Siesta Gardens Controller

Requirements Definition Document

RDD Version 3.0

Team T06
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1 Introduction

The Siesta Gardens provides people from all over the world the once-in-a-lifetime opportunity to witness a real-life T-rex. Visitor protection is the park's utmost priority and, as such, the system is well equipped to handle emergencies. It has monitoring system for T-Rex, sensor fences to enclose it, cameras to track its movement, and tranquilizer-armed staff prepared to immobilize the T-Rex. The SGC system uses automatic system as well as security personnel to watch over the monitoring system. In case our automatic alarm system fails the security personnel will be able to activate it manually. The introduction section outlines the purpose and scope of this document, as well as provides a list of common definitions, acronyms, and abbreviations used throughout the document. Additionally, an overview of the structure of this document is provided, which describes the layout of the other sections included therein.

1.1 Purpose

The purpose of this document is to specifically define the proposed capabilities of the Siesta Garden Controller (SGC) and delineate the logistics or constraints of the system. This document is mainly intended for the end-users and system administrators of SGC.

1.2 Scope

The "Siesta Garden Controller" is a system designed to ensure the safety and security of the Siesta Garden Park visitors and employees, while giving them a phenomenal experience of viewing a once extinct specimen Tyrannosaurus Rex firsthand. The SGC manages the kiosks, vehicles, and emergency protocols implemented by the park. As visitors arrive, they are presented with a kiosk installed with the SGC system that allows a self-pay option for a token containing a Radio Frequency Identification (RFID) chip specific to the visitor, which includes the visitor's name, assigned vehicle, time, and date of the visit and valid until information. The ticket is validated by an employee with a tablet by scanning it before entering the self-driving car to increase security and allow only authorized visitors to enter the park. Additionally, the SGC system helps manage the flow of visitors into the facility by monitoring park's implemented visitor occupancy limitation. The SGC system aims to celebrate the groundbreaking feat of de-extinction of the 66-million-year-old Tyrannosaurus Rex safely and securely.

1.3 Definitions, Acronyms & Abbreviations

The following acronyms and abbreviations will be used regularly throughout the document and are defined here for convenience:

SGC	Siesta Garden Controller
RDD	Requirement Design Document
T-Rex	Tyrannosaurus Rex
RFID	Radio Frequency Identification

Additionally, the following terms will also regularly be used and are defined as follows:

Administrator   The user(s) responsible for the management and control of the SGC system.

1.4 Overview

The remaining document includes six chapters which entail objectives, system organization, project requirements, capabilities, constraints, and assumptions of the SGC system. The objective chapter outlines the intent of the SGC system. System Organization showcases the components of the system from the user's perspective. Project Requirements describes the physical and emergency requirements and capabilities of the system. Capabilities section provides the description of how the SGC controller is expected to interact with Siesta Gardens. The constraint section defines the conditions applied as safety and security measures in the system. Assumptions segment lists lists any assumptions related to how the end-user or system administrator will behave or interact with the SGC system.

2 Objectives

The objectives of the Siesta Gardens Controller project are to create a safe and functionally robust park system that contributes to both the enjoyment and safety of the attending visitors. This system is comprised of a token management component, a vehicle management component, and an alarm system component to ensure safe passage throughout the park.

The Siesta Gardens Controller is designed to control and monitor each component as well as provide communication between individual components.

2.1 Central Management System

All of the subsystems discussed below are components of the Central Management System. This system is able to communicate with and monitor all of the park's subsystems, as well as provide direct input to these systems where applicable (e.g., remotely controlling the self-driving vehicles). Token statuses and locations, vehicle statuses and locations, and all security signals can be monitored from this system. Staff are able to manually trigger alarms via this system.

2.2 Token Management

The token management subsystem is the first component with which the visitors will interact. In order for visitors to access the transport vehicles and visit the exhibit, they will need to purchase a unique token. Tokens cannot be reserved in advance and must be purchased at the time of visit.

Tokens can be purchased from an automated booth supplied by the administrator. The SGC controls and manages the generation of unique RFID chips within each token. Upon token generation the information is communicated wirelessly to the main SGC control station.

The SGC will generate and dispense unique tokens for the visitors that include the RFID chip specific to the visitor retaining information like visitor's name, assigned vehicle, time, and date of the visit and valid until time. The token will then grant them access to

the park during their desired time slot. Each token generated will be associated with an employee chaperone. The employee will use their assigned tokens to track guests as well as physically accompany them on an available self-driving vehicle. In addition to token generation, this component will be responsible for logging all generated tokens and print out the limited number of tokens on the allotted visit duration. The token is generated in the form of a golden coin with a built-in RFID chip. The token management subsystem is completely autonomous.

2.3 Vehicle Management

There will be at least two vehicles operating within the park at all times during normal park hours. These vehicles will be self-driving and will be programmed to travel a pre-determined route around the island. Employee chaperones are staff who will accompany visitors on the self-driving vehicles. They are responsible for validating visitor tokens, as well as making sure that all visitors are present before the vehicles depart a location. They have the additional responsibility of pressing the on-board "Emergency Override" button in the case that the vehicle needs to depart but not all visitors are able to make it back to the vehicle. All vehicles are equipped to read and track the RFIDs located on visitor tokens. Chaperones are responsible for keeping visitors within 100 meters of the vehicle at all times, for RFID tracking purposes. The route will take visitors from the barge drop-off location to the T-Rex exhibit and then back. Once arrived at the exhibit, the visitors will be free to exit the vehicles and enjoy the park for the allotted time before again boarding the vehicles to head back. These vehicles do not require a driver and will operate without one, but can be controlled by Central System Management if need be.

2.4 Alarm Management

The vehicle tracking and emergency management subsystem are responsible for providing staff with relevant information regarding the location of each vehicle in operation on the island, information from sensors along the fence surrounding the T-Rex exhibit, live feeds from the surveillance cameras around the island, as well as information about the number of visitors on the island and how many are in each vehicle. This system will be able to manage communication between each of the components of the park system, so that, in the event of a crisis, emergency notifications can be sent out. This subsystem will autonomously perform the monitoring, but staff are expected to examine and react to these data. Using the employee tablet, signals can be sent to the central management station where the administrator can decide the type of security response is appropriate. In-case security system fails, to contain T-Rex we have trench just outside of the fence, it is deep enough so, that the T-Rex can't escape. The trench helps to protect visitors from possible danger when T-Rex escapes from the electric fences.

3 System Organization

The SGC system is comprised of each of the components discussed in the previous section. Each of these components is connected (wireless or otherwise) to the park's main security hub. The vehicle tracking and emergency management component will be physically located at this hub, as this is where all necessary monitoring operations are expected to take place. The token management component will include each of the kiosk terminals

at the main entrance with which guests can interact to buy tokens. The autonomous vehicles will be located in a garage near the main hub when not in operation, and will otherwise be traversing the path around the park. The system will have electric fences to monitor T-Rex. The electric fences will send the break signal to the central management system in case T-Rex breaks/climbs out of it.The central management system will deal with the emergency like sending alarm signal, vehicle routes, activate emergency button signal so, that chaperones can trigger it etc.
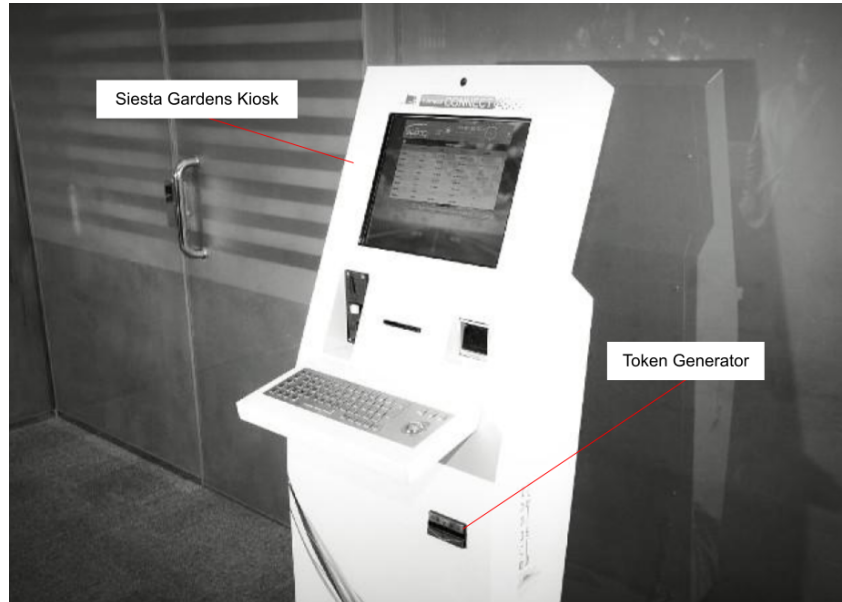

Figure 1: Siesta Gardens Kiosk

The Siesta Gardens Kiosk is the first subsystem that the visitor will interact with. Once visitors arrive on the island, they can purchase a token from the kiosk. Tokens must be purchased at the park and are required for transport to the exhibit. The Kiosk is located at the Route Start.
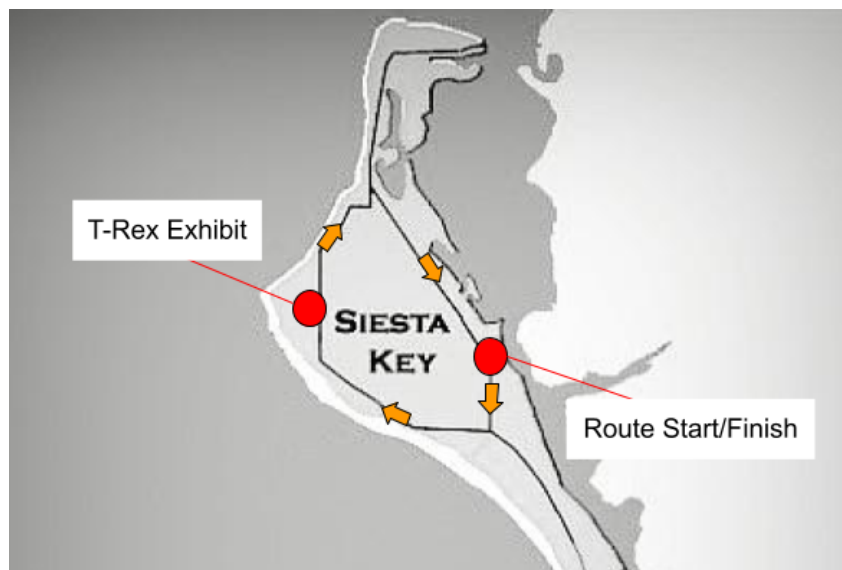

Figure 2: Siesta Key Map

After arriving on the east side of the Siesta Key, the visitors will get assigned to an employee chaperone and begin the route to the dinosaur exhibit. The employee chaperone will be present with the visitors on the vehicle. On the map, the route the vehicle follows is displayed. Starting from the East, the vehicle moves in a clockwise direction, stopping at the exhibit then returning to the starting point.

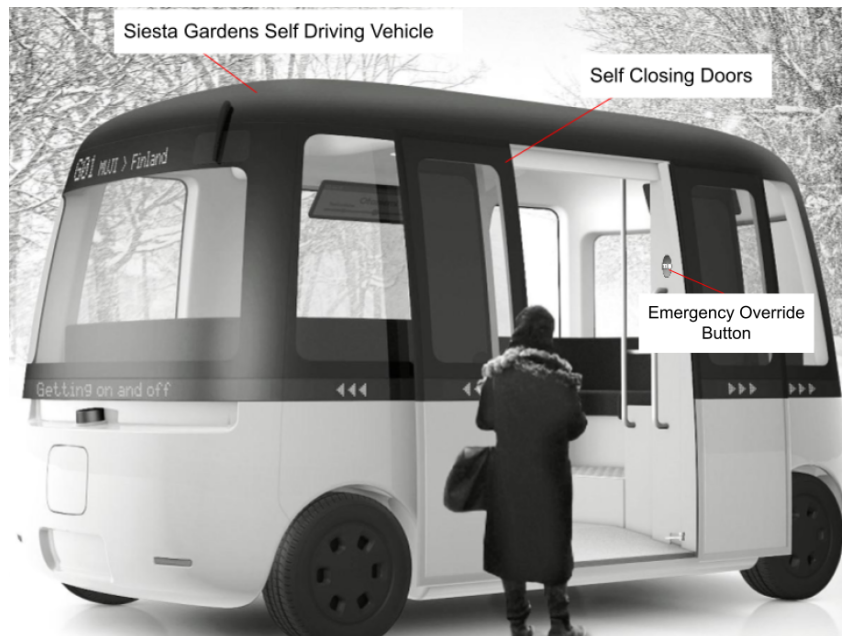Figure 3: Siesta Gardens Self Driving Vehicle (Exterior)

From the exterior of the vehicle the employee chaperone will help people comfortably get into the vehicle. The vehicle has a single entrance that has an automatic door that can be manually controlled by the SGC. from the outside the Override Button can be seen on the right hand side of the entrance.

Figure 4: Siesta Gardens Self Driving Vehicle (Interior)

On the inside of the vehicle, ten visitors can comfortably sit together while they are escorted to the dinosaur exhibit. Also from the inside the Emergency Override Button can be easily accessed next to the entrance. The override button will not be able to activate unless the central management system provides the activate signal then employee chaperones can trigger the emergency override button.

3.1   Dinosaur Exhibit & Enclosure

On the west end of the island is situated the main exhibit of the park, which will house the T-rex. The exhibit is a large expanse of land surrounded by a deep trench, again surrounded by a sensor-equipped fence. The trench is meant mainly a deterrent against the dinosaur moving too closely to fence, but is also deep enough that it could not climb out of it, preventing the dinosaur from escaping. The sensors on the fence will relay information back to the central management system about the presence (or lack thereof) of the dinosaur in the trench.

3.2   Chaperone Control Tablet

Each employee chaperone for each vehicle currently in operation will be supplied with a tablet-computer, which they can use to validate tokens, track the visitors associated with their vehicle, communicate with the central management system, and send emergency signals. The employee is responsible for keeping it on their person at all times during their shift.

4   Project Requirements

The project requirements define the features of the Siesta Gardens Controller. Requirements are divided into functional requirements and non-functional requirements.

4.1   Functional Requirements

The following functional requirements of the SGC define what the system must do.

- Token generation: The SGC controller must be able to generate a unique token specific to the visitor with details of time and date of visit, valid until information and RFID chip used for tracking the visitors while their visit at the park.

- Token validation: SGC controller must have the ability to validate tokens in order to get an access to the self-driving vehicle which takes the visitors to the T-Rex exhibit area.

- Vehicle procedures: There will be two self-driving vehicles operating in the park. The vehicles must be able to drive to the pre-destined route to the T-Rex exhibit. Only one vehicle will be at the exhibit site while the other one is preparing for departure. The vehicles at the start location must depart only when it receives a notification that the other vehicle is departing the exhibit area, and the passengers are ready to leave. The vehicle operated by the SGC controller must also be able to lock and unlock the doors for safety purposes.

- Vehicle tracking: The SGC will in communication with each vehicle to monitor its location. from the central management system the administrator is able send signals manually to the vehicle based off its monitored data. in an emergency the vehicle can be manually sent back to the starting location for example. The vehicle is also able to alert the visitors that their allotted time is nearing its end.

- Vehicle override button: In case of an emergency, the SGC controller will send the activate signal and employee chaperones is able to override its mandatory function of having to have all the visitors in the vehicle before departing from the T-Rex exhibit.

- Security camera: The T-Rex enclosure is equipped with monitoring equipment such as a security camera. the camera will provide visual feedback to the central management system to assist in management and visitor safety.

- Emergency Alarm System: The emergency alarm signal is triggered by the administrator overseeing the SGC. when signaled, the visitors will be called back to their assigned vehicle and then driven back to the starting location where they may safely exit the park.

4.2   Non-Functional Requirements

The non-functional requirements of the SGC define the general system behaviour and characteristics that affect user experience.

- The user interface for token generation must be easy to operate and easily accessible to all guests.

- The automated kiosk must not generate more tokens than the vehicles can hold for each time slot.

- The RFID on the token must be unique within a 6 month period.

- Transport vehicle must be fully automated. Guests cannot manually open and close the doors.

- Communication with transport vehicles must be done wirelessly.

- Vehicle tracking must be done throughout the entire park.

- Vehicle override button must be located in an area such that visitors cannot accidentally activate it.

- Security cameras must provide effective surveillance of the dinosaur exhibit.

- The emergency alarm system must communicate to all components within the park.

5   Capabilities

The Capabilities of the SGC describe in detail how the controller is expected to interact with the theme park, and how it communicates with its associated components.

5.0.1 Centralized System Management

The SGC is comprised of several discrete subsystems, all of which are connected to a central hub for convenient and reliable monitoring. Staff will be able to use this central hub to examine relevant information related to each of the subsystems.

5.0.2 General User Interaction

Users first interact with the automated ticket booth. The ticket booth will generate a unique token needed to board the self-driving vehicle which later is validated by the employee chaperone. Visitors can enter the vehicle only if the token is verified. Once all visitors assigned to the vehicle have boarded with their employee chaperone, the vehicle will transport the visitors to the exhibit. Visitors can exit the vehicle to freely explore the exhibit for the given amount of time. In order for the vehicle to return from the exhibit, all visitors must re-board the vehicle.

5.0.3 Token Generation

The SGC will manage the automated ticket booth and distribution of unique tokens for each visitor that purchases an exhibit pass at Siesta Gardens. Each token distributed contains information about the transport vehicle assigned to the visitor as well as the date and time-slot for their tour. Within each token contains an RFID chip that retains information: the visitor's name, the vehicle number, and time slot. Additionally, The RFID chip will be used to track visitors throughout Siesta Gardens as well as used for entry onto a transport vehicle.

5.0.4 Token Validation

In order to regulate visitors and only allow visitors with purchased tokens to board the transport vehicle, visitors must scan their unique token prior to boarding. Upon generation of a token purchase information is communicated to its associated transport vehicle.

Each token is specific to a certain vehicle and time slot for the day. Tokens are scanned by the employee chaperone. Tokens are validated by comparing the token RFID with the list of RFID's communicated to the transport vehicle upon token generation.

5.0.5 Vehicle Signals

The SGC will keep track of purchased tokens and the number of visitors assigned to each transport vehicle. Signals are sent to the vehicle to either lock or unlock the doors. If sensors on the vehicle indicate that the all visitors have boarded prior to departure, then a signal is sent to the vehicle to lock the doors and the vehicle will then proceed to move.

5.0.6 Vehicle Tracking

The SGC constantly tracks vehicle location and occupancy load as it travels throughout Siesta Gardens. Vehicle location and occupancy load is communicated to park staff and displayed on a real-time map. This will allow for a visual reference of the location of the vehicles as well as the amount of visitors present within the park.

5.1 Emergency Requirements

For the safety of the visitors at Siesta Gardens several emergency systems can be controlled with the SGC system. We have taken great security measures to ensure the safety of the visitors by regular monitoring of the T-Rex using security cameras and sensor fences and implementing different measures like alarm signals, override button. In case the alarm signal fails, we will have trench to contain T-Rex.

5.1.1 Security Camera

The Siesta Gardens has a security camera to watch the T-Rex exhibit 24/7. In addition the sensors from the enclosure will monitor the dinosaurs position and ensure that it is not outside permitted boundaries. If the employee in the central management system doesn't see the T-Rex in the camera as well as the sensors from fence send T-Rex escape signal to the central management system then he/she will follow the emergency protocols.

5.1.2 Visitor Security

To secure the visitors from any emergency conditions, many security protocols are implemented. Tracking of visitors by their token RFID is done at all times to ensure they are not entering unauthorized areas as well as ensuring guests are properly located in the event of an evacuation.

5.1.3 Alarm Signal

If the T-Rex manages to escape its enclosure, the authorized employees will activate the alarm signal, "Override" button for the vehicle, and prior enclosed trench (designed to confine the T-Rex) to open. Alarm signal operated by the employee on exhibit site will alert the visitor of possible dangers including fire hazards, fence failure, vehicle failure, etc. All alarm signals are also routed to the central management system for proper response.

5.1.4 Self-Driving Vehicle

The self-driving vehicles are controlled by the SGC system, and are equipped with a secure lock system. It will not move from its present location until all guests have returned to the vehicle. In the event that a visitor is unable to return to the bus, the vehicle's chaperone will be able to press the override button to securely lock the doors and resume the vehicle's course back to base.

5.1.5 Override Button

The "Override" button is designed for the uncertain circumstances like when visitors are unable to return to the bus. Then the override button will allow bus to safely lock and proceed to exit. The "Override" button is operated by the administrator.

5.1.6 Employee Tablets

Employees will be provided an electronic tablet which is centrally controlled by SGC system. This tablet will be equipped with a means of tracking tokens assigned to that

specific employee and overriding the assigned vehicle's route. Additionally, the tablets will be used to validate the tokens on entrance.

5.1.7 Employee Alarm

In case of an emergency where all automatic alarm signals fail, a manual alarm mechanism (a physical switch) is available in the central management system to send alarm signal. This mechanism is easily accessible and has the ability to send the appropriate signal to the SGC so that the alarm controlled by the SGC can sound.

6 Constraints

- The SGC can only host certain number of people at a time.

- Visitors are allowed to explore the exhibit for an allotted time only.

- Vehicles will not leave until all of the occupants have returned. The "Override" button can be activated by the vehicle chaperone in case of an emergency.

- The vehicles are automatic but controlled by the SGC system to operate in the fixed path and Time. In case of hardware malfunction, the vehicles will become inoperable.

- Once the vehicle en-route, it will only stop at the destination.

- Visitor are not allowed to cross any fence or barrier in the park.

- An employee chaperone will be required to accompany each group of visitors while they are in the park.

- Siesta Gardens is responsible for providing a kiosk for token distribution. This kiosk will be a means of activating and assigning tokens to a specific employee and vehicle.

- It is assumed that Siesta Gardens is operating within the constraints of local Siesta Key and Florida State laws.

7 Assumptions

The assumptions describe what the development team assumes about the environment in which the SGC system will be operated, as well as how some interactions between users and the system will occur.

7.1 T-Rex Enclosure

The T-Rex enclosure along with its level of security is strictly the responsibility of Siesta Gardens. It is assumed that the enclosure will be equipped with an electric fence and sensors as a part of security measures used for the T-Rex enclosure.

7.2   Pick Up/Drop Off

The self driving vehicles will have predetermined routes and stops. The first route being at the entrance to the park and the second at the T-Rex exhibit. The only time the vehicles may be found stopped outside of these points is if there is an emergency vehicle override.

7.3   Emergency Vehicle Override

In the case of an emergency where the vehicle is not operational or the safety of the passengers is in question, the vehicle should be equipped with a way to override the capabilities of the self driving vehicles including locks and route paths.

7.4   Exhibit Emergency Signal

In the case of an emergency concerning the containment of the T-Rex, there should be an alarm system in place. This system should be able to send the appropriate signal to the SGC so that the alarm signal controlled by the SGC can sound.

7.5   Emergency Exits and Manual Vehicles

Users will be provided with a brief introduction about the emergency exit protocol. The employees will go through training of emergency exit protocol before joining the job. The manual vehicles will be for the employee as they can operate it.

7.6   Breach and Re-containment

In the event that the T-Rex enclosure is breached, Siesta Gardens is responsible for the re-containment of the T-Rex. Siesta Gardens will also be responsible for any damage as a result of the breach including that of the vehicles and the enclosure.