



Cloud Surf Inn: Report 1

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1.1 Problem Statement

Customer (Hotel Patron)

I usually love staying at hotels but the pandemic has brought a damper on going out and staying at my favorite hotels. I have a high-risk condition and because of that, I am very conscientious of the health and safety standards of the place I am staying at. A lot of the interactions I have with hotel staff force me to be physically closer to other people than I am comfortable with being during this pandemic. If there was a way for me to get my hotel key without having to go to the front desk and potentially wait in a line and have to interact with the front desk, I would be much happier to go there and would feel much safer. I also hate how my room key is not only often misplaced but becomes demagnetized next to my phone! However, when I finally get in my room and have some time to myself, I can never find the food I want or the shows I enjoy. Oftentimes the menu is scattered on one of the tables, or sometimes even missing entirely! And when I finally get some good food to eat, what better way to eat than with my favorite show! But half the time I try to find it, I end up fumbling through channels, trying to find the channel list, or giving up and just calling the front desk. It would be beneficial and eliminate frustration if there was just one single place where I could get my TV shows or movies, and order my food, that way I would not have to waste my time looking in several different places. I also enjoy my rooms being kept very tidy and sanitary but can never find a maid when I

need her. I wish I could just schedule housekeeping to come and clean my room at a certain time so that I do not have to interact with the maid directly, and I also get my room cleaned right when I want it.

An overall downside with hotels is the room temperatures! I find myself too cold or too hot and the thermostats are so old you can not easily change the temperature or I have to get up to change it! It would be so much more convenient to change the room temperature through my phone! I also get frustrated when I am assigned a room without any note of my preferences! Or worse, I have to search through hundreds of rooms and none of them are desirable.

How will Cloud Surf Inn help me? A multifaceted app that could handle different aspects of my hotel experience would be a big boost to my experience. Since I ordered my room on the app, why can it not just serve as my hotel pass as well? This way I would not have to worry about interacting with the hotel staff and could go straight to my room, keycard on my phone. And, if this app was integrated into the TV and had the TV shows, movies, and menus listed all in one place, I would have a much easier time ordering pizza while watching *The Office*. If I could also schedule housekeeping on the app, it would make my day being able to request housekeeping even when I am not in the hotel. Plus, being matched with a room according to my preferences removes the need for me to switch rooms because I am unsatisfied. I imagine the app to be easy to use, everything straightforward so I don't need to worry about clicking around finding the information! A website or any user interface would work just as well, as long as I have no human interaction.

Owner

As the owner of a large hotel, making sure guests feel comfortable and are highly satisfied with their stay is my number one priority. With the pandemic, however, I have seen fewer and fewer people go through my doors and rent rooms than ever. A large part of that I believe is because people do not feel comfortable with the hotel stay experience right now. If I could eliminate all but the vital interactions between customer and employee, I would have a much better time advertising to customers about the safety of my hotel. Another thing I would like to do is cut my costs wherever I can. I feel like some of my employees sometimes spend their time doing non-productive work. The maids, for example, spend a larger portion of their time walking from room to room, checking if there are people there, rather than performing the housekeeping service. I would like a better way for their services to be used and only schedule

their shifts when people need the service to save money spent unnecessarily. I am also very passionate about being environmentally friendly; and unfortunately, I feel a lot of the energy we use is wasted. I would love to be able to turn down thermostats and turn off lights automatically when guests are not in use of a room; it is too difficult to get the staff to individually do this and I would end up paying them more than I would save!

How would Cloud Surf Inn help me? Contactless check-ins or housekeeping requests would greatly increase the comfortability of my guests and also reduce the time my employees spend doing non-productive things. I would love it too if the lights would automatically dim and the heat would be turned down when a room becomes vacant. I would then feel confident in saying that my hotel is doing the best it can to be sustainable. The streamlined management on top of customer satisfaction reducing room vacancies is sure to increase revenue.

Staff (Housekeeper/Custodian)

I have lots of rooms to clean in this hotel and it gets challenging to keep track of what rooms I have taken care of and what rooms still need to be cleaned. I also often accidentally run into customers if they think the cleaning is done, or they do not announce themselves and I accidentally enter. During these pandemic times, I would especially like to avoid unnecessary contact with the customers. If I just knew when customers needed cleaning and could let them know somehow that it was done, it would be much easier to provide housekeeping that better serves them and also lets me get my work done quicker and easier. It is concerning to use one master key to open all bedrooms because if I lose it, whoever finds it has access to all the rooms in the hotel- compromising security. Also, with the pandemic especially, it is hard to keep track of high-traffic areas, like elevators, and to keep them clean. If I was able to tell when someone last cleaned that area, I would have a much easier time keeping the hotel clean for myself and others. It is also frustrating to waste so many extra towels and shampoo bottles as they must be thrown out after a guest checks out. People often steal them from the cart as well making me run out before I finish cleaning!

How would Cloud Surf Inn help me? Having a schedule of when the rooms need to be cleaned as requested by guests would help me greatly. I would be able to get my work done much faster and be able to keep track of what rooms I have done, and what rooms still need to be cleaned. I also reduce the amount of wasted resources as guests request how many towels, or

shampoo bottles they need. If the system also had a part that could keep track of high-traffic areas, and let me know if they need to be cleaned again, I would be able to keep the hotel much safer for everyone.

Managers:

As a hotel manager, things are stressful and hectic, to say the least. Properly communicating things to other staff is a tough thing to get right, and when it comes to serving our guests, every detail matters. It is incredibly difficult to keep track of things happening around the hotel on any given day, and it is even harder to keep track of the guests and their requests. As a manager, guests constantly seek me out for things and I have to make sure I remember and tend to everything they tell me. Whether it is to get clean towels for a room, request a room change, or request a new key, I have to remember everything and make sure it gets done. What makes this worse is keeping track of the rest of the staff. Oftentimes, keeping track of everyone else can be a problem all on its own. I worry about micromanaging my fellow staff members by reminding them of small tasks that need to be done and who they need to be done for.

I also feel that the hotel is pretty wasteful. Not just environmentally, but also in terms of how we employees spend our time. We waste a great deal of electricity powering rooms, hallways, and services when guests are not using them, and sometimes staff forgets to power things off when not in use. It feels incredibly wasteful. I wish we could allow rooms to go into some sort of “power-saving” mode where they consume as little as possible. Regarding our time, on slow days or days where guests spend most of their time outside of the hotel, the staff stays relatively inactive, and sometimes the hotel is even overstaffed.

How will Cloud Surf Inn help me? Well, I think it addresses a lot of the issues I mentioned. Having a system where I can manage and view information about guests and the hotel itself is incredibly useful; it lets me focus on other aspects of management. Instead of micromanaging my fellow employees, I can concentrate on making sure everything is moving smoothly in addition to making sure high-level priorities are kept in check. It also goes without saying that making sure that the hotel is functioning in an efficient and environmentally friendly manner is solved. With Cloud Surf Inn, I can change my management style so that my sole purpose is to satisfy clients and let the system handle the rest.

Staff (Reception Area) :

Working at the front desk is a much harder task than most people would think. Whenever guests need someone for something (whether good or bad), they come to me and my fellow receptionists. Checking guests in and out is also a lengthy process that stresses both me and the guests. On hectic days, it is very easy to make a mistake, and I can feel the frustration of the guests when these things happen. Naturally, I feel devastated when I cannot do my job perfectly, but there is very little I can do when the check-in and check-out processes are so tedious. I am also tasked with dealing with surly customers who are unsatisfied with the room they have been given, and getting them a new one requires much face-to-face interaction to assign a new key. To make matters worse, our current system for keeping track of rooms and guests is incredibly outdated and prone to errors. I have to be incredibly careful to not give a guest a room that is already occupied, and sometimes, empty rooms are marked as occupied by the system. The Covid-19 pandemic has also made things even more difficult. Carelessly handling money, checks, and credit cards is something that cannot be taken lightly. We also limit the number of people in the reception area at any given time for safe social-distancing measures but this makes communication with guests difficult. It also makes giving out keys harder as we want to be as sanitary as possible. There has to be a simpler and more sanitary way to handle guest reception.

How will Cloud Surf Inn help me? Having guests able to book a room from the comfort of their own home makes everything much easier when they arrive. On top of that, guests can check themselves out, so even that is automated. Handling payment information is easier and more straightforward than ever. Cloud Surf Inn also accurately tracks information about the rooms and guests so I no longer have to rely on our old and obsolete system. I don't even have to worry about hotel keys as the automated hotel gives a unique room code in the confirmation email, and automatically re-generates a new code if there's a room change- eliminating guests needing to ask me for a new keycard. In short, Cloud Surf Inn makes everything about my job easier.

Staff (Service):

Serving guests and keeping them satisfied is my specialty, but I will admit that doing so is not always easy. It is incredibly difficult to keep track of which guests request what, especially when things are busy. For example, room service to a guest is simple when they request a couple of small items, but when multiple guests request service of multiple items, it becomes nearly impossible to properly queue and coordinate orders with the kitchen. Taking orders with phone

calls and writing them down with a pencil and paper is not enough to keep up with orders on a busy day. I also find myself handling money or needing credit card signatures forcing face-to-face contact.

How will Cloud Surf Inn help me? I think it goes without saying that Cloud Surf Inn is going to make my life a whole lot easier. Being able to see orders and requests neatly organized within a user interface doesn't just help me, it helps the kitchen and other service staff as well. We can focus our energy on keeping guests happy and not on keeping ourselves organized. The automatic payment processing is also valuable to reduce contact and increase sanitation. I think it is also important to mention that being able to request services is also useful to our guests. They can browse menus, request utilities, and see what we have to offer without needing to call anyone to find out; everything is at their fingertips.

1.2 Hardware and Software Obtainment:

The hardware devices needed to accomplish the requirements set by the problem statement include a raspberry pi, temperature sensors, an LED, and motion sensors. All hardware devices needed are already owned by their respected product owner or have been ordered through amazon for demo purposes. After confirming the validity of the test cases involving external hardware devices, bulk sensors and single-board computers will be purchased for the installment in every room of the hotel. The system will also be basing certain use cases on past projects. These include the "Keypad" in the Home Automation and "Clock In/ Clock Out" from restaurant automation.

1.3 Decomposition into Sub-Problems

From the problem statement the main problems identified by users, staff, and stakeholders can be divided into three categories: Wasting Energy and Resources, Housekeeping Not Readily Available, and Unnecessary Staff Interaction. Other problems pertaining to guests regard the comfort and accessibility of the hotel experience, which are viewed as less important and deviate from Cloud Surf Inn's overall goals.

Wasting Energy and Resources: This sub-problem of the system pertains to the energy hotels waste by not being more proactive in their energy management. Climate control in the systems

can be automated and improved, and hallway lighting can be adjusted to activate only when necessary.

Housekeeping Not Readily Available: Housekeepers do not perform their job when needed by a customer resulting in unsanitary and unsightly conditions for the guests. They can also disrupt guests in their room because of the lack of systematic cleaning schedules. Additional sanitary measures need to be implemented due to the pandemic such as keeping high-contact areas like elevators clean..

Unnecessary Staff Interaction: Lots of tasks in the hotel can be optimized to reduce staff interaction, receiving or changing keys, payment processing, checking in and out, and room selection. Mobile keys reduce the chance of losing magnetic keys, ease the process of changing keys, and ensure a master key is available for managers.

Guest Comfort: Guests are always searching for a better more pleasurable experience, especially relating to dining service, entertainment features, and a comfortable climate. Having food be ordered online, the information about TV entertainment be online, as well as remote temperature setting all pertains to the guest wanting a comfortable experience.

1.4 Work Assignment:

From the decomposition of sub-problems, four teams were made to address various functional features that if successful will become solutions to the problems. The three systems are:

1. Checking out of the room makes the database switch to vacant which turns off power in the hotel room.
2. A guest logs into the system and is matched with a room based on preferences, then a mobile key is outputted.
3. Guests make a housekeeping request, housekeeping logs into the system, and reviews requests.

The functional features that address the problems are labeled as, “Housekeeping”, “Mobile Keys”, “Power Control”, and “Room Matcher.” They subsequently have team codes of A, B, C, and D. Teams B and D work together on the same solution but are separated to give more individual focus to certain features. Group assignments were based on past experience working together, similar skill sets, and knowledge of subsystems.

Team Assignments are as followed:

Team	Members	Team Code
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Housekeeping	Juan, Ryder, Zach	Team A
Mobile Key	Sidonia, Bharath	Team B
Power Control	Jakub, Sebastian, Chynna	Team C
Room Matcher	JP, Chris	Team D

Team Members are as followed:

Chynna Walsh - Management & Organization, C++

Sebastian Matiz - Programming, Java, C

Juan Escudero - Writing and Documentation, Java, C, Python

Bharath Selvaraj - Programming, Java, C++

Sidonia Mohan - Java, JavaScript, HTML/CSS

Chris Kline - Eclipse, SQL, Java, C++

Ryder Morrello - Java, JavaScript

JP Dangler - Documentation, C++, C

Jakub Vogel - Report Writing, C++, Java

Zach LeMunyon - Programming

1.5 Glossary of Terms

Cloud Surf Inn: an automated hotel that uses a multi-functioning user interface system. This application facilitates the process of ordering room service, picking movies to watch, and scheduling cleaning. The purpose of Cloud Surf Inn is to give one of a kind experience to people who will safely enjoy staying at a hotel during pandemics and other events where human contact should be minimized.

Room Key: a 4 character alphanumeric pin generated at random that allows the customer to enter the room. This key reinforces the “no contact” initiative caused by COVID-19 protocols and ensures both the safety and security of the customer.

Sustainability: the automated hotel system conserves energy by reducing the energy expenditure by other systems (such as housekeeping) while simultaneously ensuring that those systems still perform the tasks they are required to do.

Automated: almost every system within the hotel can function with little to no human interference and thus reduces the risk of human to human contact.

System: the technical components that make up the automated hotel and are usually in the form of a user-interface (app) and module that has control over other services.

Smart Room: a room that can cater its settings to user preferences (turning on/off lights, temperature control) automatically and interacts with other aspects of Cloud Surf Inn to provide a unique, modern, and sanitary experience to guests.

Power Saving Mode: A mode that automatically turns down the heat, turns off lights, and activates hallway sensors. The main goal of this mode is sustainability.

Comfort Mode: A mode that automatically turns heat to a preset level and turns on lights. The main goal of this mode is user comfort.

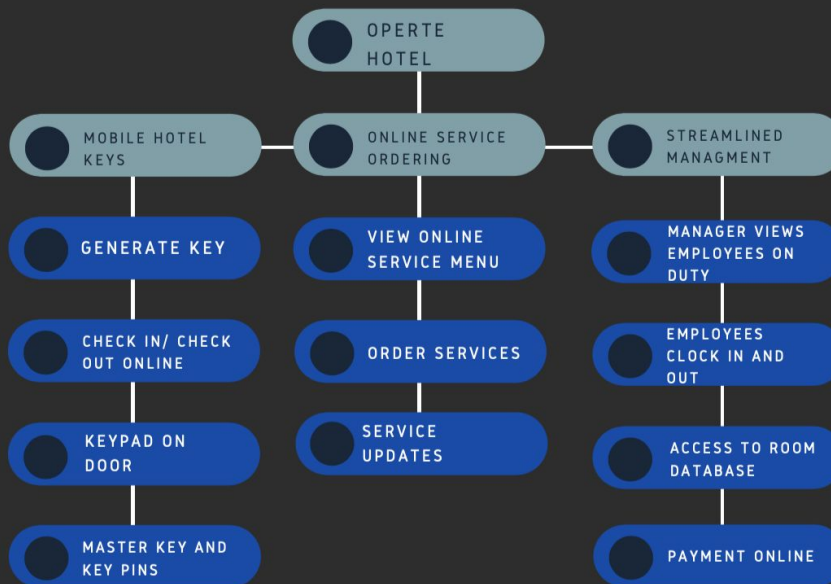
Power Controls: The hardware system containing sensors, raspberry pi, and a breadboard that controls the thermostat and motion sensors.

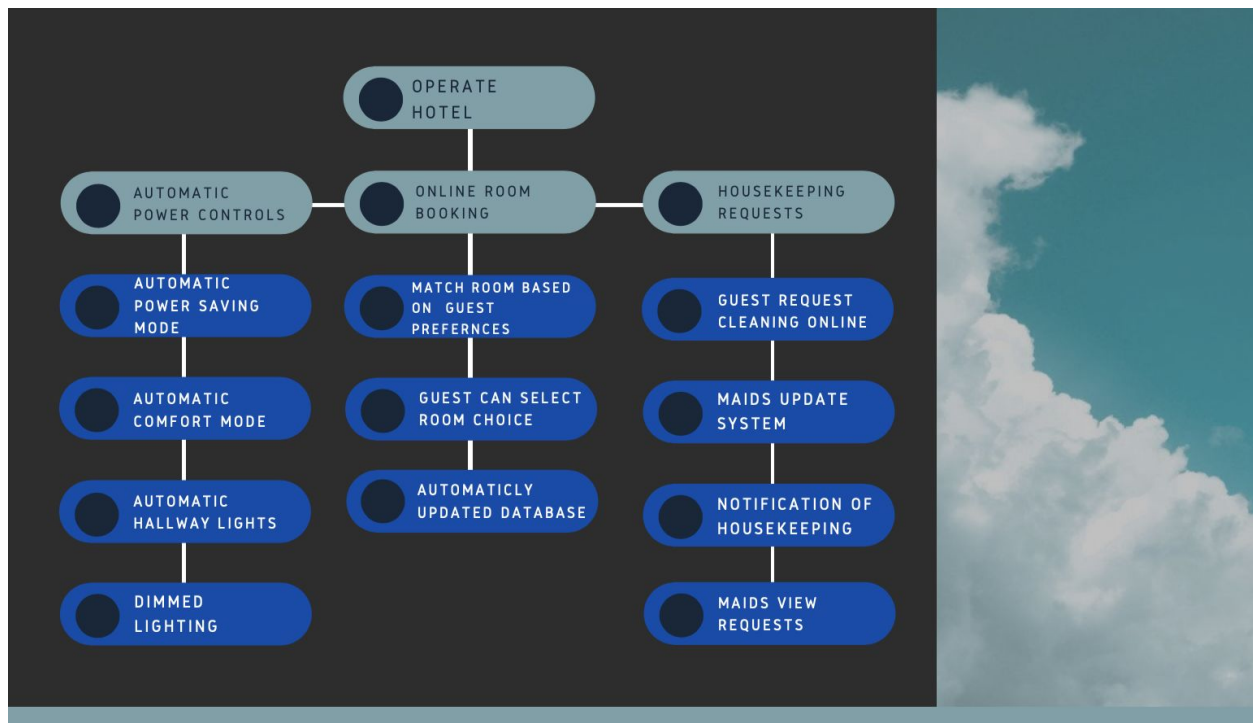
2.1 Business Goals:

BUSINESS GOALS



CLOUD SURF INN





2.2 Enumerated Functional Requirements

Identifier	Priority	Description
REQ-0	5	The system will generate a 4 character alphanumeric code.
REQ-1	3	The system emails guests their room key code after inputting credentials.
REQ-2	2	The system allows guests to order food and be able to add/request additional information regarding that item.
REQ-3	2	The control system receives input upon check-in or check-out that a room is occupied or vacant from the database.
REQ-4	4	The control system automatically shuts off heat and power in a room when vacant.
REQ-5	1	If temperature is set to an invalid setting a warning message is displayed.
REQ-6	5	A temperature sensor sends the temperature data to the system.

REQ-7	3	The system displays the temperature.
REQ-8	5	System allows the temperature to be manually changed through the user interface.
REQ-9	2	The system allows customers to view TV channels and service options.
REQ-10	2	The system allows customers to order utilities or services through the user interface.
REQ-11	5	The system allows customers to book housekeeping through the user interface.
REQ-12	2	The system allows the manager to view schedules that show when maids will come in and clean.
REQ-13	3	The system displays which rooms or areas need cleaning for the maids.
REQ-14	2	The system allows maids to input when they last cleaned high-traffic areas or rooms.
REQ-15	3	The system allows staff to view the room database.
REQ-16	2	The system allows customer to input credit card number, holder, expiration date, and CVC
REQ-17	5	The system has a database of rooms containing occupancy, room number, cleanliness.
REQ-18	4	The system matches rooms to guests based on preferences.
REQ-19	4	The system allows customers to individually choose from available rooms and opt-out of the room matcher.
REQ-20	1	The system will rematch rooms for guests and provide new codes in case of room changes.
REQ-21	3	Manager can manipulate service requests.
REQ-22	5	Staff must be able to login and see a corresponding pin for a room that requested cleaning.
REQ-29	2	The system turns off lights in hallways during the night.
REQ-30	2	Motions sensors turn on dimmed lighting at night.
REQ-31	1	All items ordered by a customer are kept on file to pay at the

		end of visit.
REQ-32	4	Customer will have to input either their driver's license or passport pin for identification purposes to receive room
REQ-33	3	For check-in, the customer will have to login in and pick the check-in option.
REQ-34	3	For check out, the customer will have to login and pick the checkout option.
REQ-35	3	Manager has a master key pin to access all rooms.
REQ-36	3	Pin will no longer work after 11 am on the day of checkout for guest
REQ-37	4	Staff can login and view and update service requests.
REQ-38	3	Staff can clock-in and clock-out of work by logging into the user interface.
REQ-39	4	The user interface has three login options for guest, staff, and managers
REQ-40	2	Customers can track their ordered food/services.
REQ-41	3	Room turns on comfort mode when check-in activated
REQ-42	4	There is a keypad to enter the room key into every door.
REQ-43	2	Manager can view employees clocked in.
REQ-44	2	Managers can view and edit employee work schedules.

2.3 Enumerated Nonfunctional Requirements

Identifier	Priority	Requirement
REQ-23	3	The UX should never make a customer use more than 10 clicks to access any feature.
REQ-24	5	The system should be able to generate unique key IDs to increase room security.
REQ-25	4	The hotel system should be able to reduce power waste and consumption by 10%.

REQ-26	3	The hotel system should be able to schedule room cleanings so maids do not have spare time.
REQ-27	1	The hotel system should allow customers to have no contact with other humans.
REQ-28	1	Keycards are available on mobile phones to open rooms.

2.4 User Interface Requirements:

login

GUEST

STAFF

MANAGER

tv page

1 CHAN1

2 CHAN2

manage

SCHEDULE:

MAID 1 : TIME

service

☐ TOWEL

☐ SHAMPOO

☐ PIZZA

☐ COOKIE

thermostat

°F

NEW:

check in/out

IN OUT

housekeeping

DAY

TIME

book room

☐ PREF 1

☐ PREF

service

ROOMS TO CLEAN:

☐ 1A

☐ 1B

Figure 1: Customer User Interface Mockup

Customer User Interface Requirements:

Identifier	Customer Requirements
CREQ-1	Customers will choose the login page.

CREQ-2	Customer inputs login information.
CREQ-3	Customer chooses the “Book a Room” page.
CREQ-4	Customer inputs guest number and checks room preferences.
CREQ-5	Customer clicks “Find Room”, and is matched to a room.
CREQ-6	Customers chooses “Payment”
CREQ-7	Customer inputs payment information and license formation.
CREQ-8	Customer can select “check out” or “check in”
CREQ-9	Customer selects “Housekeeping” and chooses date and time.
CREQ-10	Customer selects “TV” to view the TV Guide.
CREQ-11	Customer selects “Room Control”
CREQ-12	Customer inputs temperature and clicks “Update’
CREQ-13	Customer selects “Room Service” and can select from options.

Staff User Interface Requirements:

Identifier	Staff Requirements
SREQ-1	Staff will choose the login page.
SREQ-2	Staff inputs login information.

SREQ-3	Staff selects “View Room Database”
SREQ-4	Staff can select “Clock in” or “Clock out”
SREQ-5	Staff selects “View Housekeeping Requests”
SREQ-6	Staff can input when they cleaned rooms and hotel areas.
SREQ-7	Staff can select “Update Customer”
SREQ-8	Staff can input status of service order.

Identifier	Manager Requirements
MREQ-1	Manager will choose the login page.
MREQ-2	Manager will login to the manager page.
MREQ-3	Manager selects “View Room Database”.
MREQ-4	Manager can view all room details.
MREQ-5	Manager selects “Change Guest Reservation”
MREQ-6	Manager selects reservation to change.
MREQ-7	Manager selects “View Housekeeping Request”
MREQ-8	Manager selects “Schedule” to view staff clocking in and out.

MREQ-9	Manager can access “Master Key” to unlock all rooms.
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3.1 Stakeholders

Hotel Owners: Have a personal interest in Cloud Surf Inn as it allows for greater power efficiency in the hotel and a more pleasurable experience for their guests.

Employees: Are interested in Cloud Surf Inn to make their jobs easier by making their tasks more efficient and manageable.

Hotel Guests: Cloud Surf Inn will lead to a more enjoyable, relaxing, pandemic-friendly experience for hotel guests who will utilize the system repeatedly throughout their stay.

Software Engineers: Want to make a system that is easily used that has the potential to maximize the efficiency of the hotel business and continuously improve the system.

3.2 Actors and Goals

Initiating Actors

Actor	Goal
Housekeeper/ Custodian	The housekeeper/custodian is responsible for keeping rooms, hallways, and areas within the hotel clean. They will accept requests to provide cleaning and indicate whenever requests have been completed.
Guest/Customer	The guest is a customer staying at the hotel; they use the Cloud Surf Inn system to satisfy their desires and necessities.
Service Employee(s)	Service employees responsibilities include but are not limited to cooking food, delivering food/services, and indicating services are ready to be delivered/offered.
Manager	The manager will have the high-level responsibility of managing all the needs of the hotel and guests.

Participating Actors

Actor	Role
Database	The database is a system that records a customer's room number and requests the customer can make. It will hold the information necessary for the features to be able to operate.
Thermostat	The goal is to send data to the database about if a room is vacant and the current temperature of the room.
Login System	The goal of our login system is to incentivize customers to use our system again as they can utilize their login information multiple times.

3.3.1 Casual Descriptions

Room Matcher:

Identifier	Description	REQ-# Used
UC-1	"Find Room" - Matches customer with room based on checked preferences and guest number input.	REQ-3, REQ-17, REQ-18, REQ-32
UC-2	"View Room Database" - Allows staff and managers to view all rooms and their information.	REQ-13, REQ-15, REQ-17
UC-3	"Payment" - Allows customers to input payment information and charge things to the room.	REQ-31, REQ-16, REQ-10, REQ-2
UC-4	"Access Previous Payments" - Allows staff and managers to view a list of all items that were ordered in the past.	REQ-16, REQ-40, REQ-37
UC-5	"Book a Room" - Allows a potential guest to select a room of their choice	REQ-19, REQ-17

Mobile Key:

Identifier	Description	REQ-# Used
UC-6	"Login Page" - Allow customer, manager, and staff to login and see key pin available to them	REQ-22, REQ-33, REQ-34, REQ-35, REQ-37, REQ-38, REQ-39
UC-7	"Check-In/Check-Out" - Customer checks out or checks into hotel by clicking button.	REQ-41, REQ-33, REQ-34, REQ-3

UC-8	“Keypad” - Customer, manager, and staff input key pin into the keypad	REQ-42, REQ-36, REQ-35, REQ-22, REQ-0, REQ-1
UC-9	“Key pin for staffs” - Staff logs in and sees what rooms need cleaning and the corresponding pin for room	REQ-0, REQ-22, REQ-24
UC-10	“Generate Key” - A key is generated when a customer books a room.	REQ-0, REQ-1, REQ-42, REQ-20, REQ-24
UC-29	“Master Key” Manager views and accesses the master key.	REQ-35

Power Controls:

Identifier	Description	REQ-# Used
UC-11	“Set Thermostat” - Allow customers to set the thermostat online to their desired temperature.	REQ-5, REQ-7, REQ-8
UC-12	“View Current Temperature” - Allow customers to view current temperature.	REQ-6, REQ-7,
UC-13	“Automatic Power Saving Mode” - If room is vacant “power save” mode is turned on	REQ-3, REQ-4, REQ-17, REQ-25
UC-14	“Automatic Comfort Mode” - If room is booked, “comfort” mode is turned on	REQ-41, REQ-17, REQ-3
UC-15	“Automatic Hallway Lights” - At night lights turn off and are motion sensed.	REQ-25, REQ-30, REQ-29

Housekeeping:

Identifier	Description	REQ-# Used
UC-16	“Housekeeping Request” Allows customers to send housekeeping requests for when they are out of the room.	REQ-11
UC-17	“View services” - Housekeepers view what rooms need service and are provided a pin for that room designated for a specific time slot.	REQ-22, REQ-37, REQ-21,

UC-18	“Clocking In/Out” -Allows employees to clock in and out of work to keep track of hours worked.	REQ-38,
UC-19	“Ordering Services” - Allows customers to send orders to the kitchen or maintenance.	REQ-10, REQ-2
UC-20	“Checking Channel Number” - Allows guests to see what channel number the news and other desired channel is on	REQ-9
UC-21	“Notify Guest Housekeeping is Complete” - Allows the guests to be notified when their room is clean and the housekeeping has left.	REQ-14, REQ-15
UC-22	“Manager Views Number of Employees on Duty” Allows the manager to see the workers on duty and their schedules.	REQ-43
UC-23	“View the Services Menu” - Allows a guest to view the available menu of services that the hotel has to offer.	REQ-9, REQ-10
UC-24	“Service Status Update” - The employee notifies guests about the status of their requests.	REQ-40. REQ-21, REQ-37
UC-25	“Maids view housekeeping request” - Allows maids to view housekeeping requests.	REQ-13
UC-26	“Maids update system” - The maids can input if they cleaned a room and when they cleaned a high traffic area.	REQ-14
UC-27	“Room Change” - Manager can switch the room of a guest.	REQ-20
UC-28	“View Schedule” - Managers can manipulate schedules of workers.	REQ-44

3.3.2 Use Case Diagram

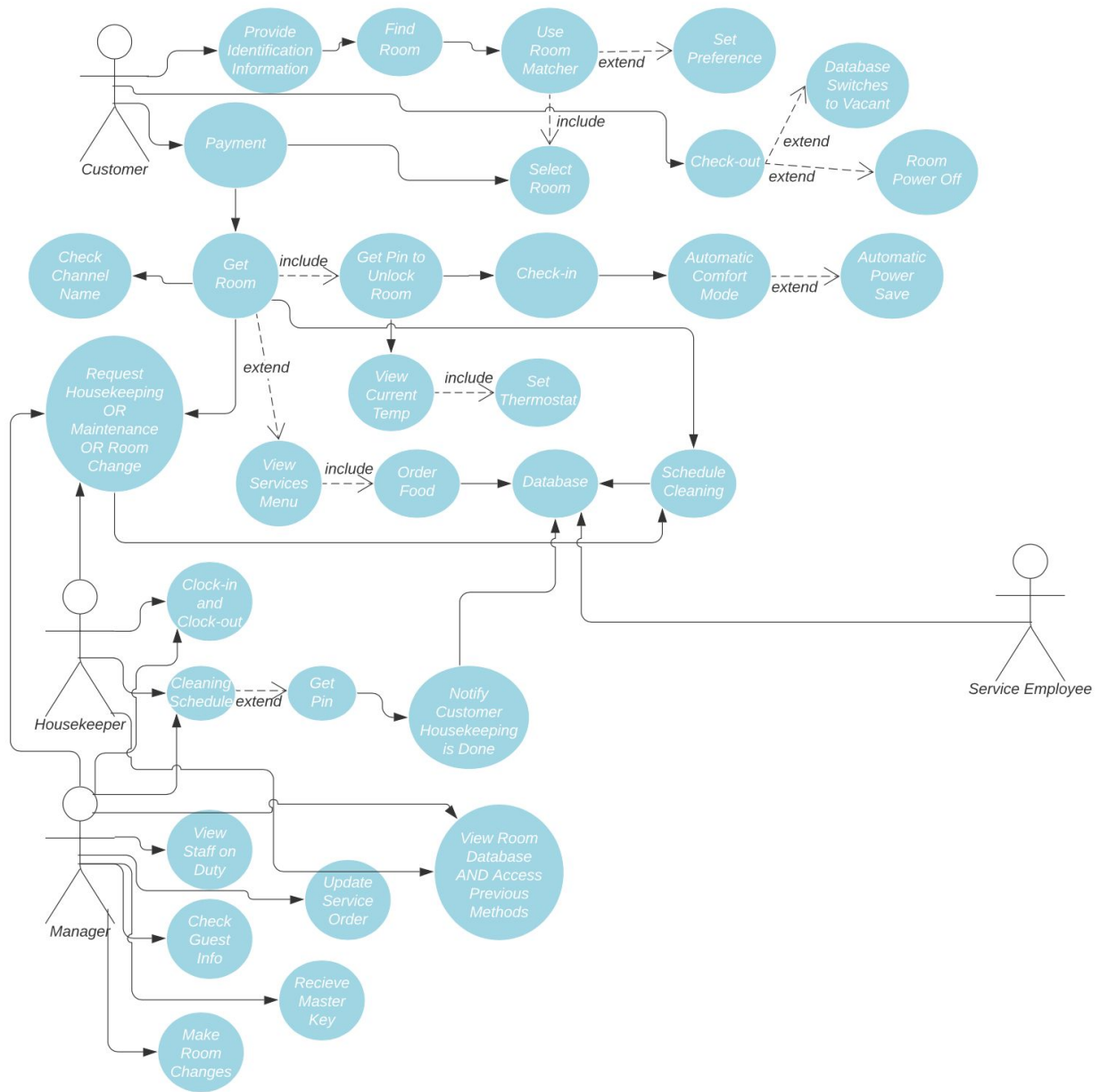
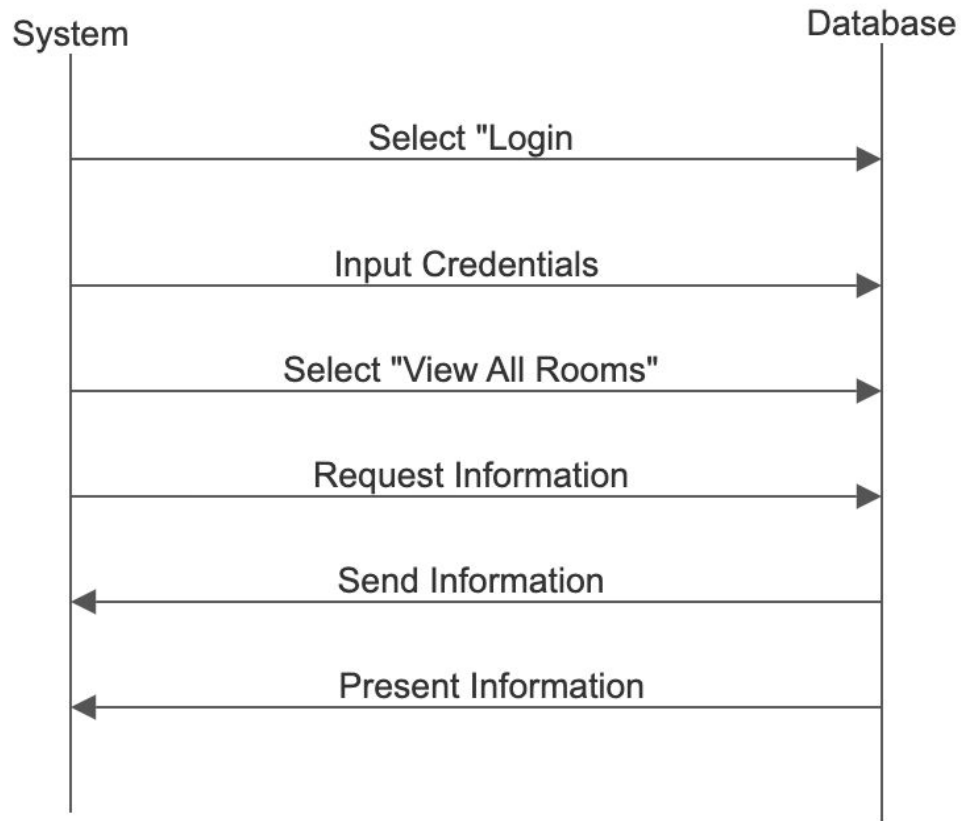


Figure 2: Use Case Diagram

3.3.3 Traceability Matrix

REQ	PW	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
REQ-0	5								X	X	X																			
REQ-1	3								X		X																			
REQ-2	2			X																X										
REQ-3	2	X							X					X	X															
REQ-4	4													X																
REQ-5	1											X																		
REQ-6	5												X																	
REQ-7	3											X	X																	
REQ-8	5											X																		
REQ-9	2																			X				X						
REQ-10	2			X																X				X						
REQ-11	5																X													

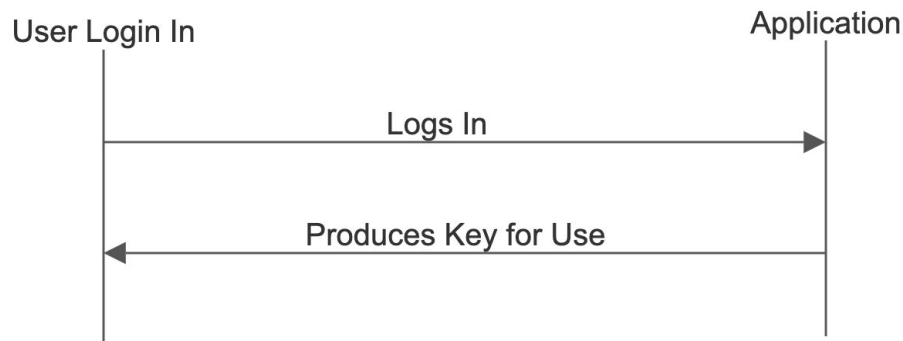
3. ← The application presents the customer all of the available rooms.
4. → The customer selects a room to book.
5. → The customer inputs the dates of booking.
6. ← The selected room is assigned to the customer for the selected booking period.



System Sequence Diagram for UC-1

UC-10: Generate Key
Related Requirements: REQ - 0, REQ-#9
Initiating Actors: Guest, Manager, Workers
Actor Goal: To login and receive a alphanumeric pin(key) for use
Participating Actors: Application
PreCondition: Login and receive confirmation of hotel stay or work to be done

PostCondition: Be provided a pin Pin stops working at 11 AM day of checkout
Minimum Guarantee: The code is received by the client
Success Guarantee: The code is received by the client, and is emailed to user
Flow Of Events for Success <ol style="list-style-type: none"> →The user books a room through matching system, and logs in to the system ←A 4 digit alphanumeric key is generated →The customer inputs drivers license ←The key is emailed to the guest



System Sequence Diagram for UC-10

UC-25: Maids View Housekeeping Request
Related Requirements: REQ-12, REQ-13, REQ-15
Initiating Actors: Housekeeper/Custodian
Actor Goal: The goal of the customer is to request housekeeping to their room at the Cloud Surf Inn.
Participating Actors: Database
PreCondition: Customer must have made a housekeeping request.
PostCondition: Housekeepers will know the time when they must clean the customer's room.
Minimum Guarantee: Housekeeper/Custodian will accept a cleaning request and it will be added to their schedule if possible. They will be able to view scheduled times of cleaning requests (even if not so elegantly). They will be able to indicate when their task has been completed.

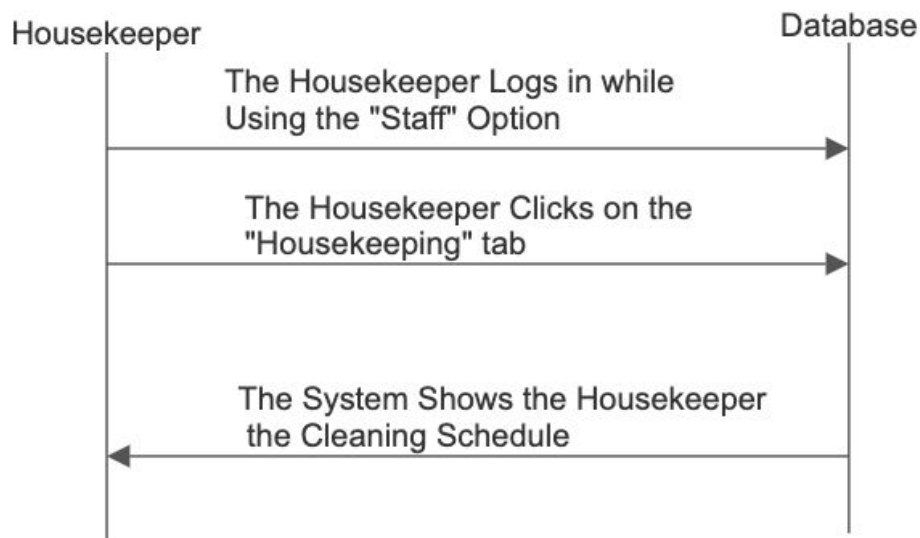
Success Guarantee: Housekeeper/Custodian will accept cleaning requests and view them in a calendar format. They will be able to adjust their schedules, indicate when their task has been completed, and indicate if additional time is needed.

Flow Of Events for Success:

1. → The housekeeper/custodian logs in while using the “Staff” option.
2. → The housekeeper/custodian clicks the “Housekeeping” tab.
3. ←The system shows the housekeeper(s) the rooms that must be cleaned along with the times associated with them.

Alternate Flow of Events:

1. → The customer sets up an account or logs in.
2. → The customer selects the “Room Service” tab.
3. → The customer submits a “Special Request” specifically asking for housekeeping or a service only a custodian could accomplish.
4. ←The system updates the service staff’s interface with the guest’s “Special Request”.



System Sequence Diagram for UC-25

UC-13: Automatic Power Saving Mode

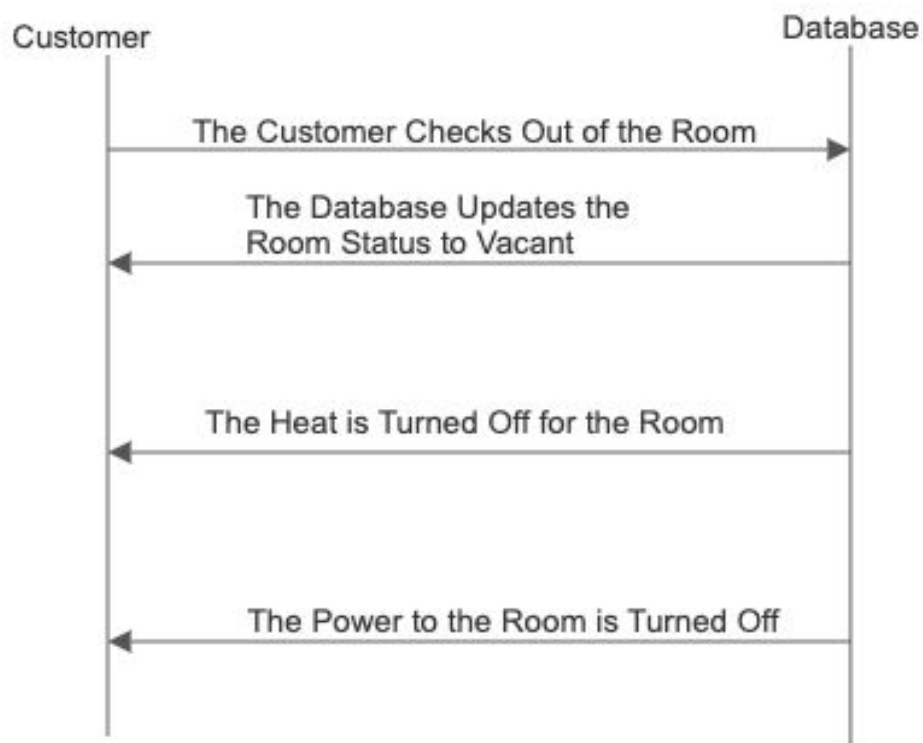
Related Requirements: REQ-3, REQ-4, REQ-6

Initiating Actors: Temperature and Power Saving System

Actor Goal: The goal is to have the Temperature and Power Saving System turn off power and heat to a vacant room.

Participating Actors: Database

PreCondition: Customer has logged into system
PostCondition: Room is in power-saving mode
Minimum Guarantee: The heat to the room is shut off
Success Guarantee: The heat and power to the room are shut off and the system recognizes when a guest checks in and turns on comfort mode.
Flow Of Events for Success: <ol style="list-style-type: none"> → The customer checks out of room ←The database updates the room status to vacant ← The system turns on power-saving mode for the room ← The heat is turned off for the room ←The power to the room is turned off
Alternative Flow Of Events: <ol style="list-style-type: none"> → The customer checks out of room → The manager changes the room status to vacant ← The system turns on power-saving mode for the room ← The heat is turned off for the room ←The power to the room is turned off



System Sequence Diagram for UC-13

4.1 Preliminary Design

Home Page



This is the first page that is presented to the user. There is a logo of our program in the top left corner of the screen and “Cloud Surf Inn” located to the adjacent right of it . Just under the name are tabs used for navigation of the application. All of these elements remain there while navigating the other pages. Additionally, on the left side of the home page is an explanation of the project. There are also pictures of what the hotel could possibly look like if the project would be implemented into an actual design.

Login Page

Home | **Log In** | Book a Room | Room Control | Housekeeping | TV | Room Service

Type of User for Log In

OR

Log In

Username:

Password:

Create an Account


Username:

Password:

Verify Password:

This is the login page where all personnel will either be logging in or creating their accounts. To get to this page the user must click the “LogIn” tab near the top of the page. Everyone must log in to access the other features of the website. Creating accounts through this page can only be done for customers or guests. To create a staff account you must go through the code. To actually log in the user must click one of the three buttons under “Type of User for LogIn” then input the correct information under username and password to log in. Once the user has filled out the correct boxes they must either click the “Log In” or “Create Account” button to continue.

Book a Room Page



Cloud Surf Inn

[Home](#) | [Log In](#) | **[Book a Room](#)** | [Room Control](#) | [Housekeeping](#) | [TV](#) | [Room Service](#)

How many occupants will be staying in your room?

Bidet Included?

☐

Check Box for YES

Leave empty for NO

Kitchen Included?

☒☐


Jacuzzi Included?

☐

More than 1 bathroom?

This is the Book a Room page where customers and guests are able to book a room to stay at. To get to this page the user must click the “Book a Room” page near the top of the screen. Displayed is one text box for telling the application how many occupants will be in the room, and all other boxes are for radio style buttons for preferences included in rooms. After they have filled out everything they would like in the room, they must click the “Book Room” button at the very bottom of the page. They will then be matched to a room.

Room Control Page



Cloud Surf Inn

[Home](#) | [Log In](#) | [Book a Room](#) | **[Room Control](#)** | [Housekeeping](#) | [TV](#) | [Room Service](#)


Check In/Out

Check In

Check Out


Current Temperature: 69°F
Desired Temperature: °F

Update



This is the Room Control page and users will be able to check in and out, view the temperature in the room, and control what the temperature in the room is set to. To get to this page the user must click the “Room Control” tab near the top of the screen. To check in or out all the customers must do it, be logged in and click the button which pertains to the action they would like to accomplish. The current temperature is displayed above a textbox where the user can enter their desired temperature. Once they have entered the desired temperature into the textbox, they click the “Update” button to update their preferences.

Customer Housekeeping Page



Cloud Surf Inn

Home | **Log In** | Book a Room | Room Control | **Housekeeping** | TV | Room Service

Day	Hour	Submit
Monday	6 am	
Tuesday	7 am	
Wednesday	8 am	
Thursday	9 am	
Friday	10 am	
Saturday	11 am	
Sunday	12 pm	

This is the Customer Housekeeper page where customers can select and time and day they would like their room cleaned. To get to this page you must be a logged in customer who is staying at a room, and click the “Housekeeping” tab. There will be two combo boxes on this page, one for the day of the week and one for the specific hour you would like housekeeping to come and clean the room. After a day and time have been selected, the customer must click the “Submit” button to have their request fulfilled.

TV Page



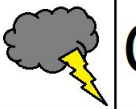
Cloud Surf Inn

Home	Log In	Book a Room	Room Control	Housekeeping	TV	Room Service
------	--------	-------------	--------------	--------------	-----------	--------------

Channel	Name
1	PBS
2	CBS
3	Nickelodeon
4	Disney Channel
5	ESPN
6	NBC
7	TBS
8	ABC
9	TNT
10	ESPN 2

This is the TV Page where customers can see a guide that shows available channels. To access this page any user can click on the “TV” tab located near the top of the screen. This page functions as a simple text box that shows the channel numbers and which channel names match those numbers.

Room Service Page



Cloud Surf Inn

Home	Log In	Book a Room	Room Control	Housekeeping	TV	Room Service
------	--------	-------------	--------------	--------------	----	---------------------

Qty	Item
<input type="checkbox"/>	Towel
<input type="checkbox"/>	Pillow
<input type="checkbox"/>	Blanket

Page 1 of 2

Food	
<input type="checkbox"/>	Pancakes
<input type="checkbox"/>	Burger and Fries
<input type="checkbox"/>	Pizza
<input type="checkbox"/>	Steak
<input type="checkbox"/>	Cookie

Page 1 of 1

Special Requests:

Submit

This is the Room Service page where customers can order things to their room. To get to this page the customer must have an account, be logged in, and currently be residing in a room within the hotel, then click the “Room Service” tab near the top of the screen. On this screen

there are a bunch of editable text boxes that require an integer quantity greater than 0 to be registered as an order. All items that can be ordered cannot be displayed at the same time, so there is a page button at the bottom of the boxes to see more items. There is also a special editable text box to the right for special requests that are not included in the boxes to the left. Once the customer has entered everything they would like to order they must click the “Submit” button at the bottom of the page to send the request to the Service Employees.

Payment Page



Cloud Surf Inn

[Home](#) | [Log In](#) | [Book a Room](#) | [Room Control](#) | [Housekeeping](#) | [TV](#) | [Room Service](#) | **[Payment](#)**

Enter payment information to start your tab

Name on card:

Card number:

Expiration date:

CVV:

Driver's License Number:

This is the payment page where customers must enter their information to be able to buy things while staying at the Cloud Surf Inn. To get to this page the customer needs to log in, then the payment tab will appear and they must go to it before buying anything during their stay. The page includes a description of what must be written and a bunch of editable boxes. Once all the information is entered in the user must click the “Submit” button to have their information processed.

Staff Page



Cloud Surf Inn

Home	Log In	Book a Room	Room Control	Housekeeping	TV	Room Service	Payment	Staff
------	--------	-------------	--------------	--------------	----	--------------	---------	--------------

Clock In/Out

Input Service Status:

This is the staff page where the service employees will go whenever they need to access their special permissions. To get to this page a staff member must first log in which will trigger the “Staff” tab near the top to become available. On this page, the staff member may clock in or out using the specified buttons and update customers on their current orders.

Manager Page



Cloud Surf Inn

Home	Log In	Book a Room	Room Control	Housekeeping	TV	Room Service	Payment	Manager
------	--------	-------------	--------------	--------------	----	--------------	---------	----------------

Clock In/Out

Input Service Status:

This is the manager page where the managers will go whenever they need to access their special permissions. To get to this page a manager must first log in which will trigger the

“Manager” tab near the top to become available. On this page, the manager may clock in or out using the specified buttons and update customers on their current orders. The managers may also view the room database and change guest’s room assignments by pressing the buttons in the upper right.

4.2 User Effort Estimation

Creating Account: Keystrokes N/A, 2 clicks

Starting at Homepage

- a. Click "Log In" tab
 - b.1 For customers with an existing login type in username
 - b.2 type in password
 - d. select login button to login
- c. For new customers type in username
 - c.1 type in password
 - c.2 type in password for password verification
 - e. select create an account to login and create an account

Book a Room: Keystrokes N/A, at most 6 clicks at least 2 clicks

Starting at Homepage

- a. Click "Book a Room" tab
- b. Type in the textbox how many occupants will be staying in the room.
- c. To customize room
 - 1. Select box for bidet
 - 2. Select box for kitchen
 - 3. Select box for Jacuzzi
 - 4. Select box for more than 1 bathroom.
- d. Select "Book Room" to officially book room.

Room Service: Keystrokes N/A, at most 9 clicks at least 2 clicks

Starting at Homepage

- a. Click on Room Service tab
- b. To request an item
 - 1. To request a towel click towel box
 - 2. To request a pillow click pillow box

3. To request a blanket click blanket box
- c. To request a food
 1. To request Pancakes click Pancakes box
 2. To request Burger and Fries click Burger and Fries box
 3. To request Pizza click Pizza box
 4. To request Steak click Steak box
 5. To request Cookie clicker Cookie box
- d. To request a Special Request:
 1. Type in text box for any additional requests
- e. Select submit to submit requests

Room Control Page: Keystrokes at most 3, 2 mouse clicks

Starting at Homepage

- a. Select Room Control Tab
- b. Type in desired temperature in textbox
- c. Select update to submit

TV Page: 0 keystrokes, 1 mouse click

Starting at Homepage

- a. select TV tab to view a reference page for TV channels

Housekeeping Page: 4 mouse clicks

Starting at Homepage

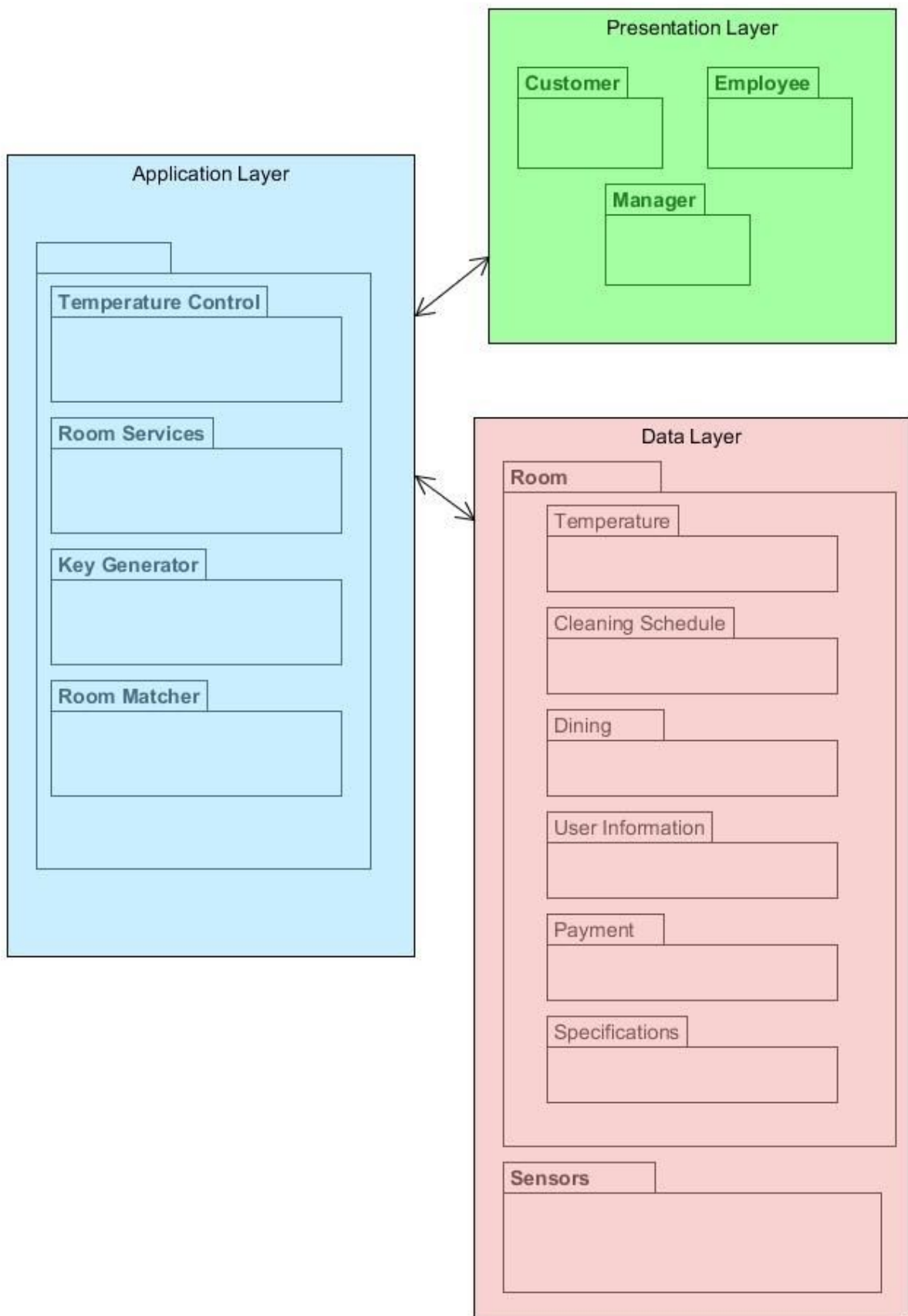
- a. Select Housekeeping tab
- b. Click on day you want housekeeping
- c. Click on hour you want housekeeping
- d. Click on submit to submit

5.1 Identifying Subsystems

The subsystem package diagram depicts the three-tier architecture decided upon for the system. Starting with the presentation layer, different user interfaces are tailored to individual user's needs depending on if they are customers, employees, or managers. Following the presentation layer comes the application layer, which holds the business logic for fulfilling various functions the user might require such as matching to a room and especially for the

automatic power-saving mode. The application layer handles most of the interaction between the presentation layer and the data layer and manages the overall system. The data layer interacts with the application layer to provide the large amounts of data stored about the hotel, it includes things such as individual room specifications, i.e., number of beds, amenities provided, as well as information about the sensors needed to control the temperature and lighting. The data layer contains a room package with other separate packages because of the large amounts of information that is associated with specific rooms and the users that interact with those rooms, and the need for the different aspects of the room package to be divided and conquered.

The separation into layers, as well as the distinct packages in those layers, allow separate teams in our group to tackle different parts of the system that are seemingly related. This maintains a degree of separation between layers and even packages so that a problem in one group does not negatively affect another.



5.2 Architecture Styles

The first main architecture style used is the Layered architecture, more specifically, the three-tier architecture. It encompasses a presentation layer, an application layer, and a data layer. This allows Cloud Surf Inn to have more resilience and adaptability since each tier can be modified and upgraded separately. It also allows for more security, the application layer and the data layer contain access to critical information regarding guests as well as various hotel controls which are separated by a boundary from the presentation layer. Additionally, it allows for greater stability; for example, a change in the presentation layer is much less likely to corrupt information from the data layer. The presentation layer has to do with the user interface that interacts with the customers and employees. The application layer is a back-end part of the system, which takes requests from the presentation layer and matches them with the information required from the data layer. It also has the responsibility of performing the automatic features of the system, such as the power-saving mode. The data layer stores information about each room and the hotel operations.

Cloud Surf Inn also utilizes the Client-server model. The clients consist of the customers who must access the temperature and thermostat server, and the database to reach information about rooms. The managers are also clients who access the power saving mode feature to enable the automatic power control system and can view room statuses and housekeeping schedules. The employees are another set of clients that access room information and housekeeping schedules as well. The different clients here also have access to different user interfaces depending on which features apply to them. The clients must interact with the server to receive temperature information, room information, to enable the power control system, to receive ordering information, room key information, and various other services. The client-server model allows Cloud Surf Inn to connect its many potential clients with the information or service needed from the database or application layer.

5.3 Mapping Subsystems to Hardware

In the Cloud Surf Inn, we are using a client-server model, we will need to have a client and a server, which will also hold the database, running on different computing devices. The client will run on mobile devices and will be the way the users, both customers, and managers,

interact with Cloud Surf Inn. The server itself will have the responsibility of managing the user's requests regarding temperature, interacting with the database to retrieve the relevant information. The manager will also need to enable the power saving mode feature, which will automate the information in the database to execute the power saving tasks.

5.4 Connectors and Network Protocols

The Cloud Surf Inn application itself will act as the client, and the network to exchange information with the database will be plain Java sockets. The user/faculty will use a GUI to interact with our application and their access keys that will be randomly generated from Java code. The client will have temperature control access via the GUI. Temperature data will be recorded with a Raspberry Pi. The Raspberry Pi will act as a client, and our hotel application will act as a server. The Raspberry Pi will encode the temperature data into XML. The XML data will then be transmitted from the client socket to the server socket using TCP. The XML data will then be added to the database. This will then be available to the user via the GUI. The database payment system and room matcher will all be interconnected via Java Application. Our database will be accessible to all subsystems and will be built using SQLite and will implement .db files for easy access and use.

5.5 Global Control Flow

Execution Orderliness - Overall, Cloud Surf Inn is an event-driven system because we have different systems that wait for a customer/user to utilize the system and the system has to then respond accordingly. Anyone using the system can generate the actions in a different order, and for certain features like housekeeping, the system will wait until an actor who can service the requests participates in the system and updates the request. However, there is some procedure-driven "linearity" in the execution flow as well. Every user, regardless of their relationship to the hotel, will be required to sign in and perform a predefined sequence of steps to interact with specific parts of the system. For example, whenever any customer wishes to book a room, they will input specific, required information (number of room occupants, amenities wanted) through the client, which will be sent to the controller upon submission. This controller performs the needed matching algorithm given data from both the client and the server

containing the database then marks that room is booked; this happens for every customer every time they wish to book a room. After signing in, the linearity of the system diverges because users with different roles will have various levels of access to the different facets of the system. For instance, a manager will have significantly more options and sub-systems to interact with than a custodian would. At this point, the system is waiting for certain events to occur before responding accordingly. Yet for things like scheduling housekeeping, the process itself is linear regardless of who is requesting it.

Time Dependency - Our system is event-response type with no true concern for time. The system only interacts with time for user convenience. Things like scheduled housekeeping requests will have a time associated with them, but the system does not time these requests and automatically handle their resolution. Continuing with the housekeeping example, a custodian will indicate that a request has been completed only when they have finished regardless if that was ahead or behind schedule; the system will not automatically notify the guest that their room has been cleaned at the time the cleaning was scheduled to end. Furthermore, for employees clocking-in and clocking-out, the system will not time them. Rather, it will simply keep track of when employees clock-in and when they clock-out and store them for later use.

5.6 Hardware Requirements

Our Cloud Surf Inn application will run on computer systems featuring either macOS or Microsoft Windows operating systems with versions supporting the Eclipse Integrated Programming Environment. For a computer to run Cloud Surf Inn, it must have Java version 1.4.0 or later (the latest version is always preferable). In regards to hardware, most modern desktop and laptop computers have more than enough power, storage, and memory to run Cloud Surf Inn and the database it relies on. Nonetheless, because of Cloud Surf Inn's development in Eclipse, a computer running the system will need a minimum of 512 MB of memory, 300 MB of storage/disk space, and a minimum processor clock speed of 800 MHz.

The temperature sensor components rely on a Raspberry Pi 3 Model B, which will need an 8 GB micro sd card, a micro USB power source, and a reliable internet connection. The sensors used will include 2pcs DHT22 Temperature Humidity Sensor.

5.7 Alternative Ideas

An alternative to using plain Java sockets for the network protocol in the system could have been using a plain C TCP socket for the Network Protocol. The majority of the programming for the Cloud Surf Inn application is programmed in Java, so for the sake of consistency and capitalizing on the proficiencies of the programmers, Java sockets were chosen as the better networking protocol. Additionally, Eclipse uses downloadable addons for making GUI applications. There are many different add-ons that could be used to make a GUI application. Our group chose to use Eclipse WindowMaker, but the others we could have used included Eclipse Juno and Eclipse Application Window. We chose Eclipse WindowMaker because it is the simplest tool for making a GUI application.

One alternative that our system could have used to incorporate a database is a scripting language. A scripting language such as HTML, JavaScript, or PHP could be used to pair a database to some type of user interface platform. We instead decided to directly implement our GUI within Java Eclipse. This would make it overall easier for our group to work on the project cooperatively. Another potential way to use our system would be through a typical website. Having our system be accessible through a website would allow our group to work together more easily. Our group believes that this alternative would work well if our group had prior knowledge of web development. Since we do not have the necessary experience, our group decided to not pursue the website alternative. Also, hosting a website could potentially be expensive considering the numerous costs associated with web development.

6. Project Size Estimation

To find our unadjusted use case weight, we split our use cases into simple, average, and complex use cases. We had 15 simple use cases (UC-2, UC-3, UC-4, UC-7, UC-8, UC-9, UC-10, UC-12, UC-13, UC-14, UC-17, UC-18, UC-20, UC-23, UC-24) and 11 average use cases (UC-5, UC-6, UC-11, UC-15, UC-16, UC-19, UC-21, UC-22, UC-25, UC-26, UC-1) for an unadjusted use case weight of 185.

To find our unadjusted actor weight, we had to split our five actors into average and complex. The thermostat and database are average actors - external systems requiring communication protocols to interact with our system. The managers, customers, and staff are all complex human actors. Our total unadjusted actor weight is 13.

We want a distributed system (2.0) with a quick response time (1.0) and end-user efficiency (1.0). It will need to do internal processing (1.0), and we wish for the code to be reusable (1.0), easy to install (0.5) and use (0.5), and to be available for system maintenance (1.0). Our total TF is 8, our total TCF is 0.68.

Our team has application experience with Java eclipse and SQL databases (0.5), stable requirements provided by the instructor of our class and our project goals (2.0), and motivation (1.0). We have part-time staff by a technicality - this is only one class of multiple in the semester (-1.0). Our EF is 2.5, and our ECF is 1.328.

The total use case points for this project are 178.80192.

7.1 Plan of Work

In the upcoming weeks, our group will meet weekly to give progress updates, discuss edge cases, and go over weekly assignments. Throughout the week the team will split into teams to work on sub-systems correlating to the functional features. The Gantt charts are based on functional features deemed most vital by team and the fully dressed use case that accompanies the feature.

Our Project Website: [Cloud Surf Inn](#)

Plan of Work:

Team Code	Use Case	Due Date
Team A	UC-25 UC-16	03/15
Team A	UC-26	03/21
Team A	UC-21	03/21
Team B	UC-10 UC-29	03/11
Team B	UC-6 UC-7	03/15
Team C	UC-13 UC-14	03/11
Team C	UC-11 UC-12	03/15

Team D	UC-1 UC-2	03/11
Team D	UC-5	03/15

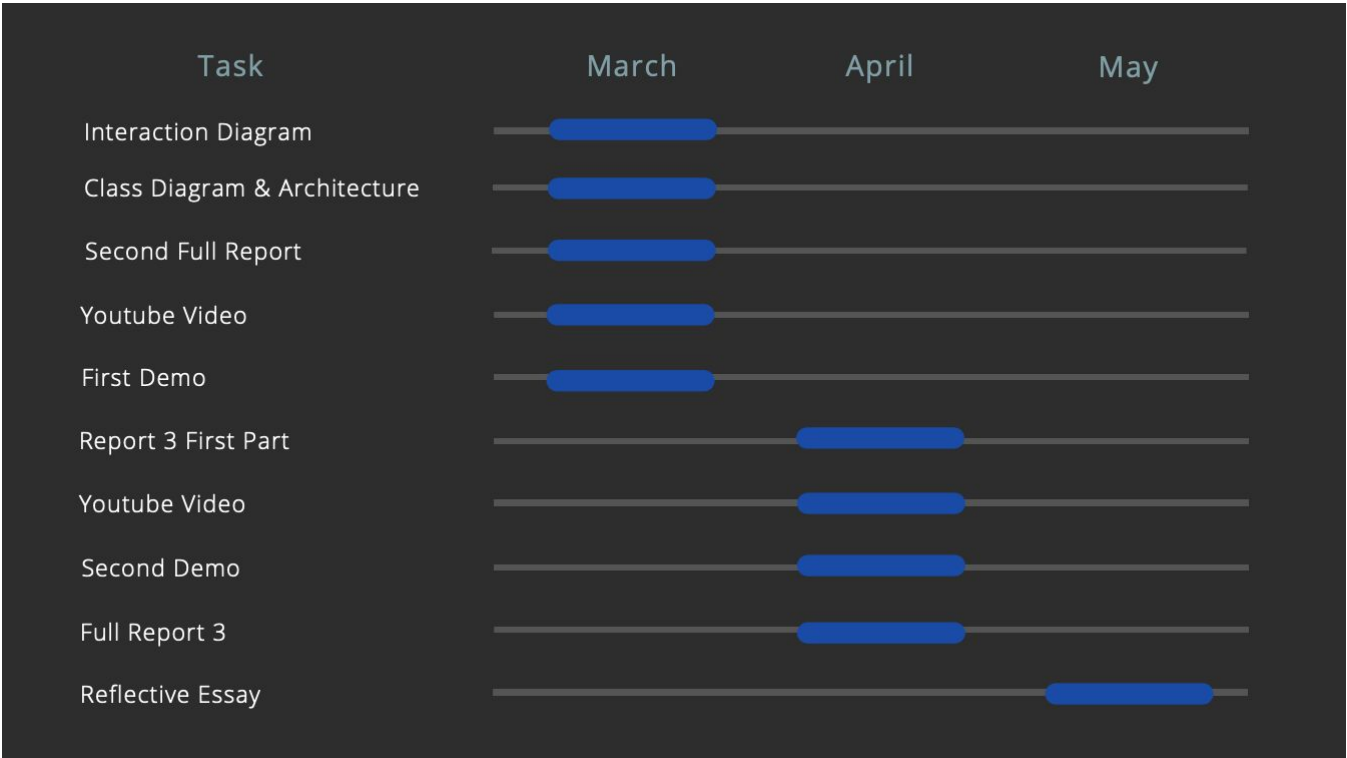


Figure 4: Project Roadmap

Gantt Charts:

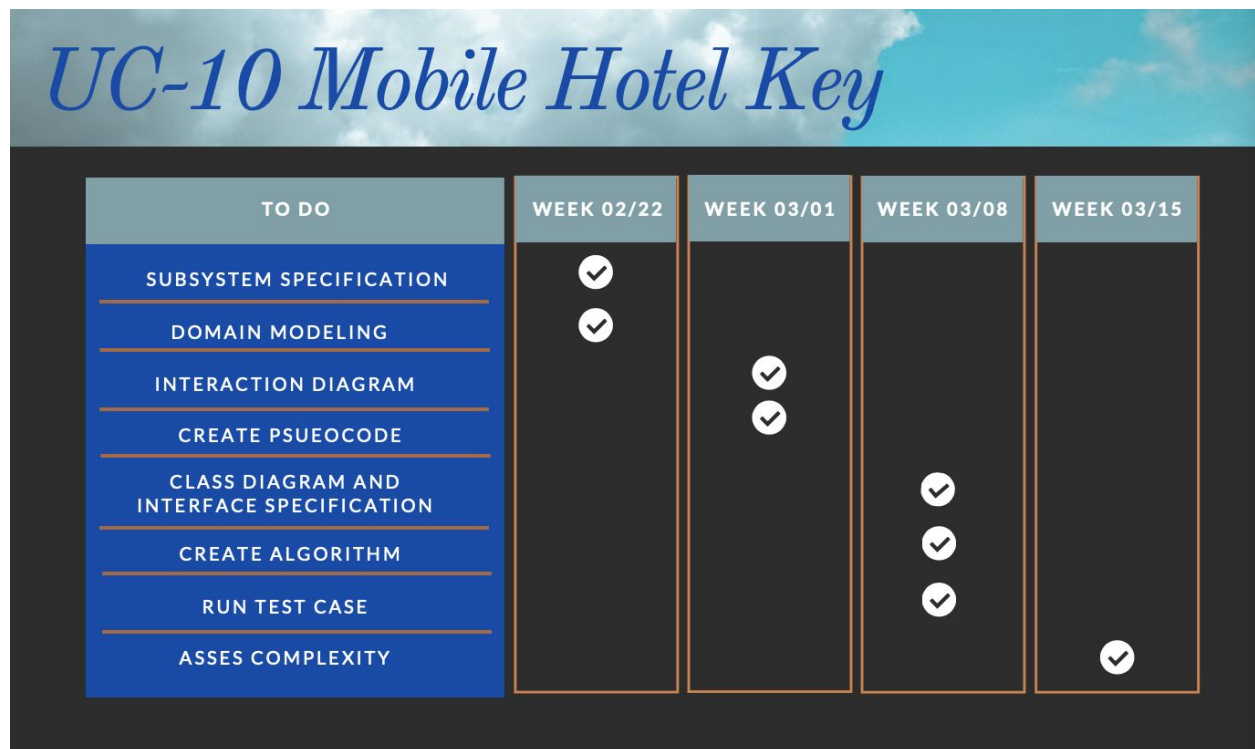


Figure 5: Gantt Chart of Mobile Hotel Key System

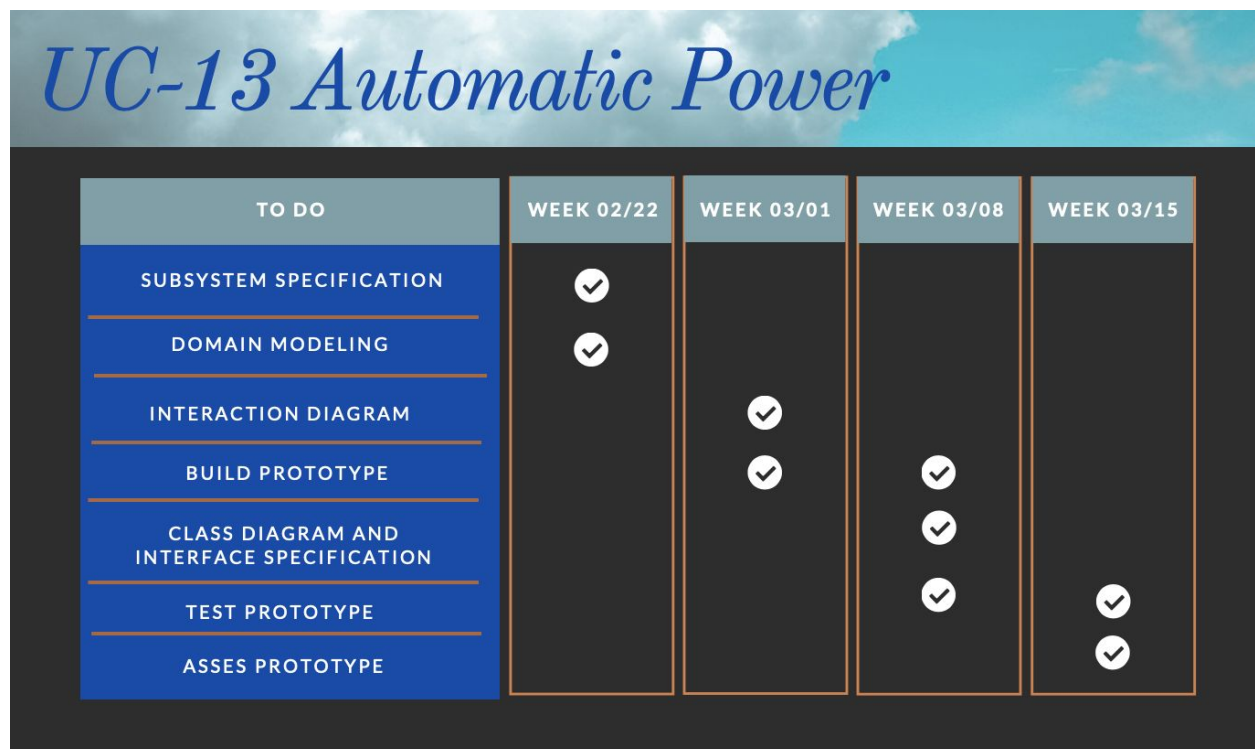


Figure 6: Gantt Chart of Automatic Power System



Figure 7: Gantt Chart of Hotel Matcher

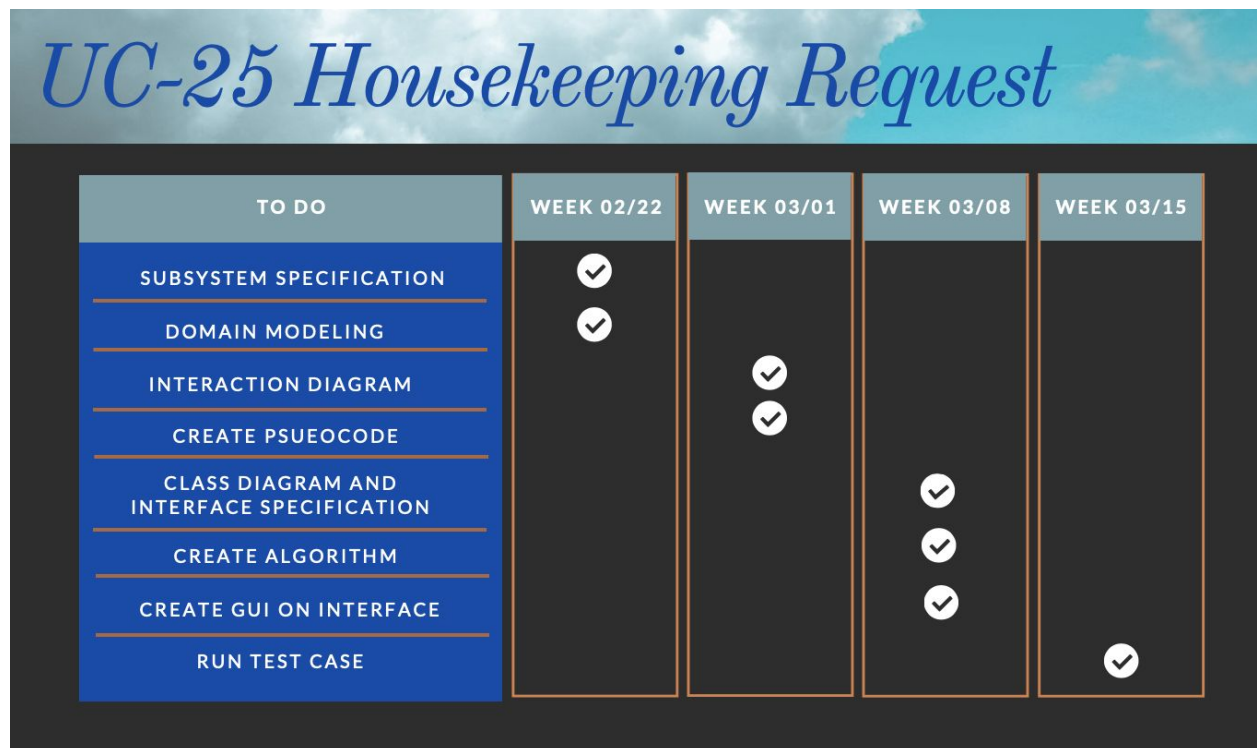


Figure 8: Gantt Chart of Housekeeping Request System

7.2 Product Ownership

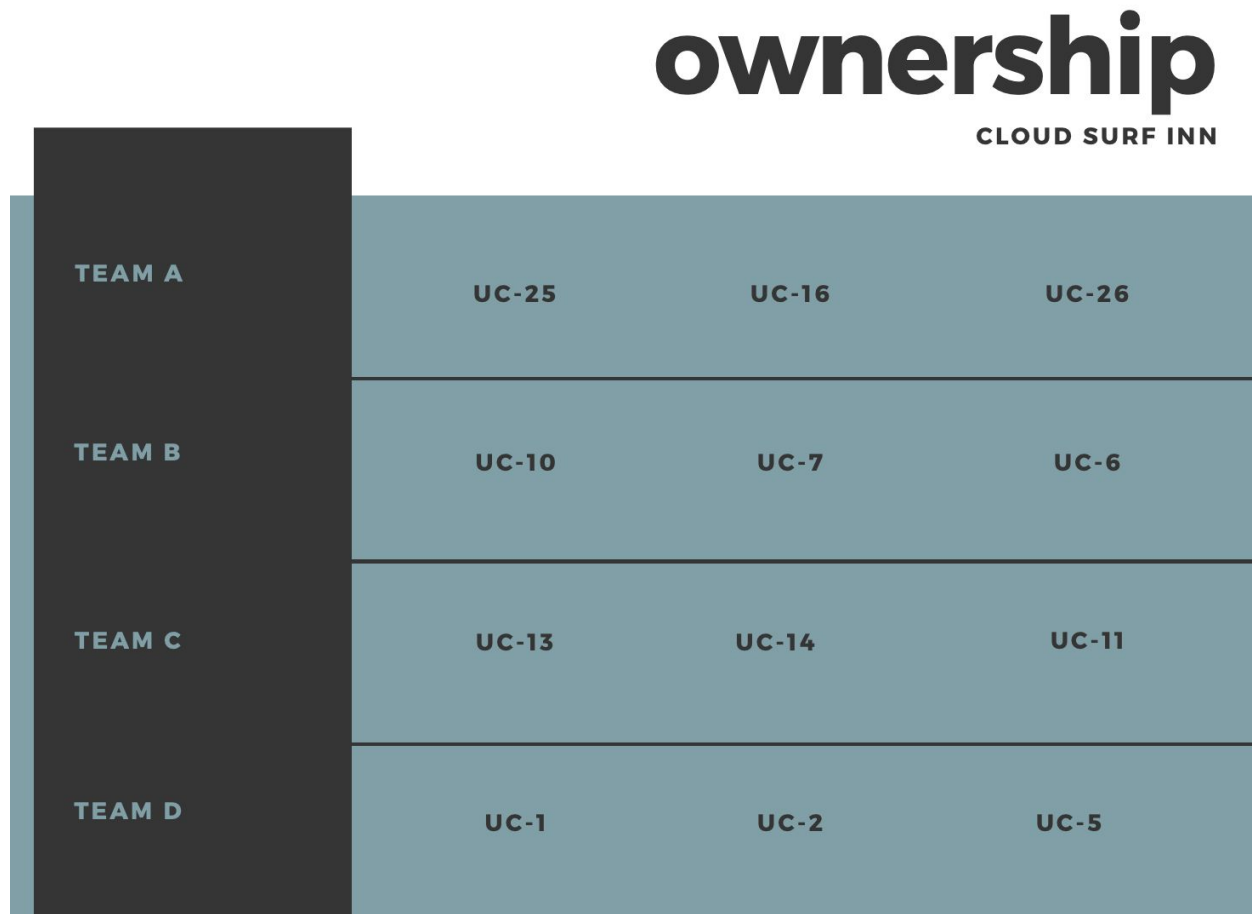


Figure 9: Project Ownership

Mobile Hotel Keys:

Sidonia Mohan will be creating the algorithm that sends the mobile key to the user's email while building the login userface. She will also be creating the GUI for check-in and check-out.

Bharath Selvaraj will be building the algorithm that constructs the mobile key while assisting with creating the login userface.

Hotel Room Matcher

Christian Kline will be using SQL to construct a database that updates with room information. He will also be responsible for the deliverable and assist with the coding of the room matcher.

JP Dangler has been instructed with creating the algorithm that will appropriately match new users to a room. He will design the interface that allows guests to choose their room through a list of preferences.

Housekeeping Requests:

Ryder Morello will be working on the user interface specifications and developing GUIs that allow for optimized access to all functional features.

Juan Escudero is going to be the main point of contact for the development of the housekeeping requests. He will design the algorithm and assist with developing the GUIs for the user interface.

Zach LeMunyon will assist with coding.

Power Controls:

Chynna Walsh is the team leader and main point of contact for the project. She will be aiding in developing the GUIs for the thermostat and helping create the prototype.

Sebastian Matiz will be developing the prototype for the thermostat and creating the algorithm to make the raspberry pi function successfully.

Jakub Vogel will be developing the algorithm and necessary data structures for the thermostat and create the GUIs for setting the temperature.

8. References

D-

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Url = https://www.youtube.com/watch?v=HQk7H_XBCRo&ab_channel=Ecobots

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Publisher = Circuit Basics

Author = Scott Campbell

Url = <https://www.eclipse.org/articles/article.php?file=Article-EclipseDbWebapps/index.html>