Cretaceous Gardens Controller

Requirements Definition Document

RDD Version 2.0

Team #3
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CS 460 Software Engineering

Contents

1 Introduction

The Tyrannosaurus Rex lives among us once again and the opportunity to provide an incredible experience has become a reality. The world will be able to experience that of which, until now, has only been dreamt. The Cretaceous Gardens experience will begin the second a visitor steps off the boat and onto the Isla Trueno. The visitor will be immersed in Cretaceous Gardens' unique, technological advancements: a truly one-of-a-kind luxurious experience. By the time they leave they will be already planning their next visit.

The purpose of this document is to define the requirements for the development of Cretaceous Gardens Controller (CGC) for our billionaire philanthropists customers in their new theme park on Isla Trueno near Costa Rica. The CGC is the main controller for components like the pay kiosks, cars, and electric fence. The CGC must provide sufficient safety, a great user experience, and ought to efficient.

Section 2 outlines the main objectives of the project, section 3 the overall system organization through a high level depiction, section 4 outlines interfaces, section 5 contains the capabilities of the system, section 6 provides all known design constraints, and the final section provides a reference for potentially unknown terms within the document [1].

2 Objectives

Four objectives believed to be critical for an optimal implementation of a Cretaceous Gardens Controller are identified here[2].

2.1 Safety

The main objective of the CGC is to provide a safe and reliable experience for the client and the end users. Whether it be electric fences or autonomous vehicles, ensuring safety is of highest priority. The end user ought to feel completely safe as should the client whose liability depends on this aspect.

[1] Introduction by Anas and Siri.
[2] Objectives by Anas and Siri.

2.2 User Experience

In order to fully realize an amazing experience for the end user, the CGC must facilitate token purchases and foster intuitive and seamless interactions with the vehicles.

2.3 Maintainability

For the sake of maintainability, the state the CGC should be easily accessible and it should be understandable. All nodes should inherit this feature. The system should also be maintainable in real-time, so it should be prepared for any redundancies that support this aim.

2.4 Efficiency

When it comes to efficiency, the CGC will make sure that both the software and hardware components are highly efficient and functional. Whether we talk about self-driving cars, pay kiosks, camera system, GPS, or electric fences, the CGC must be efficient in interacting with them. This will be possible when all the other objectives are met.

3 Overall System Organization

The CGC will be centralized[3] and will manage all relevant components. Figure 1 shows a black box diagram of the CGC. The CGC receives inputs from sensors, user interfaces, and emergency systems like the *Global Alarm System* and responds through appropriate output actions as described below.

The Cretaceous Garden Controller will have 5 self-driving cars, transporting people from south to the Exhibit Area (North of the Island). In the south of the Island is allocated a Kiosk where the clients can buy their tickets giving them access to the cars and the Exhibition. The Kiosk will record the sales and provide to the guest a token device.

[3]System Organization by Anas, Santi, and Siri.

The CGC will control the position the T-Rex via GPS and cameras. In case of one electric feces fails the emergency plan will be activated, making sound the alarms and the cars picking people and going to the south, there will be available 5 more self-driving cars in case of emergency in the North.

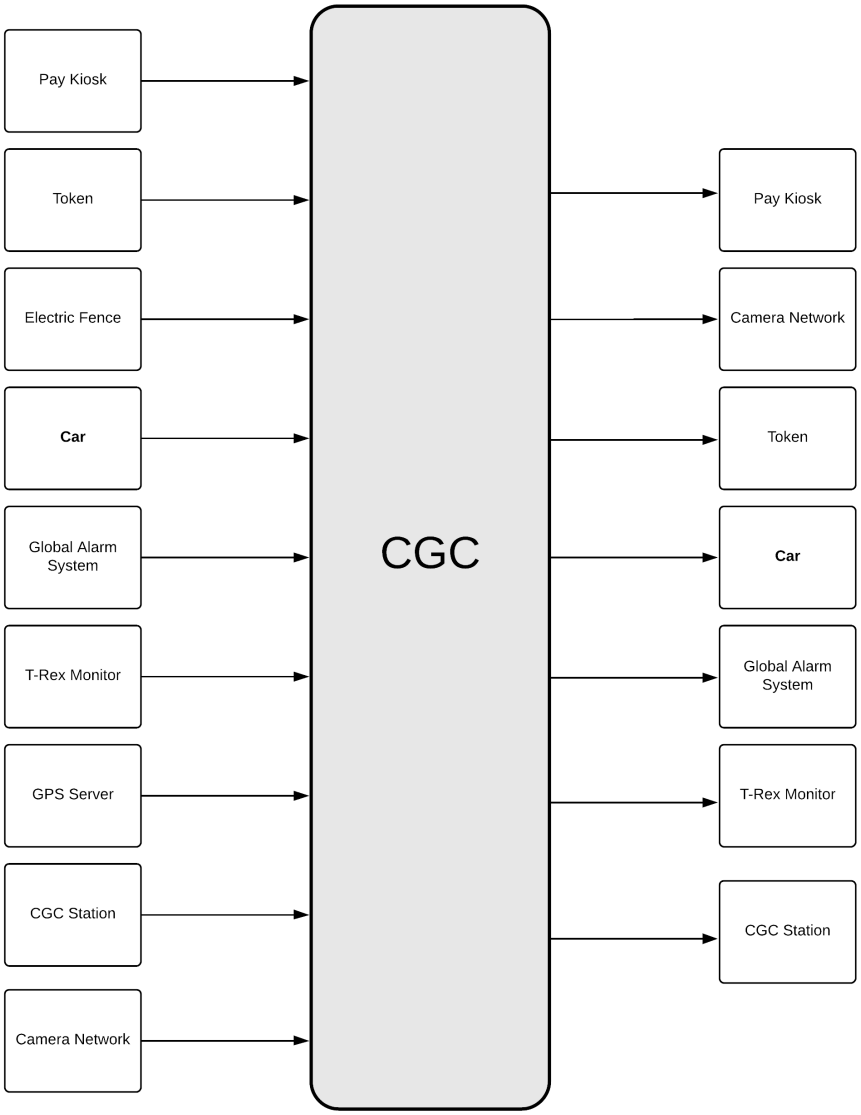

Figure 1: A black box of high-level inputs and outputs of the *CGC*.

4 Interfaces

The interfaces are broken[4] *up into main systems. They may be composed of their own sensors but said sensors do not interface with the CGC. The following list of interfaces list their sensors, hardware, and features.*

4.1 Pay Kiosk

The purpose of the the Pay Kiosk interface is to connect the physical Pay Kiosks to the CGC,which is composed of sensors and other hardware.

Sensors

Touch Screen: used to sense user interaction.

Credit Card: accepts all major credit/debit cards.

Cash Receptacle: accepts and analyzes cash.

Hardware

Change Dispenser: dispenses appropriate change to the visitor buying a token.

Token Dispenser: dispenses token with unique ID to user.

Features

Token Builder: Takes payment and the out user form and builds a unique token for the visitor.

Transaction Logger: Will provide receipts to visitors upon purchase and reports transactions with the CGC.

Maintenance: Enables employees to manage issues with kiosks and provides machine health information.

[4]Interfaces by Siri and Anas.

4.2 Token

The Token will act as an interface to multiple systems. It will provide valuable information about the visitor and also interact with the visitor.

Sensors

Touch Screen: interacts with the users.

GPS: senses the location of all tokens.

Hardware

RFID: The RFID chip will be programmed with a unique ID and used for multiple purposes included access to various systems and areas.

Speaker: the token contains speakers as hardware for alerts and instructions.

Features

Location/Map: utilizes the GPS to provide location services.

4.3 Car

There will be an interface with all the cars. The autonomous car will be built utilizing a partner. We will work closely with them to provide access to specific sensors and features.

Sensors

RFID reader: covers the proximity of the car and is used to grant access and count how many tokens are currently in the car.

Seat Weight Sensor: used to determine if there is someone sitting on the seat.

Camera: used by the car for autonomous driving and also connects to CGC for a needed scenario.

Microphone: used to sense voice for use in an intercom.

Hardware

Speaker: used to alert guests.

Automatic Door Locks: this will be initiated when the car is determined to be moving.

Wireless networking: for communication purposes to communicate with the CGC.

Features

Maintenance System: allows for health checks and health status communication of the car.

4.4 T-Rex Monitor

The T-Rex Monitor is the interface to the system that controls and monitors the T-Rex. It is critical to the safety of employees and visitors.

Sensors

GPS: senses the location of all tokens.

Heart Rate Sensor: Specifically designed to monitor the heart rate in BPM of the T-Rex. can be used to monitor stress, hungar and possible aggression

Hardware

Tranquilizer Injector: This can be triggered to inect the tranquilizer cartridge stored on the monitoring system.

Features

Maintenance System: allows for health checks and health status communication of the T-Rex Monitor.

Health Monitor: allows for health monitoring of the T-Rex.

4.5 Camera Network

The camera network interface is in charge of communicating with every camera, the redundant network links to each camera, and the DVR system that keeps recording of all cameras per retention policy. It will report on its health.

Sensors

Cameras: records video.

Hardware

DVR: stores and retains video.

Hardwire Ethernet: used for network communication with CGC.

Features

Maintenance System: allows for health checks and health status communication of the camera network.

Viewing: ability to view any camera feed.

4.6 Electric Fence

The electric fence interface will ensure that the visitors are safe from the attack of T-Rex. It will provide features for maintainability, and sensing options to reduce the risk of any damage.

Sensors

Electrical Conduction Sensor: senses for electricity going through electric fence. It has the ability to trigger when there is no electricity.

Hardware

Electrical Fence Panels: special kind of physical panels that allows conductance of electricity going through it.

Hardwire Ethernet: used for network communication with CGC.

Features

Maintenance System: allows for health checks and health status communication of the electric fence.

4.7 Global Alarm System

The global alarm system controls what gets played on a network of speakers for emergency related or informative needs.

Hardware

Speaker: the global alarm system communicates with a network of PA speakers.

Hardwire Ethernet: used for network communication with CGC.

Features

Maintenance System: allows for health checks and health status communication of the Global Alarm System.

4.8 CGC Station

The CGC station is a device and interface that interacts with employees. It contains a user interface to analyze and interact with the components that the CGC can communicate with or can monitor.

Sensors

Microphone: used to pick up voice to interact on the intercom. It can also be used to send announcements out to the Global Speaker System.

Touch Screen: used to interact with employee with a provided GUI interface.

Hardware

Speaker: can be used with the intercom.

Hardwire Ethernet: used for network communication with CGC.

Features

Maintenance System: This one is unique in the sense that it can communicate with all other maintenance systems and initiate system checks.

4.9 GPS Server

The GPS server interface provides locations of all the active and surrounded GPS devices that it needs to interact with.

Features

Tracking: keeps track of all GPS devices and their longitude and latitude.

Services: third party service to provide GPS services.

5 Capabilities

The capabilities of the system are significantly expansive due to its central role in the operation of the resort. Thus, the complexity of the system naturally leads to a description of the broad topography of its capabilities. First is the overview of protocol-related capabilities, then emergency-supporting capabilities, followed by capabilities that reinforce safety features, and finally an overview of its monitoring capabilities.[5]

5.1 Protocols

1. The CGS will have a set of specified protocols for directing the network of autonomous vehicles. The protocols will vary among sets of vehicles. For example, a protocol for the visitor vehicles will be executed in the case of an enclosure breach, another for preparation before arrival of visitors and after their departure (outside business hours), another for maintenance, etc.

[5] Capabilities by Zeke and Matt.

2. The CGS will provide configurability of processes through straightforward interactions.
    (a) The creation of new protocols.
    (b) The addition of pre-made protocols.
    (c) The removal or extraction of protocols.
    (d) The modification of existing protocols.
3. The CGS will allow for the simulation of any given protocol.

5.2 Emergency

1. The CGC will be able to receive distress or failure signals and propagate through the siren and alarm network of the island.
2. The CGC will be able to communicate with external authorities and emergency personnel.
3. It will also (through human intervention) be capable of disarming the alarm system after the issue has been addressed.
4. The CGC will be able to dynamically account for new nodes in the network or for *nodes* that are taken out for whatever reason. An extension may be that nodes may be used to triangulate the location of missing nodes.
5. The CGC will have the following protocol as a fallback. It should be noted that This can happen any time of day and, for the sake of argument, it will be assumed at that there is peak activity in the garden. In other words, it is assumed that there are *many* visitors at the north end of the island (viewing the T-Rex).
    (a) The electric fence interface reports a breach which triggers this *Emergency Protocol*.
    (b) The T.Rex monitor interface triggers the device to administer the tranquilizing agent to the subject and the subject's heart rate is reported to the CGC every second, as is the subject's location.
    (c) Through the Global Alarm System,

i. *All speakers* emit the alarm (protocol-specific) sounds.
ii. Instructions to find and enter the nearest vehicle are propagated through the speakers.
iii. Instructions are also sent to all active token devices.
iv. Interleaved reassurances that more available vehicles are headed north are also transmitted.

(d) All *safely occupied* vehicles begin to shuttle people (guests and staff) southward.

(e) All *safely inactive* vehicles are dispatched northward.

(f) Once there, the safely inactive vehicles will receive people until *safely occupied*.

(g) 5d, 5e, and 5f will be repeated emergency mode is deactivated or until all vehicles run out of energy.

5.3 Safety

1. The CGC will allow the monitoring of every panel of the enclosure.
2. The CGC will allow the monitoring of every camera.
3. The CGC will reinforce power backup measures.
4. The CGC will maintain redundant uplinks on the network(s).
5. The CGC will command a fleet of patrol vehicles around the island.
6. The CGC will support a maintenance mode for real-time repair of any node.

5.4 Monitoring

1. The CGC will be able to track all guests at all times in the following ways:

   (a) Relative to others in their groups.

   (b) Relative to their assigned vehicles.

   (c) Relative to the whole island.

(d) Relative to their current zone within the island.

2. The CGC will be able to track all vehicles at all times.
3. The CGC will be able to track the location of the T.Rex at all times.
4. The CGC will be able to process live video stream of various locations on the island.
5. The CGC will be able to process live video stream of the enclosure.
6. The CGC will be able to process live video stream at kiosks.
7. The CGC will be able to perform regular or on-demand audits of the network state.

5.5 Financial Analysis

1. The CGC will be able to provide financial information and basic summary statistics.
2. The CGC will be able to identify any striking patterns of cash flow.
3. The CGC will be able to maintain long term financial records.

6 Design Constraints

The various constraints [6] *for the Cretaceous Garden Control are as follows.*

6.1 General

- The Cretaceous garden is located in Isla Trueno.
- The Cretaceous garden will count with a dinosaur.
- In the north of the Island will be allocated the Exhibition Area.
- The Kiosk will be allocated in the south of the Island, where the guest arrive.

[6] Constraints by Santi

- The Kiosk will provide the guest the tokens.
- The CGC will control the functioning of the whole park (cars, kiosk, tokens, financial and emergency).
- The CGC will know the exactly position of all cars, guest and T-Rex.
- Each car (self-driving) will have a total of 10 seats and only leaves when it is full.
- There is only one path from the south of the island to the north.
- Each car will have an alarm to tell the guest the remaining time.
- The token device will let the guest to know the remaining time and will perform as a GPS of the guest.
- There will be only one token per guest.
- The CGC will control the camera networking, showing images on real time of the park.
- At the exit of the park each guest has to return his token device.

6.2 Safety

- In case of a electric fences fail the emergency plan will be activated.
- The CGC if the emergency plan is activated will activate the alarm system and will communicate the cars to evacuate.
- The Alarm System will activate the alarm from the south to the north.
- The cars will drive to the south (maybe they are not full) in case of evacuation.
- There will be also some cars parked in the north to help in case of evacuation.
- The tokens in case of emergency will explain the emergency steps.
- The cars will drive with a secure speed.

- The cars will lock and unlock safely before start.
- The CGC will contact directly with the Emergency from Costa Rica, in case of emergency.

7 Definition of Terms

Here we have some definitions to terms used in the document. This section will help clarify meanings for different areas of the document.[7]

CGC: Cretaceous Gardens Controller

DVR: Digital Video Recorder

Electrical Conduction: The movement of electrically charged particles through a transmission medium.

GPS: Global Positioning System

Hardwire Ethernet: This references the latest IEEE standard for Ethernet utilizing physical cables.

Network: All nodes with which the CGC interacts, the links that connect them to each other and to the CGC, the CGC itself, and all related databases.

Node: The generic term that refers to any device connected to the CGC in any way. This includes autonomous vehicles, tokens, the T.Rex monitor, all electric fence panels, all kiosks, and all cameras.

Safely Inactive: A state in which a vehicle is fully functional and ready to be dispatched.

Safely Occupied: A state in which a vehicle contains at least one person, is locked, and is ready to depart.

Token: An interactive device used by the visitor that grants access to locations.

[7] Definition of Terms by Siri and Zeke.