Software Requirements Specification

Kyrah Felder - CPSC 4805 - 1/18/2020

Title

XULA Laundry

Abstract

A rise in the interest and use of smart machines has increased over the past years. Everyday home devices have been turned into “smart” machines with the use of the internet and capabilities to interact with personal smart devices and tablets. While smart machines such as smart washers and dryers have increased over the recent years, the laundry rooms of Xavier University of Louisiana’s dorms remains outdated. Community dorms that share laundry rooms with many residents often provides a stressful and tiring experience. The goal of the article is to discuss the actions taken to decrease the stress from the experience of Xavier University’s laundry rooms.

As of now, the dorms only provide washing machines that are not smart and have basic functions. With the help of QR codes, the internet, and smart outlets, normal washing and drying machines can be turned into smart devices that will make the experience less stressful. Smart devices are connected to the internet and with it can provide different services to its user such as notifications based on certain activities. Using this logic, notifications can be used to both book and block a laundry room unit and to remind a person to take out their laundry when finished. The internet can also be used to service the user by informing them of which washers and dryers are available in each room. All of this to make the experience more beneficial and easier for everyone.

Problem Statement

Students who live on campus at Xavier University of Louisiana have needs such as studying and washing laundry. These are needs which cannot be escaped and should be a stress free process as much as possible. Currently this is not the case as finding an open washer or study room can be a hassle. For those students who live far from a laundry room or study room, they have to lug all of their belongings to that specific room and hope that there is free space. My research will explore ways to alleviate such struggles by providing on campus students a way to be informed about the status of which laundry rooms and study rooms are open inside the dorms. This will ideally be through an application which will show which rooms/machines are open and provide a way to alert the student when their clothes are finished for the laundry rooms.

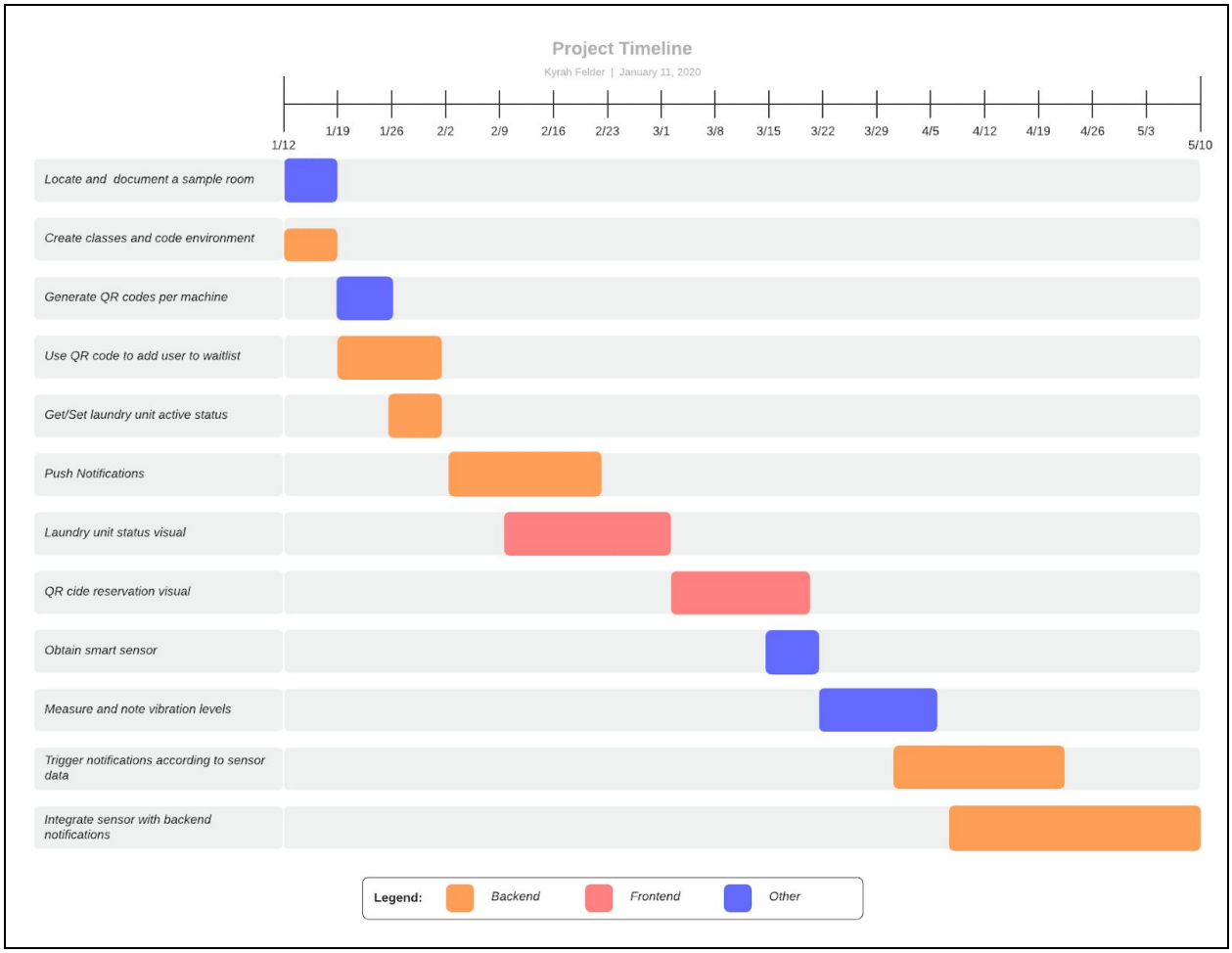
Hypothesis

Why are on campus students unhappy with the dorm amenities? Because there is not a way to know which washers and lounge areas are available inside the dorms.

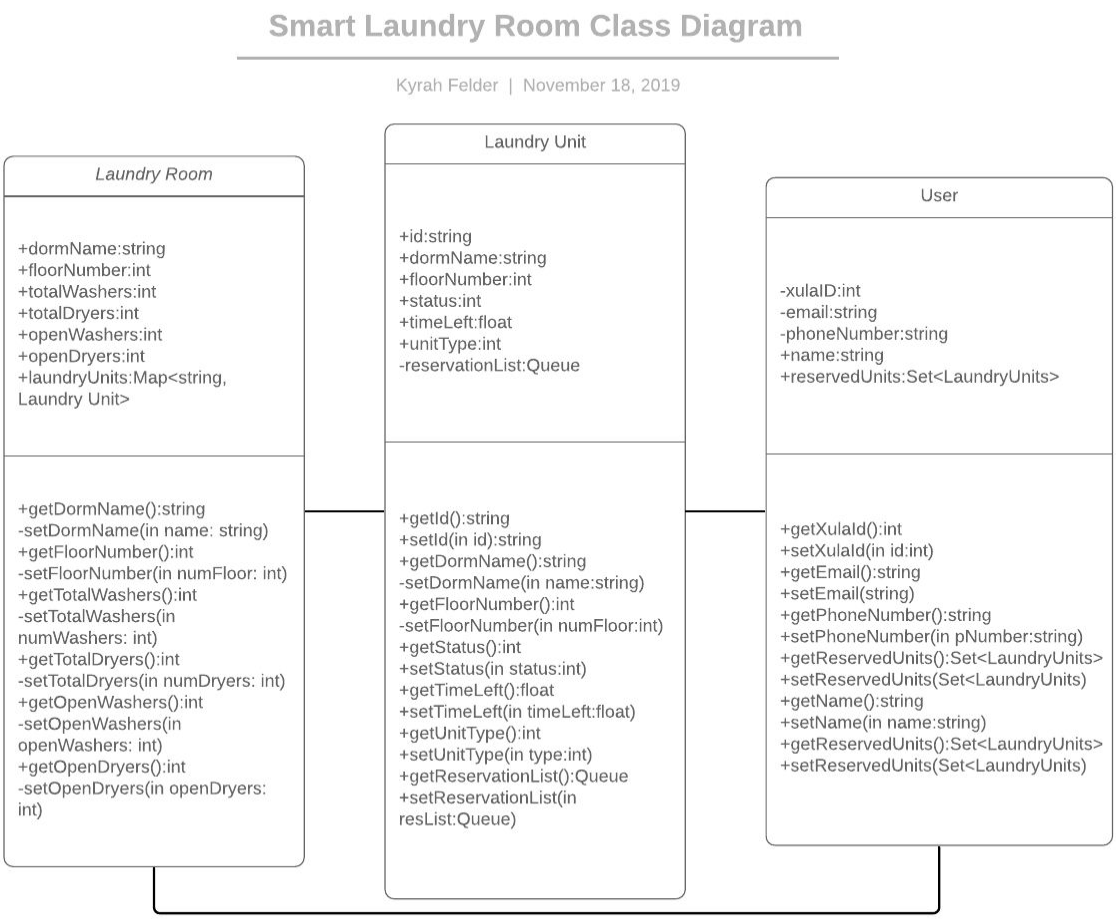
Objectives

- Locate and document structure and layout of a sample laundry room in the dorm
- Create classes to replicate laundry rooms and convert layout of sample room to this
- Generate machine specific QR codes/numbers
- Build backend that takes the QR code and adds the user to the waiting queue for that machine
- Build backend ability to get and set active status of a laundry machine
- Integrate phone/email notifications for unit updates (ex: when one is finished)
- Design frontend for laundry room status
- Design frontend for QR/machine code reservation and notifications
- Build backend to check the number of people in a lounge area and the ability to add yourself to the list
- Design frontend to see status of lounge areas
- Obtain/buy smart sensor device that can detect vibration levels of a laundry unit
- Measure the vibration states/levels of laundry units. Note and define these measurements
- Trigger notification/time prediction based on the unit's state and the time that it has been active
- Build backend to alert the user based on their reserved unit's status

Timeline


Project Timeline
Kyrah Felder | January 11, 2020
1/12
1/19
1/26
2/2
2/9
2/16
2/23
3/1
3/8
3/15
3/22
3/29
4/5
4/12
4/19
4/26
5/3
5/10
Locate and document a sample room
Create classes and code environment
Generate QR codes per machine
Use QR code to add user to waitlist
Get/Set laundry unit active status
Push Notifications
Laundry unit status visual
QR cide reservation visual
Obtain smart sensor
Measure and note vibration levels
Trigger notifications according to sensor data
Integrate sensor with backend notifications
Legend:
Backend
Frontend
Other

Design


Smart Laundry Room Class Diagram
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Laundry Room
+dormName:string
+floorNumber:int
+totalWashers:int
+totalDryers:int
+openWashers:int
+openDryers:int
+laundryUnits:Map<string, Laundry Unit>
+getDormName():string
-setDormName(in name: string)
+getFloorNumber():int
-setFloorNumber(in numFloor: int)
+getTotalWashers():int
-setTotalWashers(in numWashers: int)
+getTotalDryers():int
-setTotalDryers(in numDryers: int)
+getOpenWashers():int
-setOpenWashers(in openWashers: int)
+getOpenDryers():int
-setOpenDryers(in openDryers: int)
Laundry Unit
+id:string
+dormName:string
+floorNumber:int
+status:int
+timeLeft:float
+unitType:int
-reservationList:Queue
+getId():string
+setId(in id):string
+getDormName():string
-setDormName(in name:string)
+getFloorNumber():int
-setFloorNumber(in numFloor:int)
+getStatus():int
+setStatus(in status:int)
+getTimeLeft():float
+setTimeLeft(in timeLeft:float)
+getUnitType():int
+setUnitType(in type:int)
+getReservationList():Queue
+setReservationList(in resList:Queue)
User
-xulaID:int
-email:string
-phoneNumber:string
+name:string
+reservedUnits:Set<LaundryUnits>
+getXulaId():int
+setXulaId(in id:int)
+getEmail():string
+setEmail(string)
+getPhoneNumber():string
+setPhoneNumber(in pNumber:string)
+getReservedUnits():Set<LaundryUnits>
+setReservedUnits(Set<LaundryUnits)
+getName():string
+setName(in name:string)
+getReservedUnits():Set<LaundryUnits>
+setReservedUnits(Set<LaundryUnits)

Basic Use Case Diagram

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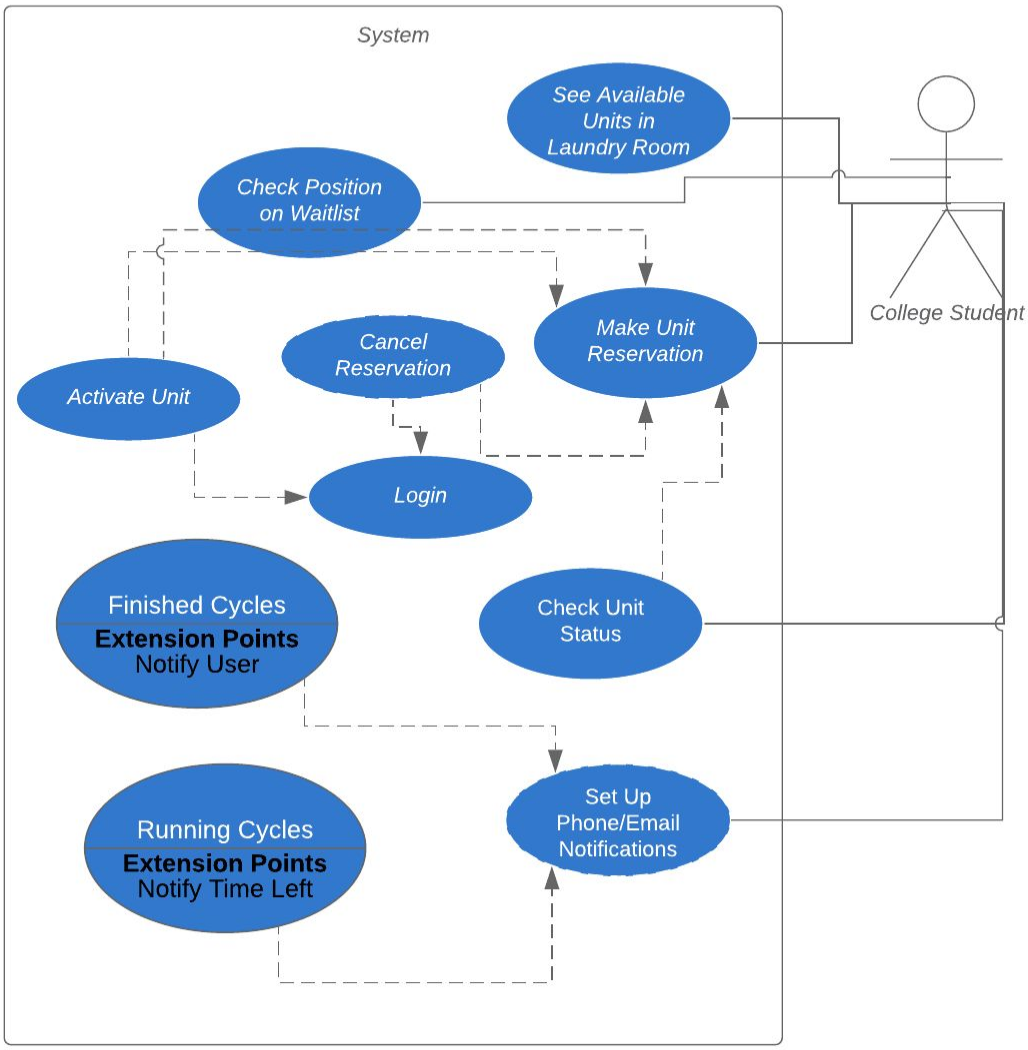

Literature Review

The purpose of this paper is to outline the primary and secondary sources related to my research which is to provide a way for students to see the status of, book, and receive

notifications for certain amenities on campus (wash rooms and lounge areas). This will provide a clearer view of my goals and how to approach them. It will also make me aware of the work already done in the same field. This can help guide me as I brainstorm how to complete this research by seeing things that have worked in the past and the things that did not work.

The first source is a primary source that talks about QR codes and the technology behind them. As defined from the article, a QR (or Quick Response) code is: “a 2D matrix code that is designed by keeping two points under consideration, i.e. it must store large amount of data as compared to 1D barcodes and it must be decoded at high speed using any handheld device like phones.” Some of the most popular uses for QR codes today include: providing a fast way to befriend a person on social media and obtaining fast access to a linked website. QR codes relate to my research because I plan to put them on the washing/drying machines and doors of the lounge areas inside of the dorms. Doing this will ideally allow the user to confirm their use of that particular washing machine or lounge area. This data is necessary to update the online database with the status of occupancy for both of these amenities. It will also provide the user with the ability to receive phone notifications regarding the status of whether or not their washer/dryer is finished.

The second source is another primary source called LibCal. LibCal is an online service that provides a way to book things such as rooms online. LibCal is the system that the Xavier University library currently uses for its personal room booking. In order to use the study rooms inside of the library, students must go online to the library website and select the room they wish to use and at which time. LibCal provides information such as room availability, times available, email notifications, and booking restrictions.

This relates to my research because I plan to provide a way to book a washing machine and possibly to also book the lounge areas inside of the student dormitories. In order to do this I will need a way to know at what times are which units available and for how long a student is planning to use a particular amenity. LibCal seems like a great source to learn from and to look more into in order to find direction of where to go with my research.

The third source is a primary source about an experiment someone did to make their washing machine smarter. In this article, the author, Phil Hawthorne, first talks about his motivation for his experiment and then the equipment purchased in order to execute it. He then broke down all of the steps he took in order to execute the experiment such as deciding how he would measure the different states of the machines. Using the smart switch, he decided to measure the states of his machines by how much power it was drawing. This way he could know when a washer or dishwasher was done with a cycle and thus set a notification to go off on his phone. He then provided his method and the code that he wrote in order to execute this idea so that others may also set up themselves inside their own homes.

This source relates to my research because I will essentially be doing the same thing. I will have to turn the older washing machines that currently inhabit the dorms and make them “smart washers”. To do this I will also need to research a way to monitor the several cycles and states of the machines. If funds were not an issue, it would seem that this smart device idea would be worth looking into. By simply plugging the washing machine into this new port I could monitor and control the washers (to an extent) from online.This would make it easier to notify a device if their clothes are finished inside of a washer or dryer. I am not sure yet how this could

be useful to monitor how many people are inside of a lounge area. It is possible that a different smart home device could help solve that problem.

The fourth source is a secondary source about SmartThings. This source is a blogpost about how a user utilized a SmartThings product in order to notify her and her husband about when the dryer was finished. Instead of using a smart outlet like the previous source, this user attached a SmartThings Multi Sensor onto the laundry machine and paired it to the SmartThings "Laundry Monitor" application. This application monitors when the laundry machine stops vibrating and then sends the user a notification. Because these machines stop more than once before being finished with the cycle, the application adds the ability to customize certain time thresholds (such as the time taken for water to fill the tub and the minimum cycle time) so that the notification does not get falsely triggered. This provides a cheaper alternative than buying a smart washer itself.

This article once again relates to my research because it essentially turns an older washing machine into a smart one. Not only that, but the method used is different from the previous one. Instead of monitoring power drainage, it monitors the vibration levels of the machine. While this can be complicated, the application provides a workaround for the possibility of false notifications. Since this is a problem I may eventually have to tackle, it is good to be able to see how another person approached this issue. It will be useful as I plan my approach to turning older washing machines into smart ones.

The fifth source is a secondary source about WashLava. The article describes the same problem that I am trying to tackle, the washing process on campus is very outdated and needs to be improved. It then talks about WashLava, a service currently only being tested on select college campuses at the moment. According to the article, with Washlava app students can: reserve machines, lock them, pay for loads, and even learn how to do laundry on [their] newly-installed machines."

It seems as though that WashLava directly tackles most of the main points that I am trying to solve which is why it is so relevant to my research. They approached the problem in a very modern way that seems to provide a lot of happiness to the students and residential staff on campus. Some issues to point out however is that in order to do this, new machines were installed and that is not quite the approach that I am looking for. While WashLava's solution seems the most idealistic and successful, I cannot just easily replace every laundry unit on campus with a smart one. It is still good to observe the work that they have done and to apply it to my research for how I should approach implementing a similar function on Xavier University's campus.

All of the sources found are very useful and cover an aspect of my goal for this research project. Analyzing them along with others not mentioned gave me more insight as to how to solve the problem that I am attempting to solve.