University of Nevada, Reno

Department of Computer Science and Engineering

CS 425: Software Engineering

"Optimum Property Fix"

Team 5

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Abstract

The University of Nevada, Reno's (UNR) dormitory maintenance requests system presents itself as a problem in need of improvement ridden with inconveniences and flaws to dormitory students. The intended audience of Optimum Property Fix (OPF) are dormitory students at UNR and facilities services for dormitories. OPF is a planned approach to solving this problem through web technologies and advancements in Artificial Intelligence. Additionally, the design process for OPF entails an assessment of planned features, identification of the application technology stack, and organization of team members to fully accomplish the objective. Team members' contributions to the design process of OPF are recognized and delineated based upon submitted work.

Project Description

Main Goals and Objectives

The main goal and objective of OPF, are to overhaul the UNR's current dormitory facility service systems with web technologies. Overhauling of the current system is the removal of paper trail, making facility services accessible to all dormitory students, and providing powerful insights into building health through artificial intelligence. Accomplishing this objective requires executing the following: selecting technologies to use within the application's technology stack, designing the web application's backend infrastructure, and conducting end-user surveys to ensure the application demonstrates the primary objective. The combination of these goals would accomplish fulfilling the need for making the current system focused for students rather than seen as last thought.

Main Functionality and Characteristics

First, the students living in the dormitories at UNR will be able to create an account on OPF and submit maintenance requests. The web application will ask general questions such as a dormitory number, the location of maintenance needed, and a text description of their respective issue. Next, the student can upload a one-to-two-minute video, and/or a picture of the issue. Additionally, the maintenance request will be scheduled on behalf of the students and categorized based on the severity of the issue. The student will receive either a text and/or an email confirmation as well as a reminder of the maintenance appointment. After the maintenance issue has been fixed, an automatic two-week follow-up/survey will be sent to the respective student via text and/or email.

Secondly, members of the Facilities & Management at UNR will be able to create an account, log in, and have visibility of maintenance requests for dormitories. Any team member of the Facilities & Management will be able to view the text description and the one-to-two-minute video, and/or a picture of the issue. Once the maintenance request has been completed, a member of the Facilities & Management team will be able to upload notes of the job they have completed. The notes can be viewed by other members of the Facilities & Management team for traceability.

Lastly, administrators at UNR will be able to create an account on OPF and generate reports based on maintenance requests. The visual reports will contain data such as the number of

maintenance requests, locations, dates, and times. Furthermore, the reports may give insight to administrators such as planning and budgeting for dormitory renovations.

Intended Audience

The primary audience for the OPF web application is dormitory students and the Facilities and Management at the UNR. The dormitory students will be able to submit maintenance requests online. In addition, the members of the Facilities and Management team will be able to view the maintenance requests, perform tasks, and update the status of the tasks based on the requests. Currently, these users utilize a paper system and not an effective electronic system to communicate with each other and receive continuous updates regarding dormitory student requests. OPF plans to help users convert from a paper system to an electronic system to have a seamless and more efficient system. OPF assists dormitory students and the members of the Facilities and Management communicate while facilitating their structure and keeping track of their requests.

Key Usability Goals

OPF's goal is to assist students access services for maintenance issues that occur within dormitories. Dormitory students will benefit from OPF with five key characteristics of usability including learnability, effectiveness, efficiency, satisfaction, and error tolerance. OPF ensures simplicity and clarity by providing understandable messages and actions. Limitations on information on each page avoids clutter and unnecessary displays by only displaying useful information in order to complete the task. The user interface consists of the proper color, font size, and aesthetic that represents OPF. Ensuring design for all ability levels benefits users that have visual impairments. The options offered by OPF, such as providing pictures, descriptions, setting up appointments, and communication with the appropriate service can predict their actions for future use, leading to a fast and satisfying result.

Potential for Further Development/ Product Enhancement

The future enhancements of OPF further develop in order to be utilized by other user groups. New user groups include the UNR faculty, administration, and all campus services. Additionally, OPF's future development includes expansion to private institutions such as apartment complexes. A user from an apartment development views different functionality than a user from a University facility therefore the application can be scaled. Furthermore, OPF extends to generate a list of materials needed to repair the issues as well as ordering materials that are low in stock.

Challenges and Obstacles

First, selecting the project topic had to be an innovative application while creating a solution to an already existing problem. The OPF team desires to create an application that is original and stand-alone. Additionally, OPF must have a meaningful purpose while maintaining long-term functionality in the ever-changing market.

Second, the performance and scalability will be a challenge for the team to address. The load times of the application will have to be taken into consideration without sacrificing the functionality of the web application. Additionally, another obstacle to consider is making the application extensible and while incorporating new features. An equal obstacle for the team will

be standardizing early in the creation of the web application to make for consistent and maintainable code.

Lastly, team communication is a challenge for scheduling team and advisor meetings. Furthermore, engaging all team members in the OPF project while simultaneously seeking input from each member will be an obstacle. An effective tool in team dynamics is to adapt to different work styles with people from different backgrounds. Additionally, a challenge for the OPF team is to leverage the area of expertise of each member to create a successful web application.

Technology Description

GitHub is a code repository service that uses Git to publish and view code online. The service will be used amongst team members for the code development of OPF.

React is a free and open-source front-end JavaScript library for building user interfaces components. React will update and render components if data changes when designing simple views for each state in the OPF web application.

Amazon Rekognition is a service through Amazon Web Service that seamlessly adds visual analysis to applications. Rekognition image uses deep neural network models to detect and label objects in images. Integrating OPF with AWS Rekognition builds a powerful application to search, verify, and organize images. In addition, Amazon DynamoDB is a fast and flexible nonrelational database service that will allow OPF to offload the administrative burdens of operating and scaling. Furthermore, by integrating OPF with DynamoDB, the team will be able to deploy a non-relational database in a matter of minutes.

Team Overview

Araam Zaremehrjardi

Araam Zaremehrjardi primary interest is embedded programming and a secondary interest in backend programming. The main skill sets are in Java, C/C++, and some experience using VHDL languages like Verilog. Contribution to the development of OPF will be in the design and implementation of the backend infrastructure and delivering input on front-end design.

Joanna Lopez

Joanna Lopez with a primary interest in cloud computing, computational biology/ informatics, and smart wearable technology. Specific skills include proficiency in C++, Java, HTML, CSS and MySQL/PostgreSQL. The main expected involvement will be integrating AWS tools, managing user access, and work cross-functionally on both the front end and back end technology.

Melissa Flores

Melissa Flores primary interest is in UI/UX design with significant skills include HTML, CSS, Java, Javascript, C++, Adobe Creative Cloud, wireframing, and prototyping. As a student with this broad set of skills, she will contribute to the development of this project by creating aesthetically pleasing UI, user research, and the bridge between programmers and designers of the group.

Nasrin Juana
Nasrin Juana primary interests consist of Data Science and Human Computer Interaction. Her specific skill set consists of proficiency in C, C++, Java, Python, MySQL, and PostgreSQL. Her expected involvement in the project is the management of databases and the implementation of the backend and frontend structure.

Aisha Co
Aisha Ysabel Lao Co interests include virtual reality and holograms, which both involve image processing. Some specific skills include C, C++, Java, HTML, CSS, and minor JavaScript. The main contribution expected would be helping in parts of the project that deals with images and AI. Furthermore, she may also assist with UI development.

Advisory Overview

Advisor Erin Keith
Erin Keith is the advisor for Team 05 with her experiences, she would be a project manager figure by providing assistance in resources and expertise if needed for the project.

Market Potential or Open Source Significance

Market Analysis
Determining the market potential of OPF would depend on the behaviors of the dormitory students which would affect the state of UNR's properties, competition, and consumer patterns. The application offers optimum service, assistance, and accessibility, the expected market potential is promising. OPF ensures to offer fast and proper service as maintenance issues cause inconveniences, especially to the already busy college student. The design of the OPF web application and the technologies implemented in it will help dormitory students find the appropriate service for their needs, leaving them to always turn to OPF.

Competitive Analysis
There are similar related products on the market such as the Fiix [1], NET Facilities [2], and Maintenance Care [3] with different features applicable to facilities and management. Figure 1, is the competitive outline of each of the three related products alongside OPF and the different integrations on their unique platform.

		Competitive Analysis			
		OPF	**Fiix**	**NET Facilities**	**Maintenance Care**
PROFILE	**OVERVIEW**	OPF web application lets one manage student housing maintenance.	Fiix Software for school maintenance lets one manage maintenance for affiliate sites abroad, buildings on campus, outdoor fields, and everything in between. Full access to powerful tools that will help you simplify maintenance management strategy.	NET Facilities links together and manage administrative buildings, libraries, classrooms, student housing (dormitory), modular buildings, grounds, athletic departments/ gymnasiums, auditoriums, fleets campus medical facilities, faculty centers, and others.	Maintenance care can help the maintenance team track work orders and PPE, start preventative maintenance programs, develop asset tracking, track progress, and report on progress. Students, teachers, and administrative staff need a functional environment to succeed; school management software can help them be the best leaders for our youth.
	COMPETITIVE ADVANTAGE	Customization – Built inclusively for the UNR	AI-powered reports	Used in the vast majority of industries such as education, government, property management, health care, etc.	Custom Built Features
MARKETING PROFILE	**TARGET MARKET**	UNR	All industries	All industries	All industries
	MARKETING STRATEGIES	None	Social Media, Free Online Demonstrations	Social Media, Free Online Demonstrations	Social Media, Free Online Demonstrations
PRODUCT PROFILE	**PRODUCTS & SERVICES**	Maintenance requests, Preventative Maintenance, Reports/ Metrics, Task Management, Help Center for Students.	Training and Implementation, Help center, and Fiix Community. Asset, Parts & Supplies, Work Order Management.	Work Order Management, Asset Management, Preventative Maintenance, Inventory Management, and Key/Lock Management.	Work Order Management, Task Management, Preventative Maintenance, PPE/ Tool tracking, Reports, and Alexa integration.
	PRICING & COSTS	N/A	Quote: Custom Pricing (Pay-as-you-go)	Quote: Custom Pricing (Pay-as-you-go)	Quote: Custom Pricing (Pay-as-you-go)
	DISTRIBUTION CHANNELS	Direct to Consumer	Direct to Consumer	Direct to Consumer	Direct to Consumer
SWOT ANALYSIS					
	STRENGTHS	Customization	AI integrated Software	Already in most industries	Custom to customer needs
	WEAKNESSES	No actual product built, features not decided.	Not local, time zone difference, and no 24-7 customer support.	Not customizable to fit all needs and wants.	Too slow to adapt to change i.e., newer technologies
	OPPORTUNITIES	Potential for usability and streamlined process for students and Facilities & Management.	Improving customer satisfaction and industry awards.	Building strong customer relationships	Improve overall product quality design and product features
	THREATS	Not creating products in time for student use	Possible new product failures	Maybe overly price compared to most competitors	Products becoming too outdated

Fig. 1: Market Analysis of OPF Competitors.

Currently, there are no direct and/or indirect competitors for the OPF web application. The current system at the UNR has a paper request as well as an online survey for maintenance requests for the dormitories. As of today, UNR has not thought of replacing the paper system or updating the online survey it has in place.

Competitive Advantage
The process in the residence halls has students filling a paper application to request maintenance. Switching to a web-based application, dormitory students would be able to create a maintenance ticket online seamlessly. For instance, the ability to enable dormitory students to take a photograph or video for maintenance requests is an innovative characteristic. Additionally, categorizing the maintenance request based on severity is using innovative technology compared to paper requests. The text-based notification system is an ingenious solution compared to the current system of promised-based communication. Lastly, the building dashboard for dormitory services can aid in visual and preemptive maintenance based on maintenance requests. OPF compared to the paper-based system is a superior service that can solve maintenance gaps.

Time Worked on Project Concept

Araam Zaremehrjardi's Contribution to Project Concept
Araam Zaremehrjardi's total time worked on the capstone project proposal and concept totals to ten hours. Contribution entails writing the following sections: abstract, main goals, and objectives, and individual team overview. Additional contributions included editing of the report for appropriate grammar and formatting in collaboration with Joanna Lopez.

Joanna Lopez's Contribution to Project Concept
Joanna Lopez's total time worked on the project proposal and project concept totals fifteen hours. The contributions include the writing of the main functionalities and characteristics of the project as well as the challenges and obstacles to be encountered. Additionally, specifying a competitive advantage of OPF and its innovative characteristics. Lastly, writing of the budget and justification of costs and editing of the document in conjunction with Araam Zaremehrjardi.

Melissa Flores' Contribution to Project Concept
Melissa Flores's total time worked on the project proposal and concept totals to seven hours. The work that involves this time and effort includes key usability goals, market analysis, and individual team overview. The section describing key usability goals required intensive research and the different aspects that go into good usability. Market analysis also requires additional research in describing OPF's market potential, promise, and value.

Nasrin Juana's Contribution to Project Concept
Nasrin Juana's total time worked on the project proposal and concept totals to five hours. The contribution includes the writing of the following: intended audience, the potential for further development and product enhancements, and individual team overview.

Aisha Co's Contribution to Project Concept
Aisha Co's total time worked on the project proposal and concept totals to two hours. The contribution includes writing the following: advisory overview and competitive advantage. The advisory overview section focuses on the advisors that would be helping the teamwork on the project while the competitive advantage demonstrates why the team's solution (project) would be better than the current system being used.

Project Related Resources

1. "The #1 School Facilities Maintenance Software Platform." *Fiix*, 23 Aug. 2021, https://www.fiixsoftware.com/cmms/industry-solutions/university-maintenance-software/ .

2. "CMMS Software for Maintenance, Facility and Property Management." *NetFacilities*, https://www.netfacilities.com/?hsLang=en.

3. "Management Software Designed to Simplify Maintenance at Schools." *Maintenance Care*, 13 May 2021, https://www.maintenancecare.com/education.