which determines what is shown on the screen.
- Beacons - Used in stores to help with advertising, etc.
- Alli Gator chatbot on UF websites.

## 3. Timeline

**Relevant Dates**

- Alpha Build – September 9th
- Beta Build – September 28th
- Release Candidate – October 28th
- Production Release – November 30th

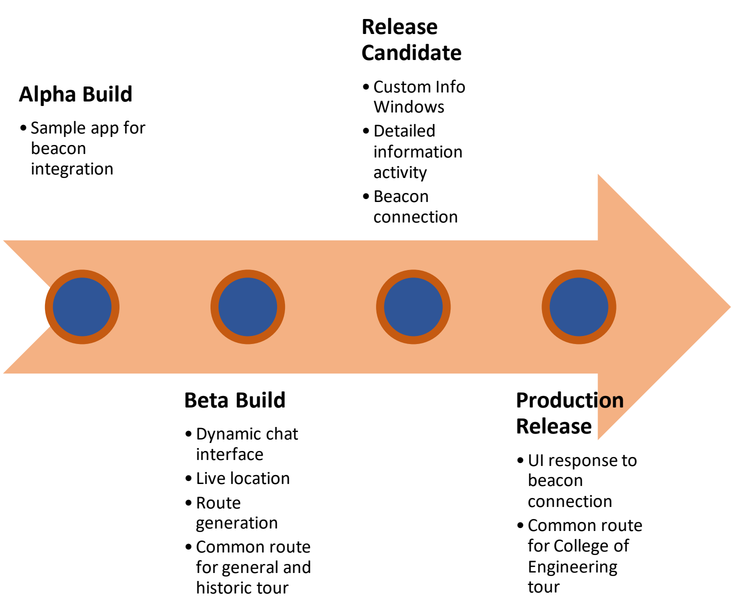


**Figure 1. Visual representation of project's timeline and its completed features**

## 4. Design

The design of the project, on a high level, consists of an Android mobile application with a user interface (UI) where the user can customize and participate on tours displayed on a map as well as chat with the app's virtual "tour guide" Alli. The app takes advantage of the mobile device's internal systems (screen input, microphone, etc.) allowing the user to interact with the UI. Moreover, the backend of the app is a collection of subsystems used to implement the beacons, map, and chatbot functionalities. The details of the design system and subsystems are discussed ahead.

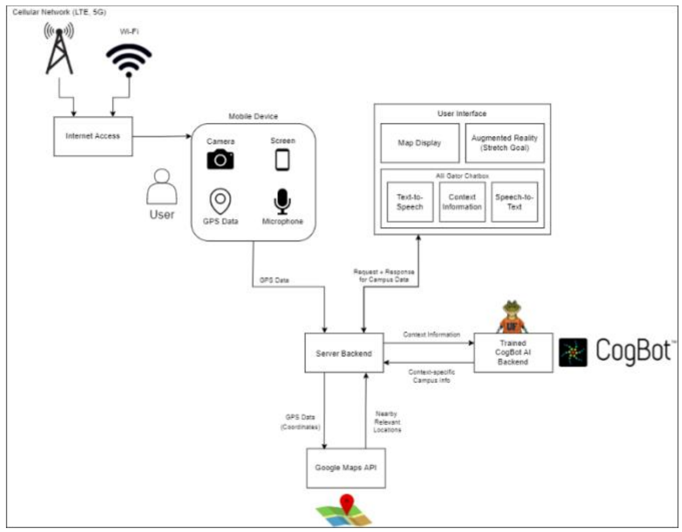


**Figure 2. Diagram of system design displaying interactions between subsystems**

### 4.1. Communication Systems and Protocols

**Internet**

The application's functionality heavily relies on internet communication. Internet connectivity is necessary for the backend to carry out API requests to Google Maps and CogAbility services. Additionally, internet access is used by android's internal coarse and refined location capability.

**Bluetooth**

Android devices' internal Bluetooth protocol is necessary for the application's interaction with the physical low-energy Bluetooth beacons used to identify the user's proximity to a tour location.

### 4.2. Internal Systems

**Input/Output (I/O)**

Screen - this is the main input device used to interact with the app. App takes advantage of multi-touch input for gesture navigation of the map that aligns with commonplace navigation in mainstream map applications (Google Maps, Apple Maps, Waze, etc.).

Microphone - For accessible communication with the chatbot Alli, microphone access is used to implement speech-to-text capabilities.

**GPS**

The application makes use of android's internal coarse and refined location capabilities such that the live location of the user can be displayed in the UI.

### 4.3. Subsystems

**User Interface (UI)**

The user interface is the front-end subsystem where the user would be able to interact directly with the system (backend). For this reason, the UI brings all subsystems together.

**Google Maps SDK and API**

The Google Maps SDK is used by the application to implement and integrate the map and its basic functionalities such as map display and navigation, location markers and markers' info windows.

Additionally, the Google Maps Places API is used for implementation of live location including request for location permissions.

Finally, the Google Maps Directions API is used to get the most optimal route between tour locations.

**CogAbility CogBot and API**

Communication with the CogBot Alli is accomplished through API requests (passing the user's message) that return the relevant response of the chatbot.

Additionally, CogAbility's CogUniversity is used to train Alli to provide more accurate information related to the tours. CogUniversity is the virtual portal where the corpus of information of CogBots are managed.

### 4.4. Design Breakdown

**Front End (UI)**

Main Menus - Choose between default or customizable tour; if customizable, choose starting, ending, and middle points of the tour.

Map - Display of UF map with markers (pins) on relevant locations. Live location is displayed and relevant information on locations can be accessed by tapping on pins.

Dynamic chat - Chat interface to communicate with Alli. It simulates mainstream chat implementations (history of Q/A exchange with message bubbles).

**Backend**

Google Maps SDK/API - SDK handles map generation with relevant features (markers, info windows, navigation), and APIs produce live location and route directions results.

CogAbility CogBot API - API produces answers to relevant questions sent by the user.

GPS - Internal android mobile devices system used for refined live location.

**Communication**

Internet - Internet connectivity used to carry out API requests.

Bluetooth - Used for interaction between mobile devices and low-energy beacons.

## 5. Results

### 5.1. Completed Features

**Campus Tour Map**

Main Menu - The user is prompted to choose between participating in one of the default tours or to create a tour from scratch. Additionally, in this menu the user can access the chat functionality with Alli Gator.

Default Tour Options - The user selects from the list of default tours.

Tour customization - Consisting of three consecutive menus, the user is prompted to choose starting, ending, and middle points (locations to visit) of the tour. It is important to note that the selection process was designed as such because the Google Maps Directions API (used to produce route polyline) requires the origin and destination of the route to be specified while the waypoints (locations to be visited in between or middle points) are optional.

Map Display - Consists of successfully displaying UF's campus map with relevant markers, user's live location, and route polyline.

Info Windows - The user can see brief information about the tour's locations directly on the map with info windows, which are custom layouts of information that show/hide when a location's marker is tapped.

Detailed Information - Extending info windows functionality, when the user taps a visible info window, the app redirects the user to a scrollable screen with extensive information on the location of interest.

**Alli Gator Chat**

Dynamic Chat Interface - The interaction with Alli Gator the CogBot takes place through a dynamic chat interface that resembles a real-time mainstream text conversation with message bubbles and scrollable history.

Speech-to-Text - For accessibility purposes, messages to Alli can be composed using speech instead of directly with typing.

History deletion - The user can remove individual message bubbles by simply tapping on them; therefore, being able to control the chat's history.

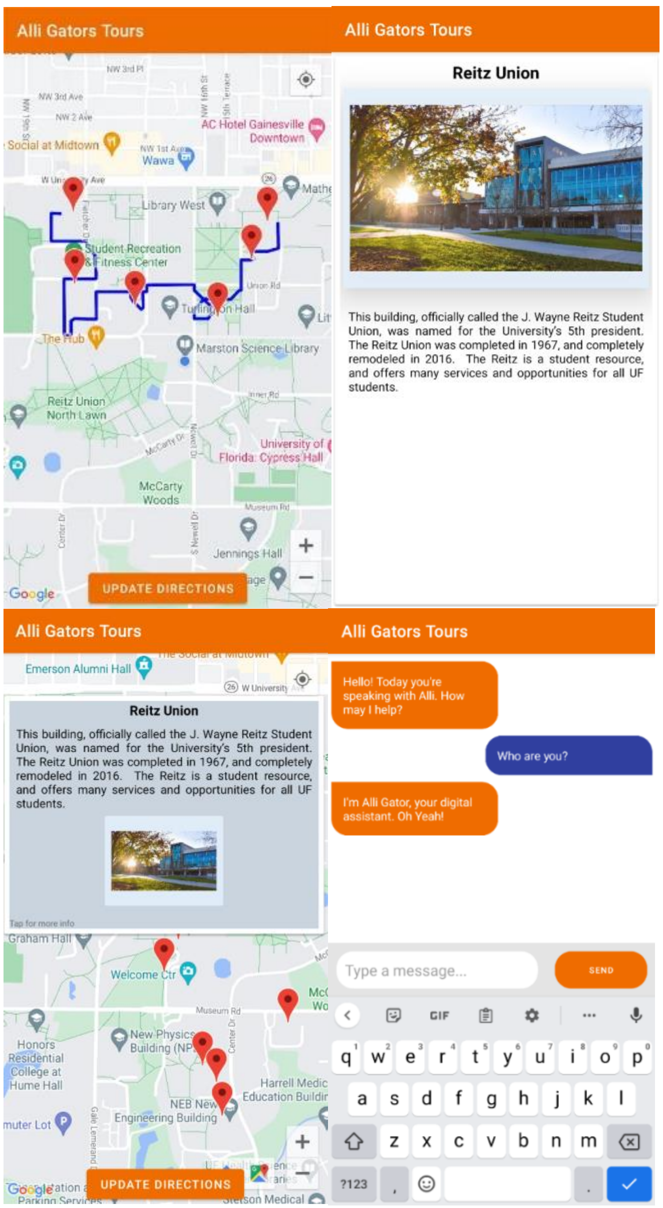


Figure 3. Screenshots of application showing working state of features

**Bluetooth Low-energy Beacons**

Connection to Gimbal BLE beacons - Through the Gimbal Android Version 4 API, the app successfully connects to beacons that are within a certain range. This is done through two classes: GimbalApp and GimbalIntegration which sets the API key and sets up listeners that will notify the app when a beacon has been spotted.

Figure 4. Picture of Gimbal BLE beacon

Geofence capabilities - Also through the Gimbal API, developers can set different geofences (certain locations within a specified radius) in which the user will be notified upon entering.

Gimbal BLE Beacon notifications - When a user's device comes within the connection range of a Beacon, the app screen is automatically updated to display the detailed information of the relevant tour location. Additionally, for an improved user experience, the UI notifies users they have reached a specific location through an Android toast message.

## 5.2. Incomplete Features

Although all features have been successfully implemented, there are incomplete improvements that could potentially increase the robustness and value of the already implemented features.

Route Optimization - Currently, route generation is successful and reliable, but when a customized route has many waypoints (middle points between origin and destination), the suggested route can become messy and conglomerated.

Chatbot Optimization - The chatbot implementation of the app successfully displays all answers in the UI as strings. However, the chatbot provides different response type objects that, with further implementation, could be parsed to display clickable links and separately formatted answer options.

Simple Database for Location Information - We wanted to implement a simple database such that a person building the app with little to no programming experience could edit the information of tour locations without having to delve into the app's code. Nevertheless, by the release candidate milestone we had implemented the fundamental functionalities of the tour map feature in such a way that adding a simple database required a major restructuring of the app's implementation. Therefore, it proved difficult to carry out this task in time for the production release milestone.

### 5.3. Testing

Performance Testing - To test the basic performance of the application we built and ran the application in 2 different physical Android devices (Samsung Galaxy S7, Samsung Galaxy Note 10) and 2 different Android device emulators (Google Pixel 1 and 4). By each milestone, we would ensure that the application's consistency and robustness were satisfied by going through all major use-cases and fixing any observable issues.

Stress Testing - To stress test the application, we used Android's development tool "The Monkey" to generate a pseudo-random stream of user events (clicks, touches, and gestures) on the emulators and fixing any cause of app crashes. Stress testing was particularly useful in the development of the first milestones because it helped us realize that some of our API calls were not asynchronous – the application would crash when UI interactions took place before an API's request returned its respective response.

User Testing - This form of testing consisted of getting individuals, who had not previously interacted with the app, to use the application after being given a high-level description of the purpose of the project and a few major use-cases. Afterwards, we used their feedback on user experience and suggested improvements.

## 6. Impact

### 6.1. Relevance

Considering the functionality of the project and the background information provided in section 2, the relevance of this project falls on the improvement of efficiency in information sharing, particularly in hospitality and tourism. Even though our project focuses on the University of Florida and its ability to provide resources for individuals interested in learning more about the university's campus and community, the principles of innovation brought forward by this project could be extended to any institution or organization with an interest in hospitality and information.

### 6.2. Limitations

The foundation of this project also has some limitations. Applying the same principles on future works limits user access to those in possession of the necessary technology.

### 6.3. Potential Future

We believe that this project sets a foundation for future works that seek to incorporate a digital space into a physical space (community) with the goal of facilitating individuals' interactions with the physical space. We believe that, from an economic perspective, organizations and institutions could use projects of this nature to reduce spending on physical resources that are not as efficient (i.e., physical tour guides in the particular use-case of our project). From a societal perspective, such works manage to accommodate most users because they eliminate obstacles like scheduling, accessibility, and scalability.

## 7. Conclusion

The Alli Gator Tours project has finally reached a reliable state where all major features provide a user-friendly experience to tour the University of Florida's campus and learning about its important landmarks and what it has to offer to students. With the objective of improving UF's hospitality efficiency and attractiveness, this project works as a proof of concept that could be further improved to fully exploit the benefits of Bluetooth beacons on the integration of digital and physical spaces, and of artificial intelligence chatbots on the optimization of information sharing.

# References

[1] Griffiths, Sion et al. “Exploring Bluetooth Beacon Use Cases in Teaching and Learning: Increasing the Sustainability of Physical Learning Spaces.” *Sustainability (Basel, Switzerland)* 11.15 (2019): 4005–. Web.

[2] Ivanov, Stanislav, and Craig Webster. *Robots, Artificial Intelligence, and Service Automation in Travel, Tourism and Hospitality*. Ed. Stanislav Ivanov and Craig Webster. First edition. Bingley, UK: Emerald Publishing Limited, 2019. Print