SGC - Siesta Gardens Controller

Requirements Definition Document *Version 1.4*

Team 03

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1 Introduction

"B-STACK" is a software design group consisting of Brandon Stringham, Shreeman Gautam, Tanner Hunt, Amun Kharel, Cody Crane and Krista Conley. This team has been tasked with developing a software system, Siesta Gardens Controller (SGC), for a theme park, Siesta Gardens, that will safely and efficiently transport and track the guests to the main exhibit and then back to the main entrance.

The theme park's main exhibit is a Tyrannosaurus Rex that has been genetically recreated through advanced science. Due to the explicit dangers of such an amazing scientific feat, the system must implement high security and safety protocols, and the park will be located off of the mainland in the event that the T. Rex escapes. The theme park is located on the beautiful Siesta Key off the coast of Florida. Guests will be taken from the mainland to the Key via a barge. Once they have landed on the key, they will be taken along a scenic route from the East side to the West side of the Key where they can view this exciting advancement of science with a live T. rex from 66 million years ago in a lush oceanic landscape.

The objectives section outlines the major goals of the software system. The system organization section explains the main devices of the SGC and shows a visual layout of the system interacting with the guests. The capabilities section outlines all the features of the system such as the safety protocols, the interactions between the guests and the cars, and the communication between all components. Finally, the constraints of the SGC system will be to protect against environmental elements so that the system is fully operational 24/7 to ensure the safety of the guests while offering an enjoyable, smooth, fun, and unique vacation experience!

2 Objectives

The SGC system will be designed with three main objectives in mind. These objectives are safety, reliability, and efficiency.

Safety of the park guests is of utmost importance. Our definition of guest safety is protection from death, crimes by other guests, and health hazards. To ensure this definition of guest safety, our park accounts for the safe transport of guests to and from the exhibit, and protecting them from the T. rex.

Reliability of our park systems is essential to guest enjoyment of our park. We define reliability as our system running smoothly and consistently in accordance with guest expectations. Our park accounts for this objective by providing easy-to-use and consistent user (guests and staff) interactions with the park devices and all amenities. The system will be fault tolerant and can remain operational despite multiple device failures.

Efficiency of the park is essential to proper operation. We define efficiency for our park to be a fast and effective execution of park tasks using high quality software and hardware devices.

3 System Organization

The SGC is a complex and dynamic system that controls the whole theme park. The central control building will house a small and highly efficient group of personnel who will monitor all the devices and software that comprises the SGC. The system organization explains how all the devices communicate with the central control staff through the SGC. The SGC manages the following hardware devices: Token Kiosk, RFID bracelets, RFID scanners, the T.Rex monitor, the self-driving cars, the cameras, PA system, and the electric fence. The guests interact with the SGC through the kiosk and the self driving cars. The staff of the park interacts with the SGC via an interface located in the central control building. There is constant two-way communication between the devices and the SGC facilitated via buried hard lines and wireless communication.

3.1 Central Control Building

The Central Control Building will contain many monitoring screens that will display all the feedback from all the other devices. One main large screen will contain all the feedback except the camera's feed which will be on several smaller screens. There will also be a storage device that will backup the system and all the data.

3.2 Token Kiosk

This device dispenses to each guest a unique RFID Token Bracelet, and sends the RFID bracelet information to the SGC to be registered.

3.3 RFID Token Bracelets

The RFID Bracelets are the guest tokens used for tracking the guest and allowing access to their vehicle via pings to the RFID scanners located throughout the key and the vehicle's RFID scanner. These bracelets can also receive alerts from the SGC to display on a smartwatch style LCD screen.

3.4 RFID Scanners

The SGC will utilize both active and passive RFID scanners. Active scanners will be strategically placed throughout the key to provide the SGC system the ability to monitor guests' position in the park. Passive scanners will be installed in vehicles to allow for convenient vehicle passenger RFID bracelet verification.

3.5 T. Rex Monitor

The T. rex monitor is a GPS tracking chip that is surgically embedded into the T. rex. The Tracker is equipped with a pacemaker battery such that it will last the duration of the animal's life. It will send vitals information and location of the animal to the SGC.

3.6 Vehicles

The vehicles are self-driving on a set path and can be programmed to run on a set schedule by the SGC. Each vehicle contains a GPS tracking chip and provides location information to the SGC. Each vehicle can hold up to a maximum of ten passengers.

3.7 Cameras

The cameras are placed throughout the park and the enclosure to relay guests and T. Rex activity to the SGC. The video feeds from the cameras are sent to the SGC.

3.8 PA system

The PA system is how staff can communicate with guests anywhere in the park and announcements can be made autonomously by the SGC.

3.9 Enclosure Perimeter

The electric fence is used by the SGC to prevent the dinosaur from getting out of its enclosure. The electric current in the fence is enough to deter the dinosaur but not kill it. It sends its voltage status information to the SGC. There will be a transparent barrier preventing guests from touching the high-voltage electric fence to protect them from shock.

3.10 System Organization Diagrams

Figure 1 shows the various devices that communicate with the SGC, and which devices communicate with each other.
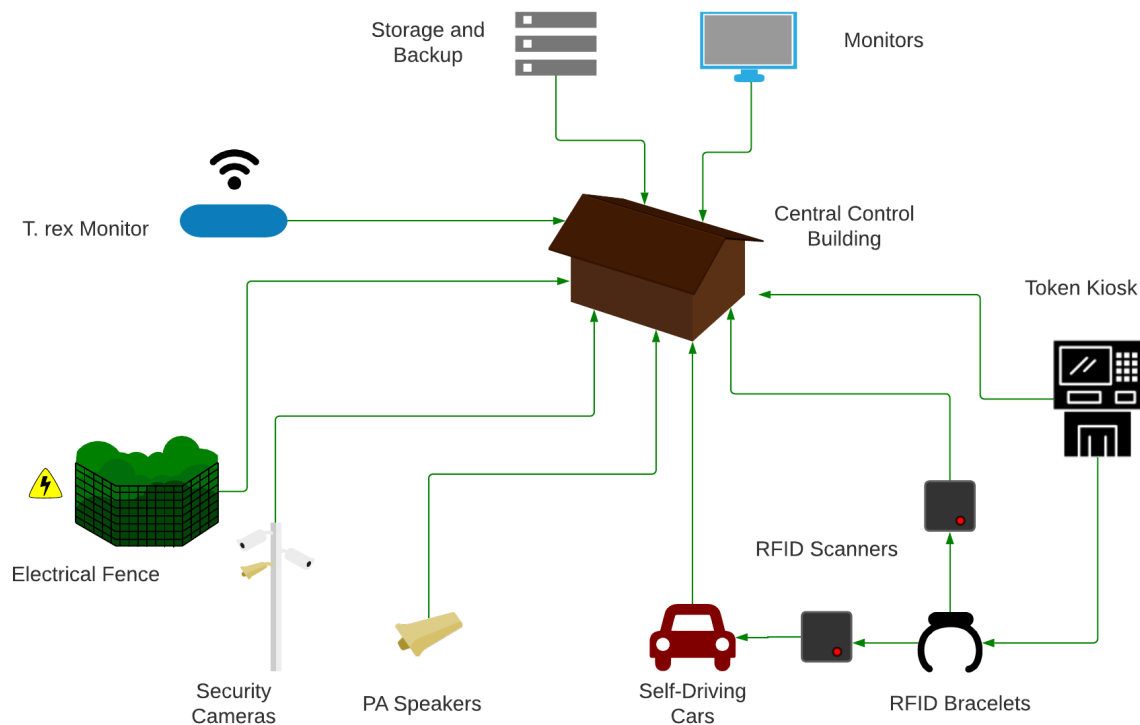

Figure 1: System Organization

Figure 2 shows the topological layout of the park and some of the devices utilized by the SGC and where the visitors will interact with that part of the SGC. Guests will arrive on the key on the east from a barge from the mainland. They will then interact with the token kiosks to get their pre purchased tokens for the day. Then the guests will board self driving cars to be driven to the exhibit on the west side, and then back to the east. The exhibit is surrounded by the electrical fence. Scattered around the park are the security cameras and loudspeakers. In the middle of the key is the central control building where park staff monitor the whole park.
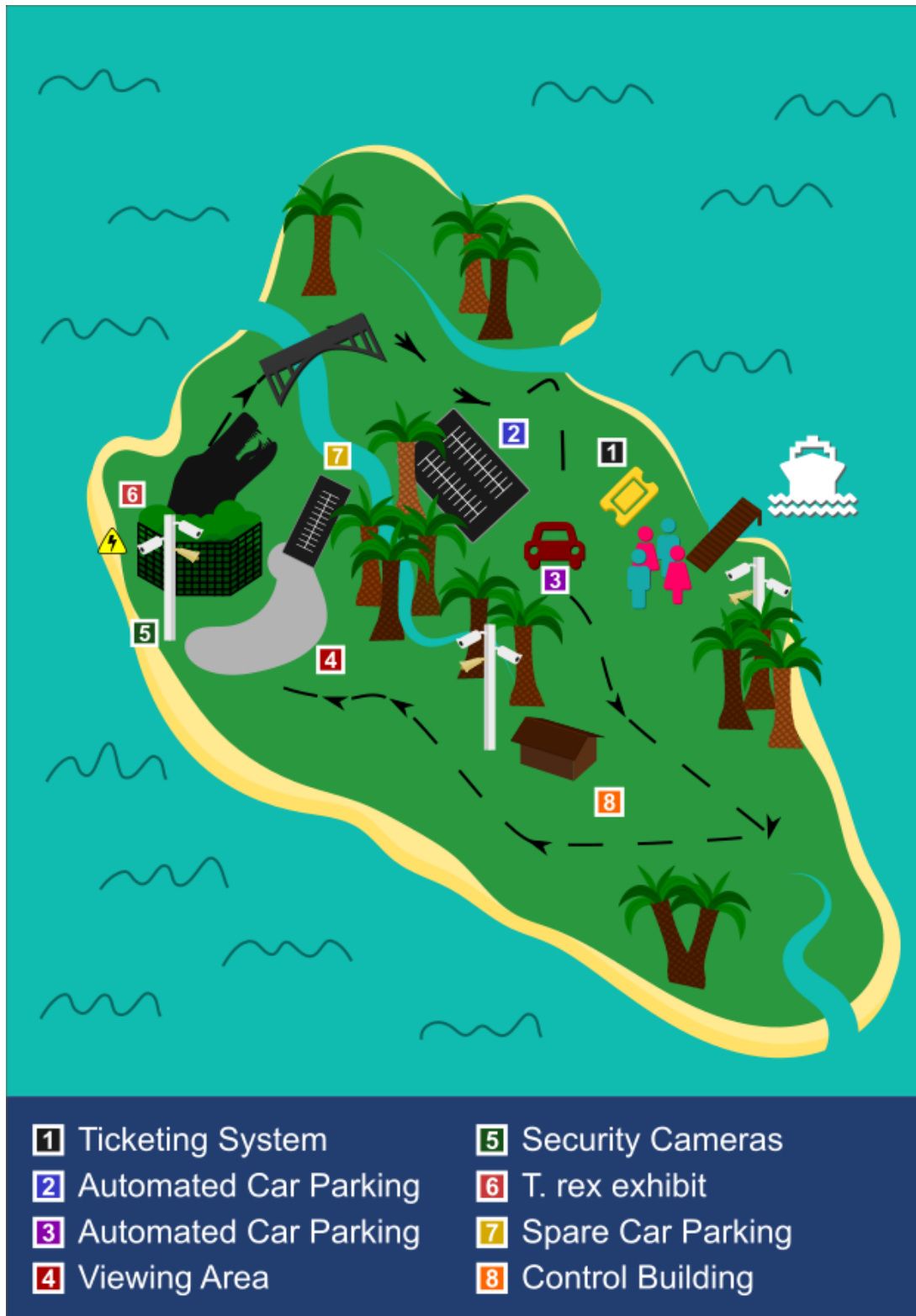
Figure 2: System Organization Map

4 Capabilities

The SGC compiles, organizes and displays information from the hardware components to staff in the central control building. It also provides a user interface for staff to issue alerts and communicate with guests. The SGC can also schedule self-driving car pickup, dropoff and exhibit view times. Finally, the SGC also coordinates an emergency response if required.

4.1 Token Kiosk

- Kiosk machines have an LCD display to interact with the guest for token distribution.
- Communicates guest registration info (name, token number, date/time) to the SGC by scanning the pre-purchased receipts provided by the guests upon park entry.
- Handles the return and deregistration of tokens when guests leave the park.
- Guests purchase the tokens prior to visiting the Siesta Gardens via the park website. The guests will present their purchase code to the kiosks upon arrival at the key. The kiosks can then verify with the website that the purchase codes are valid.
- There are enough kiosks to ensure that there are short lines based on the capacity of the barge.

4.2 RFID Token Bracelet

- The RFID bracelets are akin to smart watch devices, and they communicate with the SGC through the network of RFID scanners around the park and in the vehicles. The SGC can communicate messages to guests through the bracelet's screen and haptics.

4.3 Vehicles

- The cars are programmed to self-drive on a specific route and on a set schedule.
- The cars scan the RFID tokens via a RFID scanner from the guests and link them to the car for tracking with central control.
- The cars track the number of onboard guests using the RFID scanner to ensure no more than 10 are allowed per car and send this information to central control. The car does not move when there are more than 10 people on account of overcrowding.

- The cars alert SGC in the event of breakdowns and the SGC can direct the cars to pick up guests immediately for emergencies.

- The cars have an internal alarm system to alert guests that the exhibit viewing is over and a separate alarm for emergencies.

- There is also an alert message for guests in the event that a guest tries to enter the wrong assigned car. It will send this alert to SGC which will alert the guest of their correct car via the display on the RFID bracelet.

4.4 Central Control

- The central control houses a user interface that will display all the information sent from all the other devices in a well-organized visual format. All this information will be stored in a surge-protected data storage device housed in the building for safety and security.

- Collected data will be purged on a three month rotation schedule.

- The park personnel can use the user interface to initiate emergency protocols and/or communicate with park guests.

4.5 Other Amenities

There will be other amenities provided to the guests like restroom facilities, food concession stands, and a small medical staff for medical emergencies. There is also a small security staff for guest mitigations. These amenities are not automated but run by a small staff. The park staff have methods to communicate with each other outside of the SGC.

5 Constraints

The park's schedule is constrained by time, as in, the park is fully operational from Monday to Saturday, sunrise to sunset. The park is closed on Sunday for regular park maintenance and occasional software maintenance like system updates, patches, and any necessary upgrades.

The park's schedule is constrained by inclement weather. For instance, the park would close down completely, to protect people at the island, for a day/days in the event of a severe hurricane. The SGC, however, is still operational in normal inclement weather, even though people are not there. This is ensured by back-up surge protection. This protection ensures the system is fully operational at all times for the safety of the guests and employees.

PA system speakers have to be tested regularly because they do not have the ability to send health status updates to central control.

Due to the Animal Welfare Act, there exists a constraint such that the welfare of the animal must be kept in high regards.[1] The habitat will be cleaned and if for some reason the animal needs medical attention then the park will unexpectedly close down but the park will issue refunds to the affected guests. The Florida wildlife commission regulates the cleanliness and the humane treatment of wildlife. [2] Therefore, unexpected inspections may occur and the park will have to shut down temporarily to abide by state laws.

The system is required to track guests using cameras and RFID bracelets while they are at the park. To respect guest privacy, after several months, the aggregated data of the guests will be purged from the system. In that sense, the system is constrained by guest privacy to not hold guest information like name, camera footage and payment method after several months.

6 References

[1] "Animal Welfare Act," *NAL*. [Online]. Available:

https://www.nal.usda.gov/awic/animal-welfare-act. [Accessed: 09-Apr-2021].

[2] "FWC Overview," *Florida Fish And Wildlife Conservation Commission*. [Online]. Available:

https://myfwc.com/about/overview/. [Accessed: 09-Apr-2021].