Cretaceous Gardens Controller

Software Architecture Design

SAD Version 3.0

Team #3
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CS 460 Software Engineering

Contents

1 Introduction

Good software is identified by the end user for its features and functionality, by the client for its profitability and maintainability, and by the programmer for its legibility and clarity. It should be clear that all three pillars ultimately characterize good software, but more importantly that the three are interdependent. The developer must therefore guarantee all of the above for the sake of all entities involved. A top down approach has been followed thus far. The Technical Feasibility Study posited and answered the fundamental question: Can it be done? The Requirements Definition Document was then passed the baton and answered the next question: Within what parameters can it be done? Then, the Software Requirements Specification document sought to answer: What is the desired behavior of the system? Now this document seeks to answer the following: What design will guarantee the desired behavior in a manner that is clear, maintainable, extensible, and pragmatic?

The ultimate goal is to ensure an efficient, safe, and maintainable implementation of the Cretaceous Gardens Controller (CGC) software. To that end, all objects are illustrated in their proper contexts, and their crucial functions have been delineated as clearly as possible while simultaneously allowing the programmer enough flexibility so as to not stifle his or her creative process.

This document is a road map for the eventual implementation of the system and details the most relevant objects and their relationships in the form of diagrams. Explanations accompany all diagrams for the sake of clarity. Section 2 presents an overview of the intended design, with descriptions of the largest subsystems that compose the CGC. Section 3 provides greater detail with respect to the individual components and their sub components. Section 4 provides a number of use cases for the system, which have been classified into a few categories. Section 6 delineates constraints to which the design is subject. Section 7 closes the document with the definitions of any terms used throughout the document that may need further clarification. [1].

[1] Introduction by Ezequiel Ramos.

2 Design Overview

The class architecture presented here aims to maximize efficiency, maintainability, and safety. Without an efficient system, it's safety may be compromised due to unnecessary delays between components. Maintainability can impact a safe implementation of the system if the system is permeable to programmer errors. The decoupling of concerns and a solid hierarchy are paramount [2].

[2] Diagrams by Siri and Anas.

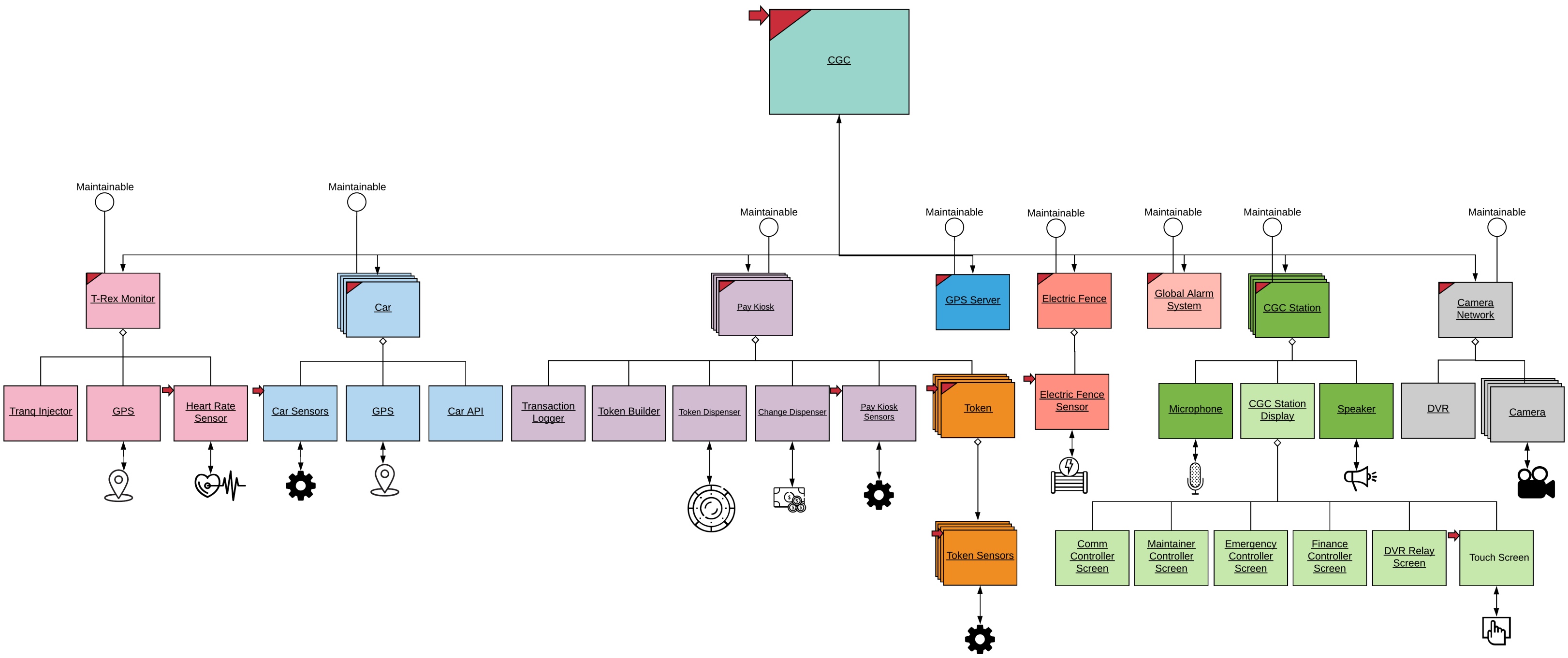

Figure 1: **CGC Overview:** This showcases the entire system as a whole working together. The CGC acts as a central system that can communicate with all active systems. We see it is not composed of any other objects, but rather it owns references to all active systems and helps keep track of them and helps bridge connections to other active systems. It is important to note that the red triangle in the corner of some objects symbolize that it runs in it's own thread. The red arrows symbolize that these objects can cause triggering events that generate some sort of action inside the system. Another thing that may not be immediately apparent is the stack of objects. This means that there can be 1 to n of these objects running at any one timeOne last thing that may seem unusual is the small circles above some objects labeled maintainable. This means that these objects implement the interface maintainable and the behavior associated with it.

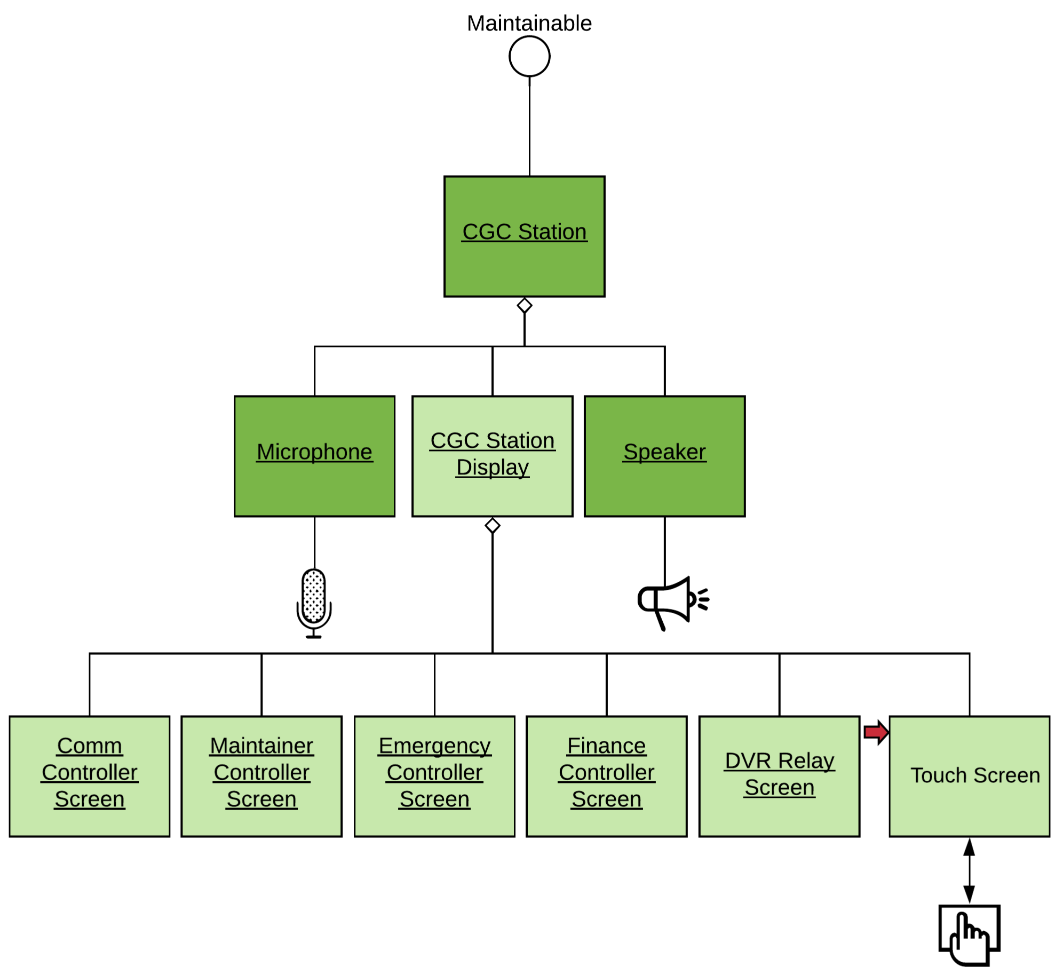

Figure 2: **CGC Station:** A critical device that interfaces employees with the CGC System. we clearly see that the device interfaces with a microphone and speaker. these are critical for intercom communication to and from other devices. There is also a touch display with a user interface that helps the Employee obtain information such as financial information, the health status of all devices, and other screens. It is a device that itself is Maintainable and also reports it's health.

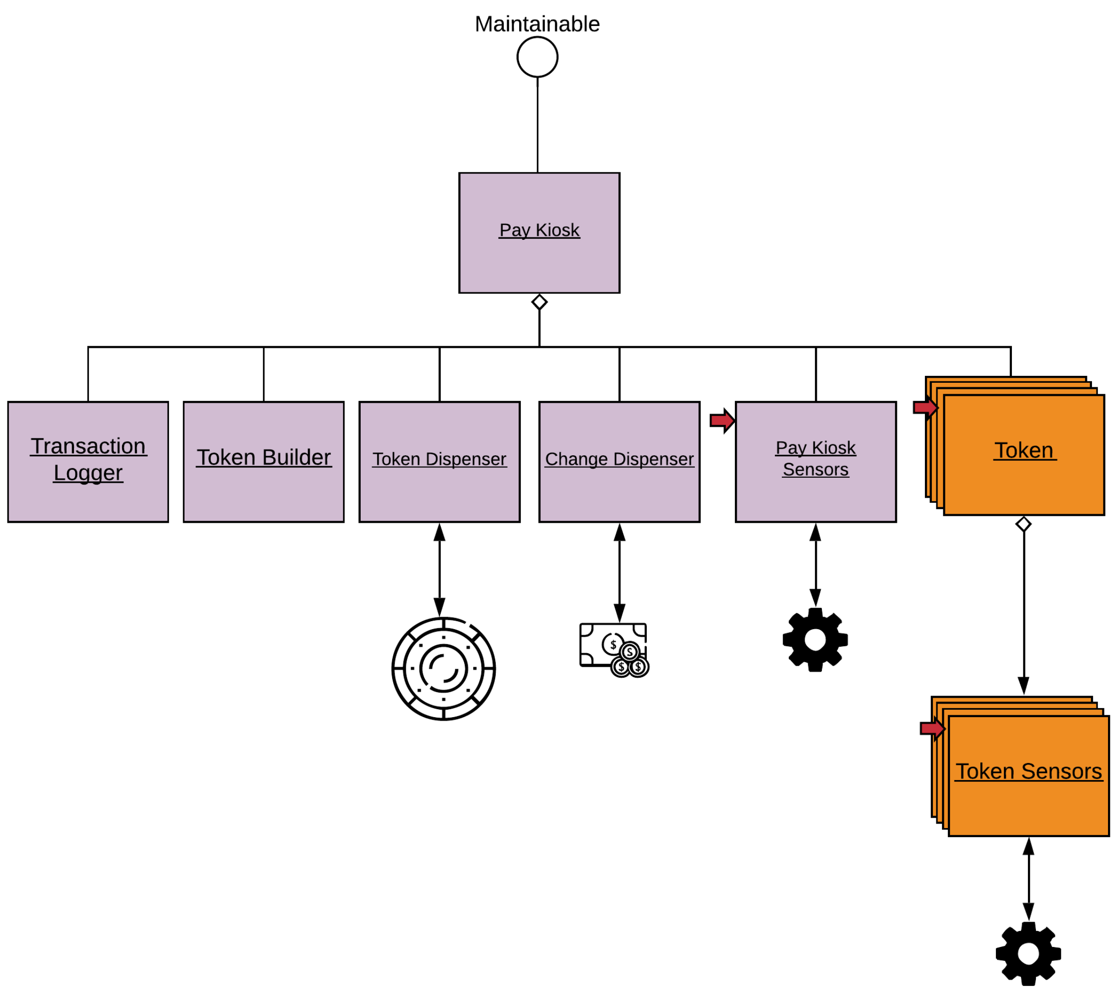

Figure 3: **The Pay Kiosk:** The Pay Kiosk object controls the Pay Kiosk device. These are devices used to purchase and build access Tokens for the visitors. It is critical as it helps the users get into the Gardens while also helping the client make money. It is composed of objects that are hardware such as the token and change dispensers. it also contains other sensors such as credit card and cash receptacles as well as a touch screen. It has a system that helps log transactions and build tokens. It will configure another critical device, the Token. this is a high tech piece of equipment that is used by the visitor as an access card, but also a communication device, a GPS device, as well as other interactive capabilities.

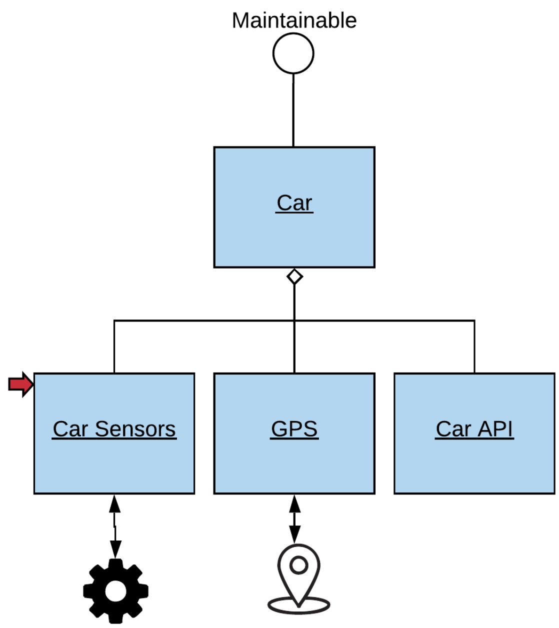

Figure 4: **The Car:** The car object is another critical device. it is a layer on top of the contracted car manufacture's own software layer for their autonomous vehicle. It can communicate with sensors such as weight sensors, seat belt sensors, and much more. It has a GPS that communicates with the GPS Server. It also includes API's that can be used to give it a destination, override the controls and other such capabilities. It is also a Maintainable object.

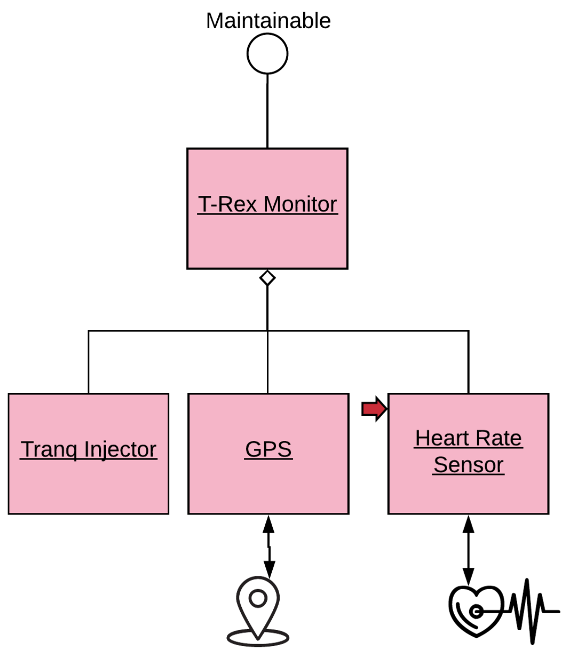

Figure 5: **The T-Rex Monitor:** The T-Rex Monitor helps the CGC keep track of the T-Rex. It monitors it's Biometrics to make sure it is not stressed out. it also controls a tranquilizer that can put the dino to sleep in a safe manner. This is another Maintainable system.

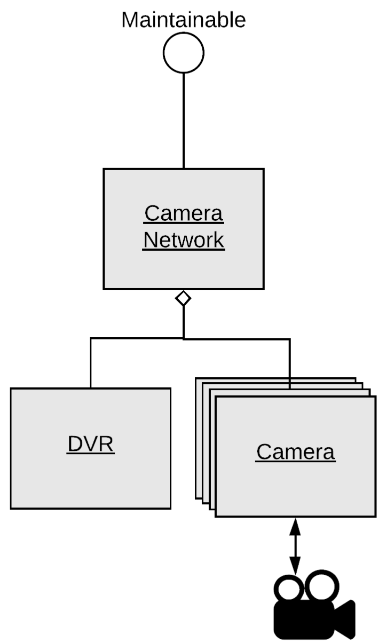

Figure 6: **The Camera Network:** The Camera Network Object has one goal and that is to control every single Camera feed. It connects this camera feed to a DVR system to help record the feed. It is a Maintainable system.

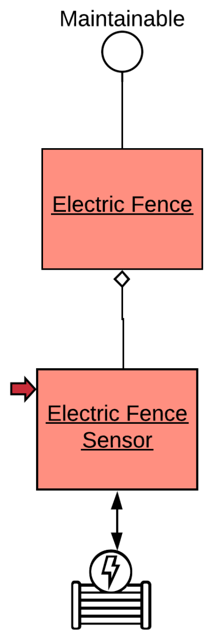

Figure 7: **The Electric Fence:** The is another very simple software system. The entire goal is to monitor the electric fence. To do this it utilizes the Electric Fence Sensor. It is also Maintainable.

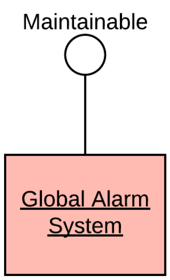

Figure 8: **The Global Alarm System:** The global alarm system controls the loud PA speakers on the island and is critical in case of an emergency. This will be able to report on its health by implementing the maintainable interface. It is very basic and the CGC can broker connections to it from CGC Stations.

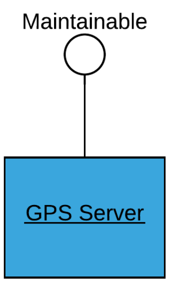

Figure 9: **The GPS Server:** The GPS server is a central server that keeps track of all Registered and active GPS devices. It contains the locations of all devices and these are made available through functions. the server will be able to report its health by implementing the maintainable interface.

3 Component Specifications

Here are the class specifications[3] *for objects found in Section 2. The most important attributes and functions are given and where appropriate, any expected preconditions, parameters, return values, and post conditions are included. Explanations are given for each component, but it should be noted that helper functions are not shown, as they are entrusted with the programmer. Important fields and helper fields are treated analogously.*

[3]Component specifications by Anas and Siri.

CGC Class	
Attributes	
RegisteredTokens	number of registered tokens.
ActiveStation	boolean station status
ActivePayKiosks	number of active kiosks
ActiveCars	number of active cars
InactiveCars	number of inactive cars.
Functions	
logTransaction(transaction)	→ write to finance controller.
queryFinanceState(SQLScript)	→ query financial data.
queryHealthState(SQLScript)	→ query health data
getAllGPSLocations()	→ get all current GPS locations.
registerToken(tokenID)	→ register token.
retireToken(tokenID)	→ remove token from registered list
relayStream(cameraID,stationID)	→ relay video stream to station
enterEmergencyMode()	→ enter emergency mode
enterNormalMode()	→ enter normal mode
activateCar()	→ activate new car from parking lot
bridgeIntercom(carID,stationID)	→ open communication link
connectToPA(stationID)	→ connects station to island speakers

Maintainer Class*	
Attributes	
health status	indicates the health of the appropriate sub-component system.
Functions	
systemCheck()	→ performs checks on the system.
maintainanceMode()	→ goes into maintenance mode.

* : In order to be not repetitive in the sub-components, this class is shown once here and is representative of all the sub-components it belongs to.

Electric Fence Class	
Attributes	
currentMode	indicates whether or not which mode is detected.
Electric Fence Sensor	object that senses any distortions in the fence.
Maintainer	object that checks for health status of the fence.
Functions	
checkStatus()	→ checks the status of the fence.
switchMode(mode)	→ switches the mode based on the specification by CGC.
reportHealthToCGC()	→ reports the health of the fence.

Electric Fence Sensor Class	
Attributes	
electric conductance	senses electricity in the fence.
Functions	
checkElectricConductance()	→ check possible distortions in the fence.

Camera Network Class	
Attributes	
Camera	software that is responsible for streaming video.
DVR	software that is responsible for storing/retain video.
Maintainer	object that checks for health status of the fence.
Functions	
checkCameraStatus(cameraID)	→ checks the status of the camera.
deleteRecording(cameraID, date range)	→ delete the recording from a given camera from specified range.
activateRecording(cameraID)	→ begin recording the given camera.
monitor(cameraID)	→ view the associated camera.
reportOutage()	→ report for any possible camera outage upon CGC request.

Camera Class	
Attributes	
cameraID	The camera number.
status	The camera status.
Functions	
getID()	→ gives the id of the camera.
play()	→ starts streaming the video.
getStatus()	→ gives the status of the camera.
getStream()	→ view camera.

DVR Class	
Attributes	
streamRecord	keeps track of video streams.
Functions	
start(cameraID)	→ begin recording of the camera.
delete(cameraID, range)	→ delete video stream.

GPS Server Class	
Attributes	
registeredGPSDevices	indicates all the valid registered GPS devices.
Functions	
pingAll()	→ will return true if every registeredDevice responds.
ping(gpsID)	→ will ping specific GPS node and return true if it responds.
getLocation(gpsID)	→ will return location.
getAllLocations()	→ gives list of all GPS devices.

Global Alarm System Class	
Attributes	
Functions	
playEmergencyAlarmSound()	→ plays the predefined emergency protocol sounds and message.
playMessage(soundStream)	→ will transform the incoming sound stream out to the loud speakers.

CGC Station Class	
Attributes	
currentScreen	the active screen.
intercom	the intercom to talk any relevant components.
Functions	
startIntercom()	→ activate intercom to speak to any specific component.
syncEmergencyState(sqlScript)	→ queries for the state of emergency.
syncHealthState(sqlScript)	→ sync the status of all the components.
syncFinanceState(sqlScript)	→ queries finance and expenses information.
activateTranquilizer()	→ activates tranquilizer in emergency state.

T-Rex Monitor Class	
Attributes	
Tranquilizer	the injection used in emergency state.
GPS	to track location of the T-Rex.
Heart Rate Sensor	to monitor health of the T-Rex.
Functions	
checkHealth()	→ checks the heart rate and health of the T-Rex.
reportBiometricsAlarm()	→ reports behavior of the T-Rex.
syncLocation()	→ gives the location of the T-Rex.
injectDino()	→ inject tranquilizer in the emergency state.

Pay Kiosk Class	
Attributes	
Token	The token for the visitor to get all perks of the park.
TransactionID	the id of the transaction.
MoneyType	type of money requested upon registration.
Functions	
buildToken()	→ builds token and logs transaction.
displayPurchaseForm()	→ displays the registration form.
register(demographics)	→ registers the visitor based on the provided information.
requestMoney()	→ requests for money.
acceptMoney(moneyType)	→ accepts the appropriate money type.
dispense(money, receipt())	→ dispenses money with receipt.
activateToken(tokenID)	→ activates token.
dispenseToken(tokenID)	→ dispenses token.

Car Class	
Attributes	
isActivated	Specifies if the car is activated
isParked	Specifies if the car is parked
Position	Specifies where is the car located
Destiny	Destiny where the car has to travel
Passengers	Number of passengers in the car
Functions	
checkPosition()	→ Return the position of the car in the island
checkIfParked()	→ Return if the car is parked
isActivated()	→ Return if the car is activated
activateCar()	→ Will activate the car
desactivateCar()	→ Will desactivate the car
travelToDestiny()	→ Will start the trip to the destiny
setDestiny()	→ Will set the destiny of the car
ValidateToken()	→ Check if the token is valid
lockDoors()	→ Will lock the doors of the car
unlockDoors()	→ Will unlock the doors of the car
passengerSit()	→ Will recognize that there is a passenger sit and has his belt on
sendLocationToCGC()	→ Will send the location to GCG

4 Sample Use Cases

A broad overview of use cases begins this section and it is followed by detailed case descriptions. Human actors are denoted by small stick figures and have the same color scheme as the box that contains their labels. This section has been generalized into three types of users for simplicity. Guests, internal personnel, and external personnel constitute the types of actors. Guests are park visitors, internal personnel are those actors that contribute (typically through daily employment) to the function of the resort on a regular basis (e.g. cars, maintenance personnel, the T.Rex), and external personnel are actors which interact with the system on an irregular or infrequent basis (e.g. veterinarians, auditors, emergency personnel).

4.1 Guests

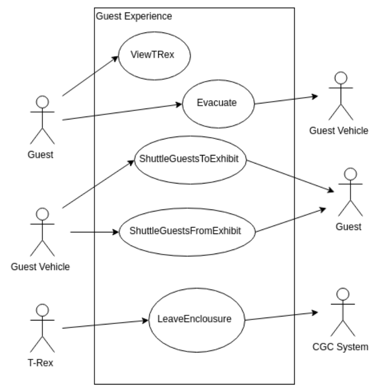

Figure 10: Shows the a general view of the Guest Use Case as a diagram.

Use Case: ViewTRex

Primary Actor: Guest

Goal in Context: To see a live dinosaur.

Preconditions: The system and all components are functioning normally.

Trigger: The guest wishes to see a dinosaur since the age of five.

Scenario:

1. Upon hearing of the grand opening of Cretaceous Gardens, the guest immediately heads to the island by whatever means possible.
2. On arrival, the guest witnesses tremendous lines formed at many pay kiosks near the entrance of the resort.
3. After what seems like an eternity, the it is the guest's turn to purchase entry to the resort.
4. The guest is welcomed through a pleasant graphical display.
5. The guest is asked a series of questions in order verify compliance with the park policies (e.g. How old are you? Do you consent to having your picture taken? Do you accept full responsibility for any injuries sustained due to personal choices? Do you accept the risks of seeing a live Tyrannosaurus Rex and free Cretaceous Gardens of any and all consequences of doing so?)

6. After ignoring all the fine print and zipping through the legal stuff, the guest finally arrives at the screen that will allow the rental of an access token.
7. The guest enters the amount of time he or she plans to stay and is given the total price.
8. The guest is prompted to enter payment.
9. The guest pays after confirmation and receives the rental token device.
10. Instructions on what to do next are displayed on the kiosk screen.
11. The guest uses the token device to enter the resort via a small gate.
12. The guest eventually arrives at a parked car, into which others may or may not be entering.
13. The guest enters the token device into the seatbelt buckle and secures the seatbelt.
14. The guest lets the car do its job (see section **??**).
15. The guest arrives at the exhibit and exits the car, taking the token device along.
16. The guest heads toward another gate which scans the token device to provide access.
17. The guest sprints toward the enclosure.
18. The guest is lucky and gets to see the mighty T.Rex sniffing around.

Exceptions:

Guest changes his or her mind anywhere in the scenario and decides to leave.

The system is triggered into emergency mode.

Priority: Essential, must be implemented.

When Available: On Demand.

Frequency of Use: Up to thousands of times per day.

Channel to Primary Actor: Direct.

Channels to Secondary Actors:

Kiosk: Display on kiosk.

Token: Device display and speaker.

Guest Vehicle: Token interfaces and seat sensors.

T-Rex: Seen through enclosure fence.

Secondary Actors: Kiosk, Token, Guest Vehicle, T-Rex.

Open Issues: None known.

Use Case: Evacuate

Primary Actor: Guest

Goal in Context: To leave the island as quickly and as safely as possible.

Preconditions: There exists some imminent threat to the guest (it may be an enclosure failure, inclement weather, or any other emergency of similar caliber). Sudden guest death (unrelated to the island or system) may also be the case.

Trigger: Something horrible occurs. For simplicity, the following scenario assumes the T-Rex destroys its enclosure and is now on the loose.

Scenario:

1. The T-Rex destroys the enclosure (see subsection **??**).
2. Emergency mode is activated.
3. 22 All guests are alerted via the car intercom, the token devices, and an island wide speaker system, the Global Alarm System.
4. Guests receive instructions via the above means with interleaved reassurances that extra vehicles are on the way to pick them up.
5. Guests are also informed that they may enter any vehicle, with or without tokens.
6. Once in the vehicle, guests are asked (via the token device) whether or not they would like to depart.
7. If at least one individual submits a yes, the car transmits a message to indicate imminent departure with a warning that doors will soon close.
8. Once in motion, the guest in the driver seat is offered the option to place the vehicle into manual mode.

9. If the individual chooses to do so, then he or she may now pilot the vehicle as he or she wishes.
10. Otherwise, the car will head south as quickly and as safely as possible.
11. Once at the south end, the car will park and wait for guests to exit.
12. After it has been confirmed that no guests remain in the vehicle (seat weight sensors indicate all seats are empty), the guests are given another warning to stand back.
13. As the guests head toward the exit, the car closes its doors and speeds north to collect more guests.

Exceptions:

The car suffers damage that causes it to malfunction.

Priority: Essential, must be implemented.

When Available: On demand.

Frequency of Use: Hopefully never, but at least once in reality.

Channel to Primary Actor: Car doors, tokens, interior car components (if manual mode is enabled)

Channels to Secondary Actors:

T-Rex: breached enclosure

Token: device display and speaker

Emergency Personnel: directly at any stage during the evacuation.

Secondary Actors: T.Rex, Tokens, Emergency Personnel

Open Issues:

None known.

4.2 Internal Personnel

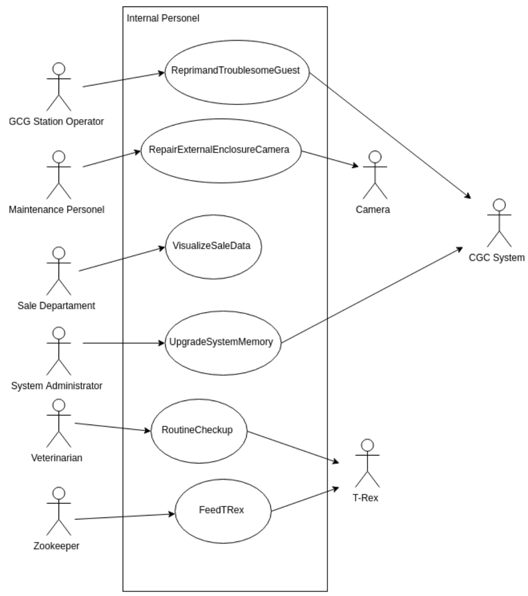

Figure 11: Shows the a general view of the Internal Personnel Use Cases as a diagram.

Use Case: ReprimandTroublesomeGuest

Primary Actor: CGC Station Operator

Goal in Context: To reprimand a guest that is causing trouble by incremental warnings ranging from casual notice, to threats of banishment from the resort.

Preconditions: The system and all components are functioning properly.

Trigger: A guest is caught throwing rocks into the enclosure.

Scenario:

1. The GSO reviews an alert from the electric fence interface.
2. The GSO reads that small voltage spikes have been detected.
3. The GSO heads to the surveillance camera that corresponds to the panel in question.

4. The GSO observes a guest hurling rocks at the enclosure, which explains the voltage spikes.
5. The GSO immediately and firmly tells the guest to stop throwing rocks through the PA system near the site.
6. The GSO is ignored by the guest who gives the finger to the camera.
7. The GSO dispatches the nearest patrol vehicle to the location.
8. The GSO explains the situation to the security guard that happens to be in the patrol vehicle at the time.
9. The GSO firmly alerts the unruly guest that a security guard has been sent.
10. The security guard arrives and reprimands the guest.
11. The guest become violent and gets tased and pepper sprayed.
12. The guest is apprehended and placed in the patrol vehicle.
13. The GSO dismisses the electric fence alerts.

Exceptions:

The system is triggered into emergency mode.

Priority: Moderate, not necessary, but can be useful.

When Available: On demand.

Frequency of Use: More frequent with higher volumes of visits.

Channel to Primary Actor: Electric fence panel, CGC Station GUI, camera

Secondary Actors: Patrol Vehicle, Security Guard, Electric Fence, Guest

Channels to Secondary Actors:

Patrol Vehicle: direct

Security Guard: car intercom

Electric Fence: direct

Guest: PA system, electric fence

Open Issues:

None known.

Use Case: ShuttleGuestsToExhibit

Primary Actor: Guest Vehicle

Goal in Context: To transport guests to the northern part of the island so they may visit the exhibit.

Preconditions: The system is in normal mode and all components are functioning properly.

Trigger: A transaction is confirmed and a tokens are provided to guests.

Scenario:

1. The guests are directed to the parked GV.
2. The guests enter the GV.
3. The GV instructs guests to enter their token devices into their belt buckles.
4. The GV detects all token-containing buckles have been used to fasten corresponding seatbelts.
5. The GV locks its doors and unlocks window functionality for guests.
6. The GV performs a quick system check.
7. The GV heads toward the exhibit.
8. The GV arrives and parks in front of a gate that leads to the exhibit.
9. The GV reminds the guests to take their tokens with them as it grants them access through the gate.
10. The guests exit the vehicle and make their way toward the gate.
11. The GV parks itself nearby and starts a timer.

Exceptions:

A guest loses his or her token device, thus preventing seatbelt access, which necessitates staff intervention.

Priority: Essential, must be implemented.

When Available: On Demand.

Frequency of Use: Up to thousands of times per day.

Channel to Primary Actor: Direct.

Secondary Actors: Guests, CGC Station Operator, Tokens

Channels to Secondary Actors:

Guests: doors, seatbelts, speakers

CGC Station Operator: direct

Tokens: seatbelt buckles

Open Issues:

None known.

Use Case: ShuttleGuestsFromExhibit

Primary Actor: Guest Vehicle

Goal in Context: To transport guests to the southern part of the island so they may leave the island.

Preconditions: The system is in normal mode and all components are functioning properly.

Trigger: The guests' time is up at the exhibit.

Scenario:

1. The car alerts the guests it shuttled to the exhibit that time is up.
2. The guests hear the alert from the car and from their token devices.
3. Some of the guests immediately head to the car while others delay.
4. The guests that head to the car enter it and fasten their seat belts.
5. The GV sends another alert to those remaining.
6. The rest of the guests finally arrive and enter the GV.
7. The GV locks its doors after everyone has fastened their seatbelts.
8. The GV heads south.
9. The GV arrives to the southern part of the island where it parks.
10. The guests release their seatbelts.

11. The GV unlocks its doors and allows the guests to exit.
12. The GV is dispatched elsewhere.

Exceptions:

A guest happens to be injured and requires another type of transportation.

A guest loses his or her token device, thus preventing seatbelt access.

Priority: Essential, must be implemented.

When Available: On Demand.

Frequency of Use: Up to thousands of times per day.

Channel to Primary Actor: Direct.

Secondary Actors: Guests, CGC Station Operator, Tokens

Channels to Secondary Actors:

Guests: doors, seatbelts, speakers

CGC Station Operator: direct

Tokens: seatbelt buckles

Open Issues:

None known.

Use Case: FeedTRex

Primary Actor: Zookeeper

Goal in Context: To safely provide food for the T.Rex, whether it be live, frozen, thawed, or prepared prey.

Preconditions: The CGC is not in emergency mode, and all components are fully functional.

Trigger: It is time to feed the T.Rex.

Scenario:

1. The CGC Station Operator dispatches the zookeeper in a self driving car to the edge of the enclosure furthest from the current location of the T.Rex.
2. The Zookeeper requests an all-clear confirmation from the operator.
3. The operator disengages the electricity of the panel to provide access.
4. The Zookeeper enters and travels a significant distance into the enclosure.
5. The Zookeeper drops off the food.
6. The Zookeeper travels back the point of entry.
7. The Zookeeper exits the enclosure.
8. The Operator confirms successful exit.
9. The Operator reengages the electricity of the panel.

Exceptions:

There is a shortage of food on the island.

The T.Rex is sick or injured and does not want to eat.

The T.Rex reaches the zookeeper before the zookeeper exits the enclosure.

Priority: Essential, must be implemented

When Available: On demand and via operator-zookeeper protocol

Frequency of Use: Periodically (it can be daily, weekly, or monthly for example)

Channel to Primary Actor:

Enclosure Panel

Secondary Actors: CGC Station Operator, T.Rex, Car

Channels to Secondary Actors:

CGC Station Operator: Car Intercom, Camera Network

T.Rex: Enclosure Panel

Open Issues:

Should the panel remain inactive while the zookeeper is inside?

Should the zookeeper simply wear an electric safety suit to avoid disengagement all together?

4.3 External Personnel

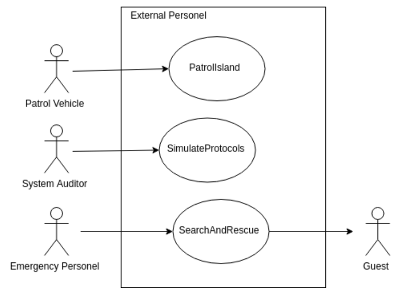

Figure 12: Shows the a general view of the External Personnel Use Cases as a diagram.

Use Case: SearchAndRescue

Primary Actor: Emergency Personnel

Goal in Context: To find any potentially remaining guests after a disaster has occurred on the island.

Preconditions: Emergency mode may or may not be currently active, but it has definitely been triggered prior to the arrival of the actor.

Trigger: A distress signal has been received from Cretaceous Gardens (from Isla Trueno).

Scenario:

1. The platoon has received orders to address an emergency on Isla Trueno.
2. The troops arrive to the island littered with debris and corpses.
3. Some Pay kiosks remain active with an eerie glow coming from an uncannily cheerful welcome screen.
4. Screams of terror can be heard in the distance, followed by tremendous roars.
5. The Emergency Personnel head to the kiosks and enter special codes that provide them with an enormous supply of token devices.
6. The EP diffuse throughout the island as they sweep for survivors.

7. Several helicopters can be heard swarming overhead and small group is sent to the CGC Station.
8. As the troops move inland they find severely injured, but alive, guests.
9. The troops give the injured new tokens which may be detected by the team at the station.
10. A second group arrives at the island, and is directed by the team at the station (via walkie talkies) to the injured.
11. The team notices the T-Rex Monitor signal moving toward the sweeping group of soldiers and they alert them immediately to get into offensive positions.
12. The helicopters overhead lower themselves to wait for the animal.
13. Permission to engage is granted and the beast is taken down.
14. The troops continue their operation until sunrise as teams of paramedics are shipped to the island.

Exceptions:

The T.Rex destroys the CGC Station.

Priority: Essential, must be implemented.

When Available: On demand.

Frequency of Use: Hopefully never.

Channel to Primary Actor: Token GPS

Secondary Actors: Guests, Tokens, Pay Kiosks

Channels to Secondary Actors:

Guests: tokens

Tokens: pay kiosks

Pay Kiosks: direct

Open Issues:

None known.

Use Case: UpgradeSystemMemory

Primary Actor: CGC System Technician

Goal in Context: To upgrade the memory of the machines within at CGC Control Station (e.g. add 16 GB RAM).

Preconditions: The CGC is not in emergency mode but may be in either maintenance or normal mode.

Trigger: Cretaceous Gardens experiences an increase in demand, which (if the trend continues) will require more computational resources to handle more guests, more efficiently.

Scenario:

1. The Sales Department notices a distinct upward trend in sales.
2. The findings percolate through the relevant business entities within the company.
3. The CST is dispatched to the Control Station.
4. The CST enables maintenance mode.
5. The CST upgrades machines that are currently being used for redundancy.
6. The CST enables maintenance mode on the redundant machines.
7. The redundant machines and active machines, switch roles.
8. The CST upgrades the now-redundant machines.
9. The CST performs tests.
10. The CST disables maintenance mode in both active, and redundant machines.

Exceptions:

The trend is ignored by management.

Priority: Moderate, should be implemented.

When Available: On demand.

Frequency of Use: Every two or three fiscal years.

Channel to Primary Actor: Control station hardware.

Secondary Actors: Sales Department, CGC Control Station, Pay Kiosk

Channels to Secondary Actors:

Sales Department: pay kiosk transaction logs

CGC Control Station: direct access

Pay Kiosk: direct connection

Open Issues:

None known.

Use Case: SimulateProtocols

Primary Actor: System Auditor

Goal in Context: To observe currently implemented protocols within the system and provide an analysis regarding their safety.

Preconditions: The system is not in emergency mode nor maintenance mode, but may be put into such modes for testing purposes (presumably outside business hours).

Trigger: The time for a system audit has arrived, either after being scheduled or at random.

Scenario:

1. The SA arrives to the CGC Control Station outside of business hours.
2. The SA requests to observe a simulation of the currently used functions of the system.
3. The SA is provided with a set of protocols that may be simulated.
4. For each protocol, the SA runs a simulation.
5. The system passes the audit and the SA leaves.
6. OR
7. The system fails while simulating one or more protocols and the auditor presents a deadline to fix the issue lest a fine is incurred.

Exceptions:

An audit occurs in the middle of a system upgrade.

The system is triggered into emergency mode (due to an actual emergency)

Priority: Low, not explicitly required, but may be useful for legal robustness.

When Available: On demand.

Frequency of Use: Annually or less frequently.

Channel to Primary Actor: CGC Control Station interface

Secondary Actors: CGC Control Station, Pay Kiosks, Cars, Electric Fence, T.Rex, T.Rex Monitor, Camera Network

Channels to Secondary Actors:

CGC Control Station: simulation

Pay Kiosks: simulation

Cars: simulation

Electric Fence: simulation

T.Rex: simulation

T.Rex Monitor: simulation

Camera Network: simulation

Open Issues:

What factors should be relevant in a simulation?

Use Case: RoutineCheckup

Primary Actor: Veterinarian

Goal in Context: To perform a regular physical exam on the T.Rex.

Preconditions: The T.Rex has been successfully sedated, the veterinarian is completely prepared, the CGC is not in emergency mode, and all components are functioning properly.

Trigger: The time for a physical has arrived.

Scenario:

1. The CGC Station Operator dispatches the veterinarian in a self driving car to the edge of the enclosure closest to the current location of the T.Rex.
2. The veterinarian requests an all-clear confirmation from the operator.
3. The CGC Station Operator confirms sedated state of the T.Rex.
4. The operator disengages the electricity of the panel to provide access.
5. The veterinarian enters and travels toward the animal.
6. The operator starts a timer.
7. The veterinarian arrives at the location of the animal.
8. The operator stops the timer.
9. The veterinarian performs a physical exam while the operator provided updates on the sedative state of the T.Rex.
10. The operator alerts the veterinarian when the previously recorded elapsed time is approaching the approximated amount of time until the T.Rex wakes up.
11. The veterinarian concludes the exam.
12. The veterinarian replenishes the sedative reservoir in the T.Rex Monitor.
13. The veterinarian travels toward the point of entry.
14. The veterinarian exits the enclosure.
15. The Operator confirms successful exit.
16. The Operator reengages the electricity of the panel.

Exceptions:

The T.Rex is found to be in poor health.

The sedative lasts less time than expected.

Priority: Essential, must be implemented.

When Available: On Demand.

Frequency of Use: As little as once a year.

Channel to Primary Actor:

Enclosure Panel, T.Rex Monitor

Secondary Actors: CGC Station Operator, T.Rex, Car

Channels to Secondary Actors:

CGC Station Operator: Car Intercom, Camera Network

T.Rex: Enclosure Panel, T.Rex Monitor

Open Issues:

Should the panel remain inactive while the veterinarian is inside?

Should the veterinarian simply wear an electric safety suit to avoid disengagement all together?

Use Case: FeedTRex

Primary Actor: Zookeeper

Goal in Context: To safely provide food for the T.Rex, whether it be live, frozen, thawed, or prepared prey.

Preconditions: The CGC is not in emergency mode, and all components are fully functional.

Trigger: It is time to feed the T.Rex.

Scenario:

1. The CGC Station Operator dispatches the zookeeper in a self driving car to the edge of the enclosure furthest from the current location of the T.Rex.
2. The Zookeeper requests an all-clear confirmation from the operator.
3. The operator disengages the electricity of the panel to provide access.
4. The Zookeeper enters and travels a significant distance into the enclosure.
5. The Zookeeper drops off the food.
6. The Zookeeper travels back the point of entry.
7. The Zookeeper exits the enclosure.

8. The Operator confirms successful exit.
9. The Operator reengages the electricity of the panel.

Exceptions:

There is a shortage of food on the island.

The T.Rex is sick or injured and does not want to eat.

The T.Rex reaches the zookeeper before the zookeeper exits the enclosure.

Priority: Essential, must be implemented

When Available: On demand and via operator-zookeeper protocol

Frequency of Use: Periodically (it can be daily, weekly, or monthly for example)

Channel to Primary Actor:

Enclosure Panel

Secondary Actors: CGC Station Operator, T.Rex, Car

Channels to Secondary Actors:

CGC Station Operator: Car Intercom, Camera Network

T.Rex: Enclosure Panel

Open Issues:

Should the panel remain inactive while the zookeeper is inside?

Should the zookeeper simply wear an electric safety suit to avoid disengagement all together?

5 Actual Implementation Plan

There is now a foundation laid out to build something incredible. Due to the limitation of time there will only be a small feature set built though. This section will ultimately outline the implementation subset that will be delivered during the class period.[4]

Overview To showcase possible behavior that may be seen at the gardens there needs to be a way to showcase the GPS tracking of the Visitors, Employees, Cars, and T-rex. The best way to do this is to simulate the actual system that would display this information. To do this we will simulate the graphics of the CGC Station which would normally display active nodes and also act as a way for an employee to control aspects of the system. This simulation will have additional controls that can control what nodes get spawned into the simulation of the park. The goal for a system like this would be to test the behavior of the protocols and also help design protocols. The protocol designer will not be implemented in this version. For now something similar to the following image will be built. The logic to help make this simulation work will also be built.

[4]Actual Implementation Plan by Siri.

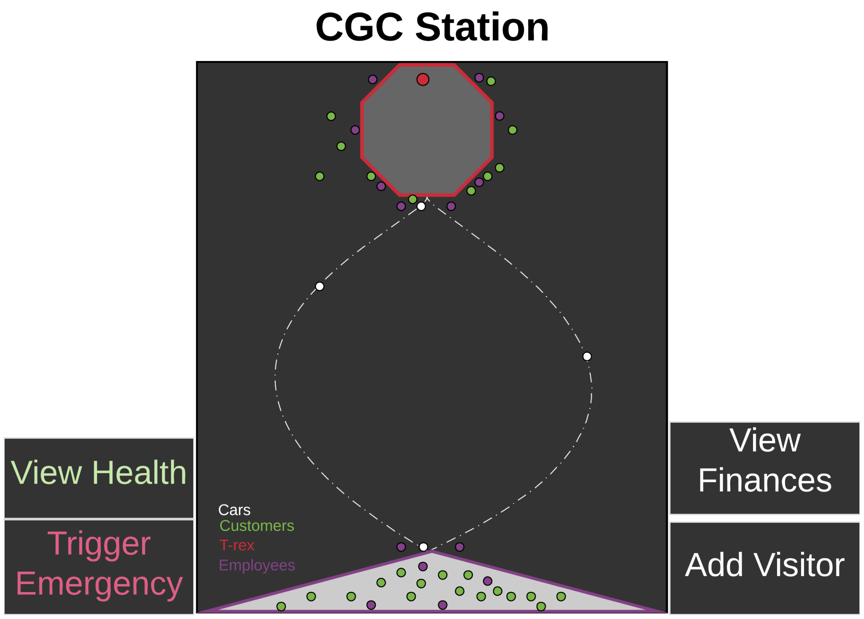

Figure 13: **CGC Station Sim GUI:** A potential version the simulated gui that will be build.

To implement this there will be only 5 major classes that will get built and implemented. There will be the CGC Station, which includes the GUI, the CGC which will spawn and keep track of the Car, T-Rex Monitor, and Token. The Car, T-Rex Monitor , and Token will implement the Tracking and Maintainable interface. This will guarantee that these classes will report their location and health to the CGC that can then be used to represent this data in a GUI format. Every class will run on it's own thread. To make these all communicate successfully with eachother, they will all own a Blocking queue.

5.1 CGC Station

The CGC Station will control the GUI. It will contain a blocking queue and a reference to the CGC blocking queue to communicate. The state of the GUI will be updated by the CGC by means of messages through the blocking queues.

5.2 CGC

The CGC has its own priority Blocking queue. It has a reference to ALL other active instances. It will spawn, manage, and kill other objects and control their threads. The goal is to allow a central location to keep track of everything!

5.3 Car

The car will have two versions, the Patrol car and the Tour car. The patrol will just go patrol the path to make sure there are no emergencies. The Tour car will implement the logic to pick up guests and bring them to the Exhibit and bring them back.

5.4 T-Rex Monitor

This will implement some basic stuff. primarily this exists to show the T-Rex Wondering around in it's cage. The T-rex wondering logic will not be very impressive. the T-Rex will not attempt to get out or hurt guests. when emergency mode is triggered, it may act like it got injected with a tranq. This will just make the movement stop.

5.5 Token

This will be used to showcase the GPS location on the map for the visitors and the Employees. It will have very basic behavior one to make it move towards the car pickup location on the south lot. It will also wonder around looking at the dinasour until time is up.

5.6 Pay Kiosk

This will randomly make sails and spawn visitors intot he simulation. and log the transactions.

Every class will extend or implement the animation timer to allow it to perform behavior against time. For example, to give a realistic pace to the movement of a token GPS. the X and Y location of the gps may not move every frame. The animation timer is what allows this animation of data. the only class that will NOT extend an animation timer is the CGC this class will respond only to messages in its blocking queue. It will wait other wise.

5.7 Details

To implement this in the 3 week period we will stratigically implement the basic functioning of the software product. If we have time , we will add additional features. The goal is to showcase something. Hopefully we can showcase a lot. The next tabel describes the goals for each week and what to accomplish

Work Schedule	
Week	**Goals**
Week 1	• Build all skeleton classes • Assign tasks from LoboGit • Begin to code
Week 2	• Complete basic implementation • Check team task progress • Assign NEW tasks from LoboGit • Continue to code • Fix Bugs • Complete ReadMe file
Week 3	• Add final touches to features • Fix final bugs • list known issues in ReadMe • Go over presentation details

6 Design Constraints

Due to the real-time nature of the system, there exist some additional constraints[5]*. Namely, it must be the case that all data structures concerning the safety controls are as fast as possible but also that they are capable of prioritizing all signals in the best way possible.*

6.1 Safety

The safety is highly prioritized in our design of the CGC. We have global fire alarm system and the CGC directly have access to it in the case emergency, this event has a very high priority and the CGC should immediately react to this event. When it comes to self-driving cars, we also need to ensure the door locks and car should follow appropriate protocol in the case of emergency. For T-Rex, the tranquilizer is a safety precaution which will keep the visitors safe at all times.

6.2 Implementation Guidelines

According to the design, we suggest programmers to use some sort of Concurrent safe Messaging Queue for the communication between sensing objects and their associated parent objects. We also recommend using concurrent safe Priority Queue for the CGC, so the CGC can react based on the certain given priority. The priority should be considered because in the case of an emergency, the priority for that event should be at the very top so that the CGC should immediately react to it and follow emergency protocol.

7 Definition of Terms

The following is a list of definitions contain the most commonly used technical terms within this document, whose meaning may not be immediately apparent to the lay reader. Most definitions are defined by the authors for use within the context of this document. Some may originate from vocabulary shared across the general references cited . In the event that a definition was taken directly from a source, it is followed by a citation. [6]

CGC: Cretaceous Gardens Controller

[5]Design Constraints by Anas.

[6]This list is mostly a reduction of the term list found in the preceding Software Design Specification document.

DVR: Digital Video Recorder

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

GPS: Global Positioning System

Hardwired 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.