Work Scheduling System for Syracuse University Food Services

Feasibility Report

IST 654

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Executive Summary

Syracuse University Food Services and Dining Centers have a system where employees just clock in and clock out when they report to a shift. This system lacks scheduling algorithm which would allocate an employee to a particular station. At present, this job is manually done by the Supervisors at the dining centers and cafes. Also, spreadsheets are used to store information about the employees working at each dining center. This is highly inefficient because it is difficult to track employees.

The proposed system would allocate employees randomly to the stations based on the priority. This will eliminate the chances of a supervisor being partial among the employees. Also, the proposed system would have relational database connectivity to store relevant data about each and every employee who has ever worked in Food Services.

The system has a reporting facility for each shift which saves paperwork and is much more efficient than the current system where supervisors use papers and pens to assign shifts to employees and display it. The proposed system would display the shifts assigned to employees at the time they clock into the system for their shift. Since this process is automated, the load on the supervisor is reduced and the supervisor can put his efforts in some other work in the dining hall.

Company Overview

(Image Reference : http://housingmealplans.syr.edu/meal-plans/food-and-plus-funds/)

Syracuse Food Services is a service specially tailored to provide meals for the 7000+ students on Syracuse University campus. Syracuse Food Services controls 5 dining halls and 20 cafes within Syracuse University campus vicinity.

Mission Statement: ‘Syracuse University Food Services is dedicated to serving the best food to students.’

Project Overview

Syracuse University Food Services requires to change their work scheduling approach from a tedious, manual to a systematic, automated approach. Currently, the task, the station is being allocated to the employee by the supervisor on the day of work on a sheet and this sheet is displayed in the office. The problem faced by food services is that the number of employees coming each day is unpredictable. Some employees don’t show up even after the task allocation is done by the supervisor. This increases the hassle for the supervisor. In addition to this the manager is in a fix if the supervisor is absent without prior notice. The employees also have to visit the work scheduling station to check the work allotted to him for the day.

The managers in some dining halls have said that some supervisors are biased towards employees for task and station allocation. Therefore, Syracuse University Food Services requires a new system that will automate the task allotment to the employees by the supervisor. This will reduce the workload for the supervisor and would create an unbiased work schedule for the employees.

Objectives

- Automate workstation allocation for the employees at different dining and cafes within Syracuse Food Services.
- Reduce workload for a supervisor.
- Create an unbiased work schedule for employees.
- Make it convenient for employees to check what task is allocated to them for the day.

Project Scope

- System requirements are gathered from Syracuse Food Service Managers.
- Use Case, Data Flow Diagram and Entity Relationship Models are designed for the system.
- User Interface is designed for the proposed system to make the implementation more transparent.
- Feasibility analysis for the system is done to show an optimal solution to the developers.
- Determine key performance indicators.
- The project does not include the implementation of the physical system.

Criteria of Success

- The system can be said successful when it satisfies the following criteria:
- The system has fully automated the work allocation of employees.
- The system is developed within the allocated budget and resource.
- The system gets implemented within the assigned time.
- Is scalable through all the cafes and dining halls within Syracuse Food Services.
- The system has a user-friendly interface tailored to meet the needs of the manager and supervisor.

Business Benefits

- The new system will reduce the number of supervisors in charge.
- It will reduce the amount of paperwork and manual efforts for the manager and supervisor.
- Prioritization of stations will make sure that the most important stations will be operational during the shortage of employees.

Functional Requirements

1. The system must allow the manager to add new employees into the system and delete the employees who have resigned.
2. The system must also allow the manager to schedule a registered employee for a shift.
3. The system must allow the supervisor to enter and set priorities to stations for a particular shift.
4. The system must allow employees to clock-in and clock-out for their shift.
5. The system must generate a report of employees (who reported and did not report) for every shift.
6. The system must allow the manager and supervisor to assign disciplinary points to the employees who did not show up for a shift.

Non-Functional Requirements

Reliability:

- The system should be functioning reliably 24 hours a day and 7 days a week.
- The system must backup the data and restore it if it ever crashes.

Data Integrity:

- Data should be consistent throughout the system.
- Data should be accurate.

Security:

- The system will be monitored for unauthorized access and DDOS attacks.

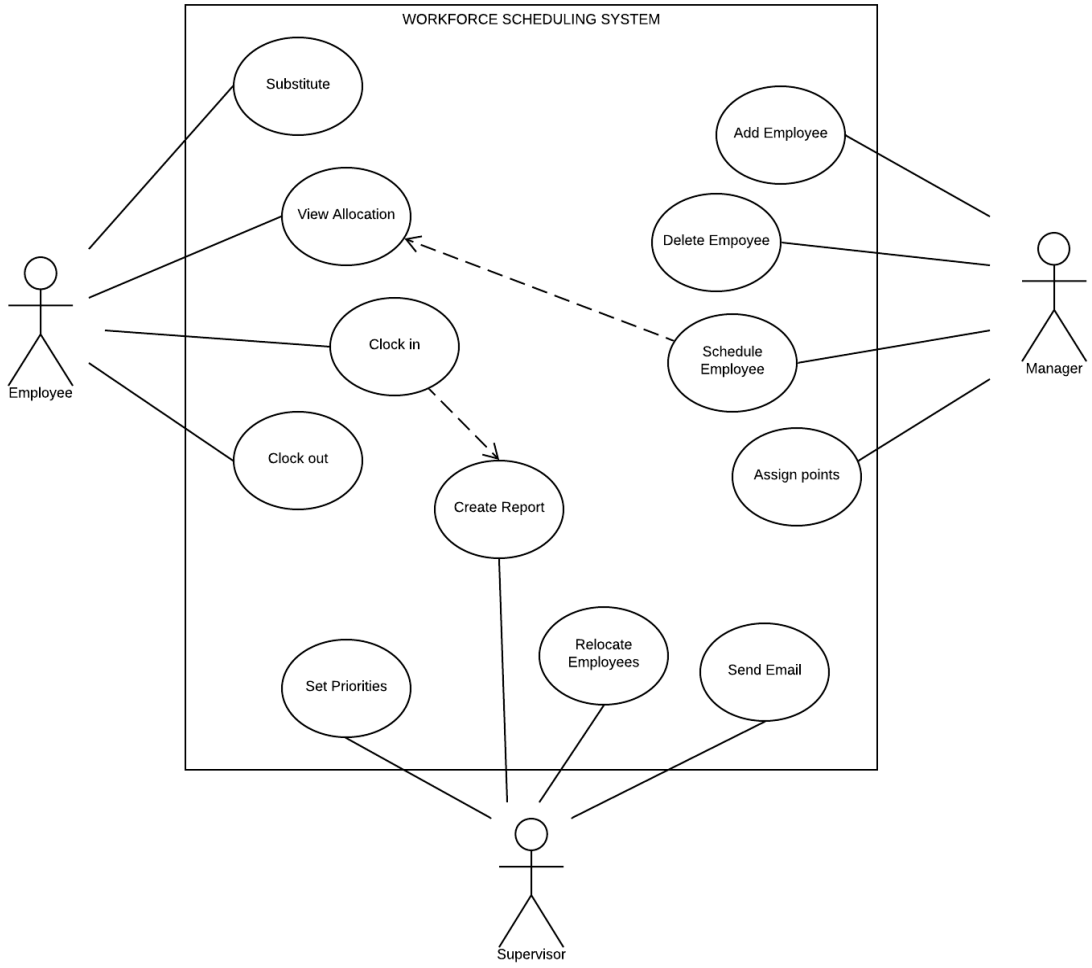
Performance:

- All data must be stored real time in the system.
- All data must be updated real time in the system.

USE CASE DIAGRAM

Actors:

1. Manager
2. Supervisor
3. Employee



Use Case Glossary

Use Case ID	Use Case Name	Use Case Description	Participating Actors
1	Add Employee	Add new employees into the system who would work for food services	Manager
2	Delete Employee	Delete an existing employee from the system once they resign from food services	Manager
3	Schedule Employee	Schedule an existing employee for a particular shift as per the request of the employee	Manager
4	Assign points	Assign disciplinary points to an existing employee who violates a rule on a shift	Manager
5	Clock in	Check into the system when an employee reports for a shift	Employee
6	Clock out	Check out from the system when an employee ends his shift	Employee
7	View Allocation	See on which station an employee is scheduled for a particular shift and report to that station after clocking in	Employee
8	Substitute	Assign a shift to a different employee who is enrolled in the system	Employee
9	Set Priorities	Assign priorities to all the stations on which an employee is supposed to report for a shift	Supervisor
10	Create a Report	Create a report based on the employees who have clocked into the system and display the stations which are vacant for that shift	Supervisor
11	Relocate Employees	Relocate an employee from a lower priority station to a higher	Supervisor

		priority station which is vacant	
12	Send Email	Send out an email to an employee to check on them before assigning points	Supervisor

Critical Use Case Narration:

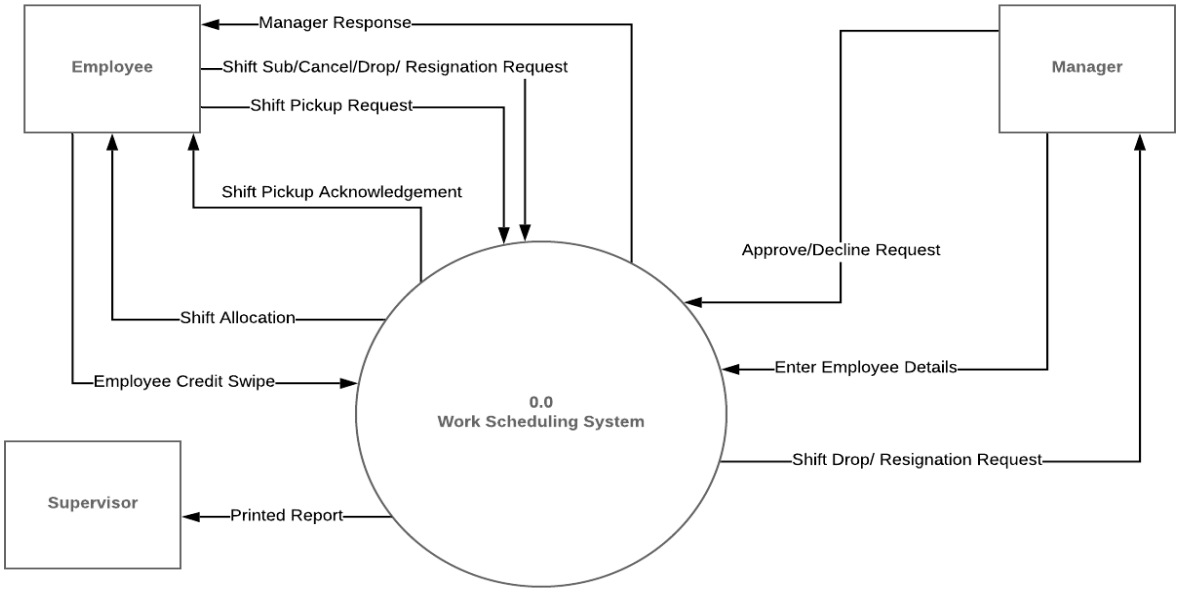
Use Case Name: Add Employee	**ID:** 1	**Priority:** High
Actor: Manager		
Source: Functional Requirement		
Description: The use case describes how a manager can add new employees into the system who are hired into food services to work for a particular dining hall or cafeteria.		
Trigger: This use case is initiated when an employee is hired and manager clicks on the 'Add Employee' button to register a new employee.		
Pre-condition: The employee should not be previously registered into the system and is newly hired.		
Post Condition: The employee is added into the system and is ready to schedule for his first shift.		
The course of Events: **Actor Action:** The manager clicks on the 'Add Employee' button when a new student with a SUID is hired for Food Services **System Response:** The system creates a new employee when a manager enters details about an employee into the system.		
Conclusion: A new employee is successfully created into the system.		
Business Rules: An employee must be a student enrolled at Syracuse University.		

Use Case Name: View Allocation	**ID:** 7	**Priority:** High
Actor: Employee		
Source: Functional Requirement		
Description: The use case describes how an employee views on which shift he is allocated once he reports to his shift.		
Trigger: This use case is initiated when an employee clocks into the system when he reports to his shift		
Pre-condition: The employee should clock in when he reports to his own shift on which he is scheduled by the manager.		
Post Condition: The system displays the shift to the employee and the employee reports to that station on his shift.		
The course of Events: **Actor Action:** The employee clicks on 'Clock in' button after swiping his valid SUID. **System Response:** The system will display the station on which the clocked-in employee should report for his shift.		
Conclusion: The employee sees and successfully reports to the station on a shift.		
Business Rules: The employee who is clocking in should be scheduled for that shift.		

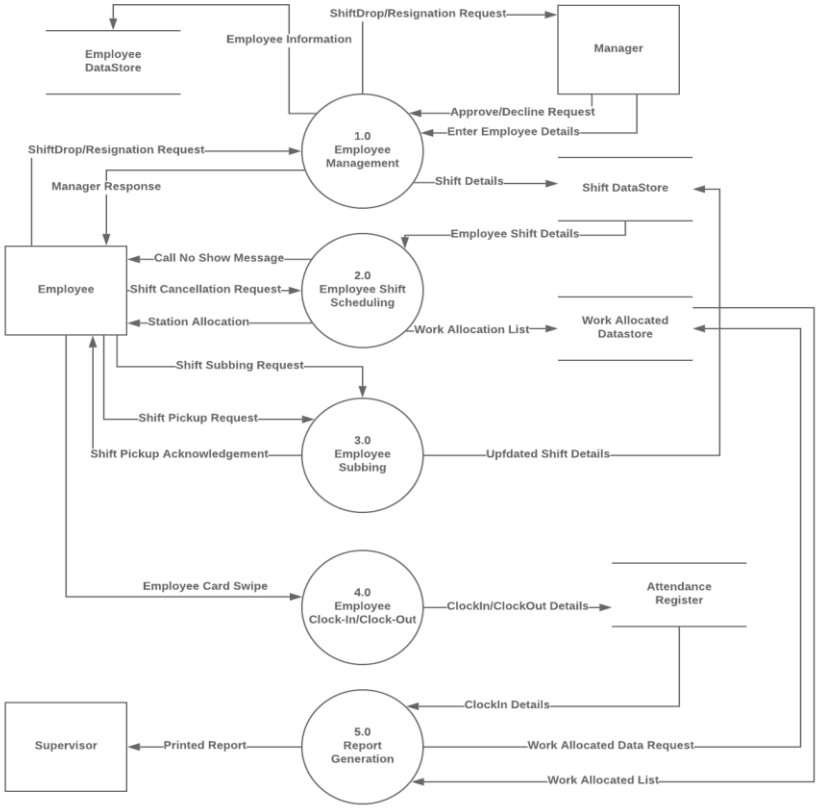
Use Case Name: Relocate Employees	**ID:** 11	**Priority:** High
Actor: Supervisor		
Source: Functional Requirement		
Description: The use case describes how a supervisor will change the employees allocated to a station based on the priority of each station.		
Trigger: This use case is initiated when a report is generated by the system and the supervisor views this report and finds if a station having higher priority is vacant.		
Pre-condition: There should be a station having a higher priority be vacant for a particular shift.		
Post Condition: The employee who is clocked in and working on a lower priority station is moved to a higher priority station.		
The course of Events: **Actor Action:** The supervisor changes the arrangement in the report and asks the employee to change his station. **System Response:** As per the inputs of the supervisor, an employee is moved to a different station and this is recorded.		
Conclusion: An employee is successfully moved to a different station and the higher priority station is managed.		
Business Rules: An employee who is moved must be clocked into the system for his shift.		

Data Flow Diagram

Level 0 Diagram

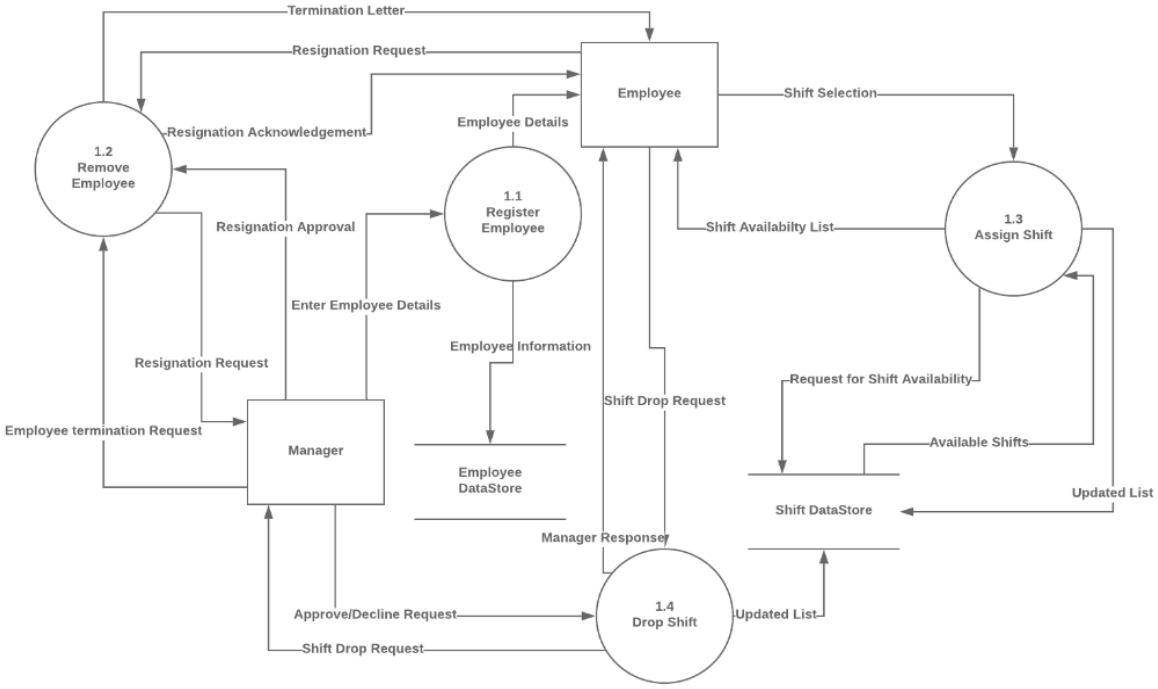


Level 1 Diagram

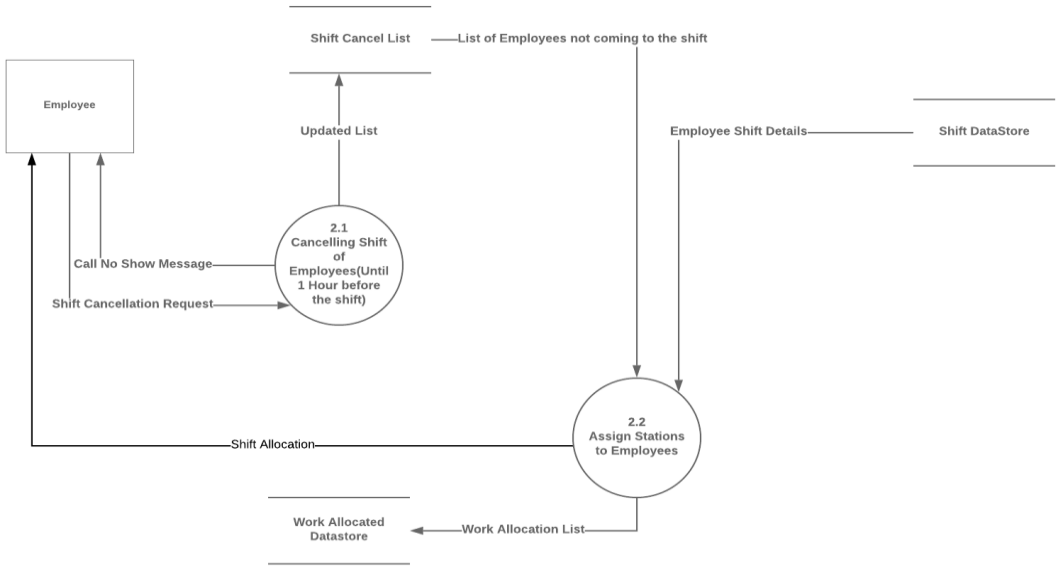


Level 2 Diagram

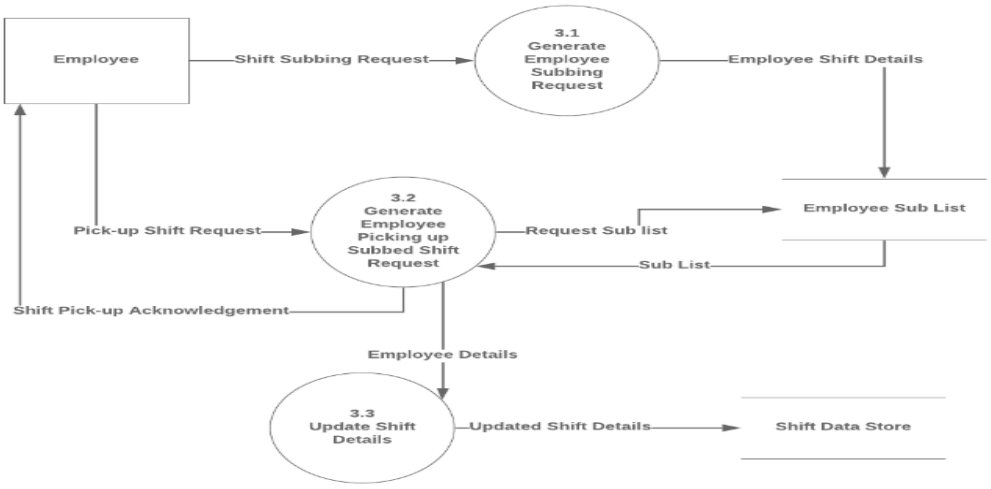
Employment Management Process



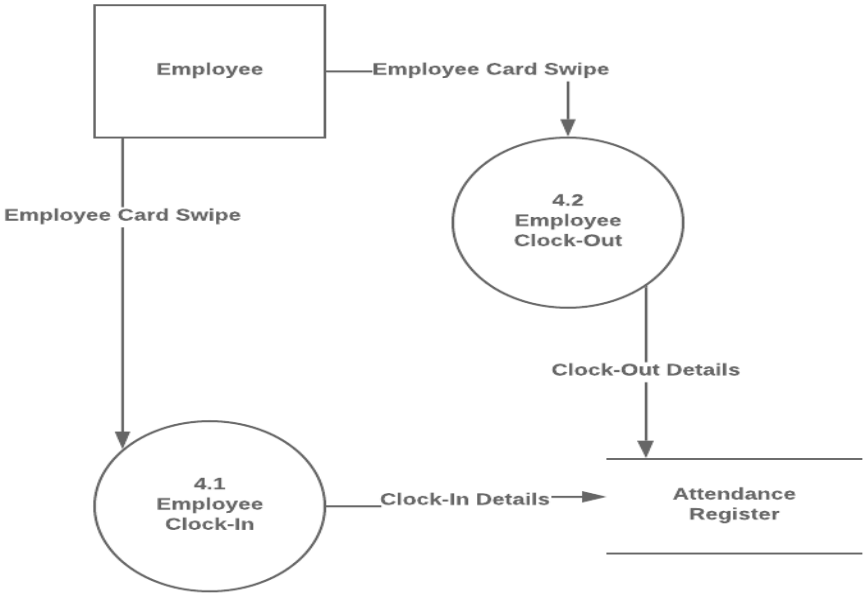
Employee Shift Scheduling Process



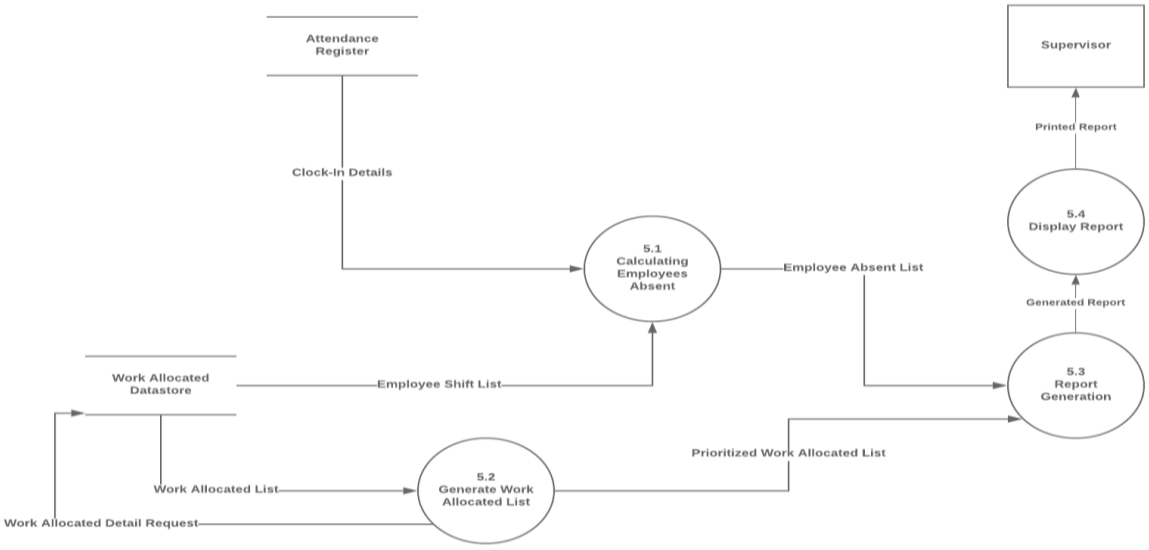
Employee Subbing Process



Employee Clock-in/Clock-out

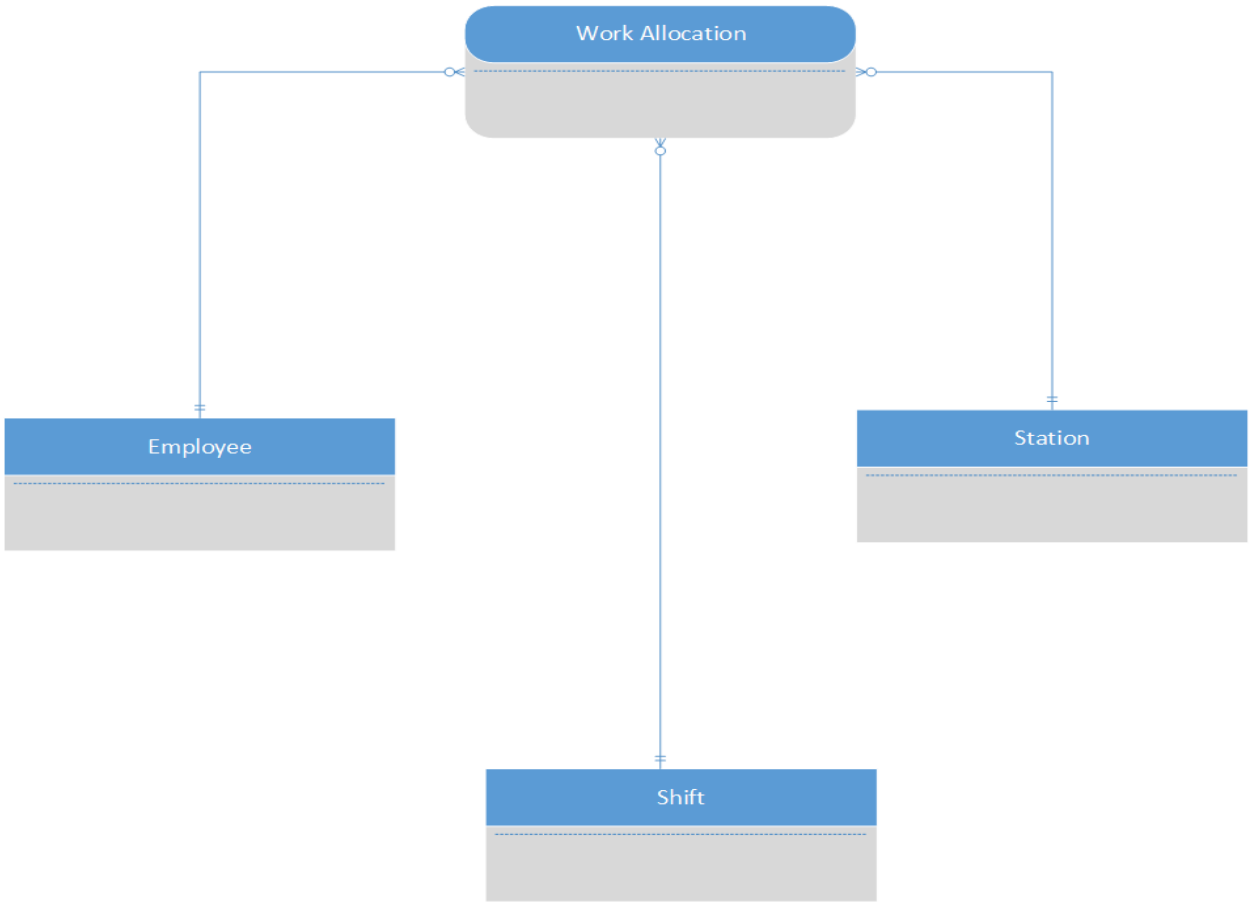


Report Generation Process

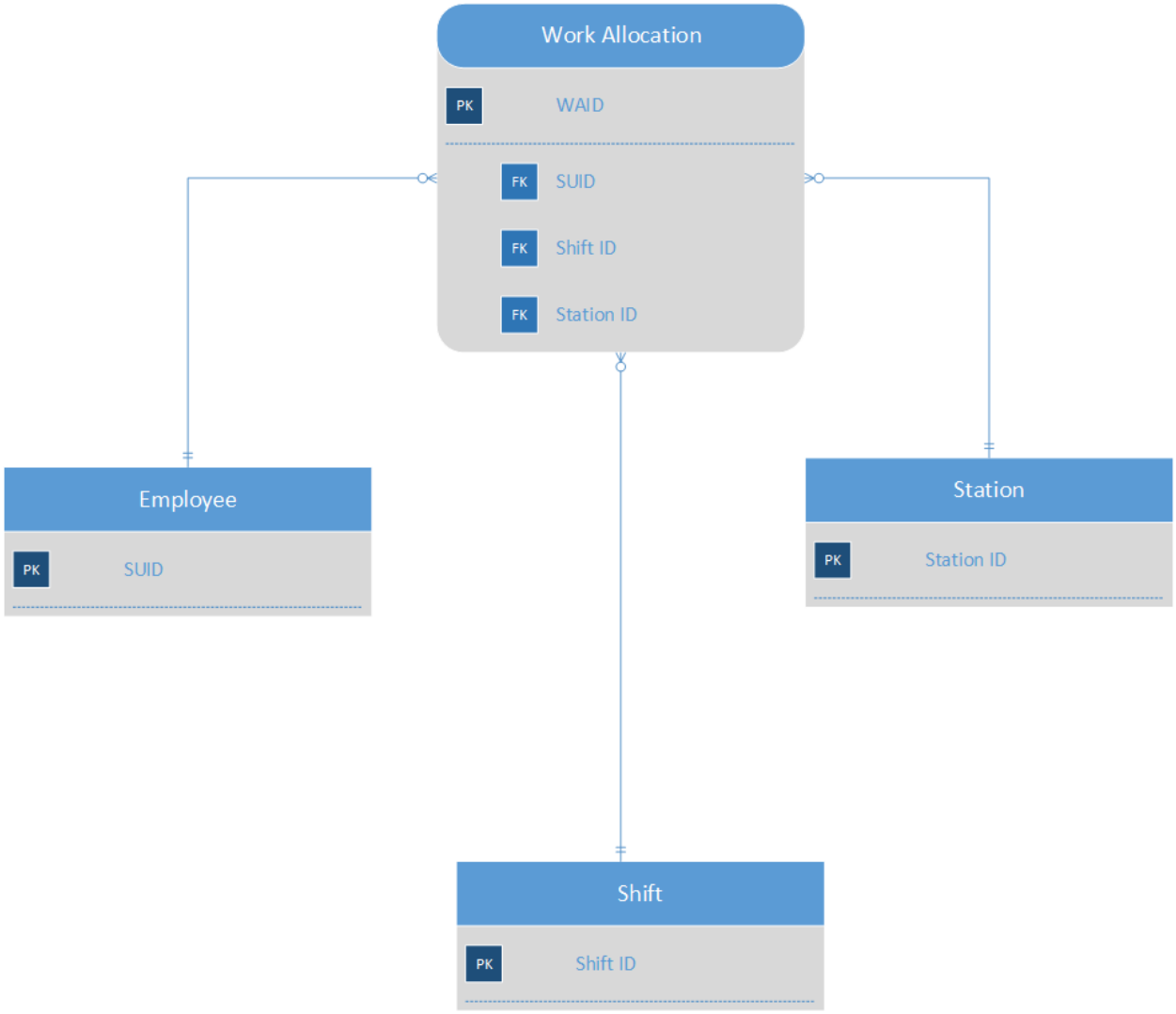


Entity Relationship Diagram

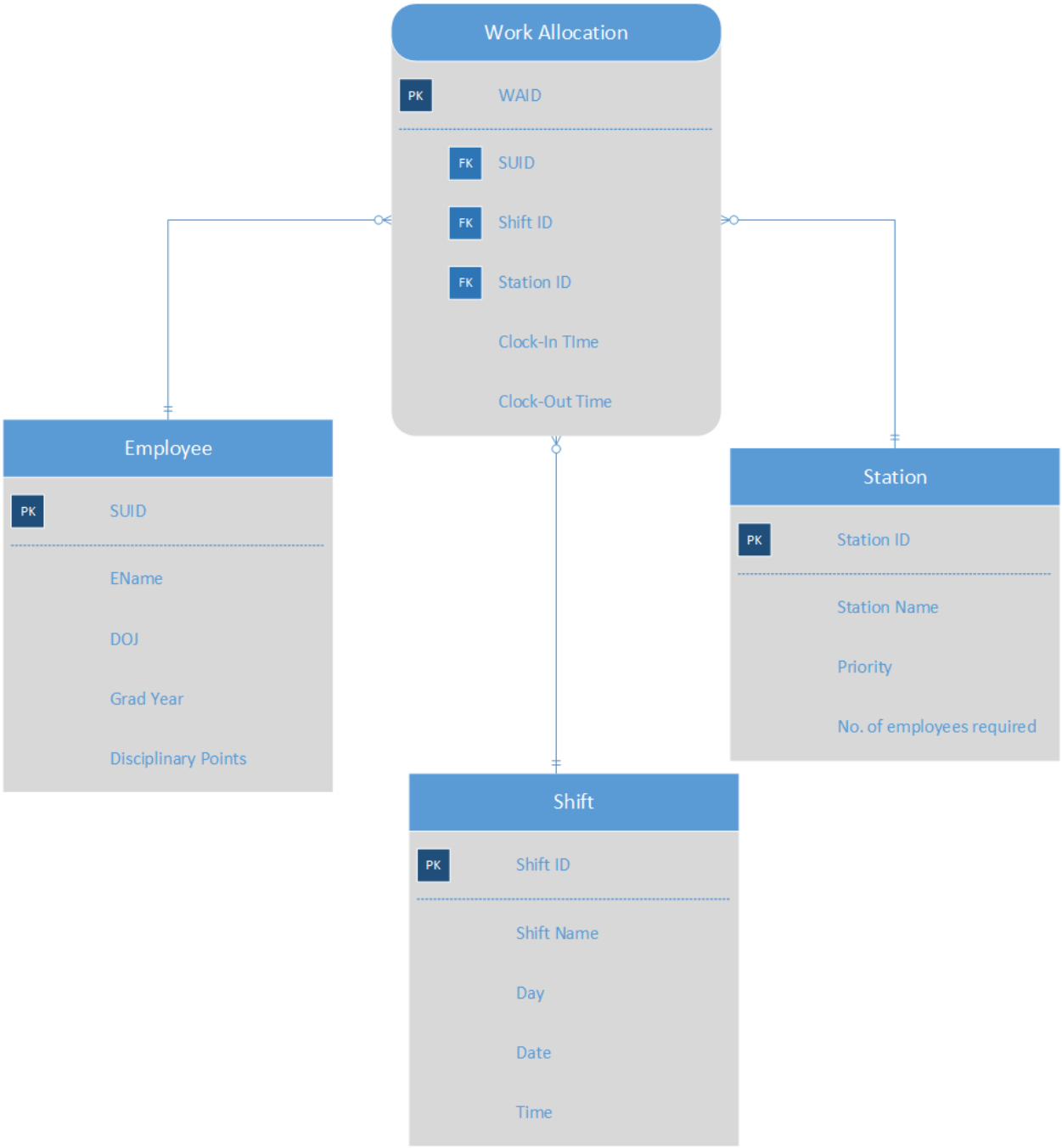
Context Level ERD:



Key-Based ERD:



Fully-Attributed ERD:



Entity Definition Matrix

Sr.No	Entity	Definition
1	Employee	Basic employee information is stored like SUID, date of joining, disciplinary points, graduation year. Here, SUID is the primary key.
2	Shift	Consist of shift information like day of the shift, timings for the shift and date of the shift. The primary key for shift entity is Shift ID.
3	Station	Station entity stores information for each station in a hall. The information consists of Station ID, station name, number of employees required on the station and priority of the station. The primary key for station entity is Station ID.
4	Work Allocation	Work Allocation is a weak entity which stores information of employees assigned to a particular shift at a particular station. Work Allocation consists of WAID, SUID, Shift ID, Station ID, clock-in time and clock-out time. The primary key for Work Allocation is WAID and foreign keys are SUID, Shift ID, Station ID.

Feasibility Analysis

Operational Feasibility:

Operational feasibility refers to the measure of solving problems with the help of a new proposed system. It helps in taking advantage of the opportunities and fulfills the requirements as identified during the development of the project.

Our proposed system would have a high impact on operational feasibility as the majority of tasks would be automated. Also, our system would reduce the number of paperwork and manual work that currently happens in the existing system.

Below is the comparison of the existing system and the new system. This comparison shows that how operationally feasible our proposed system is:

Existing system	**New system**
In the current system, the supervisors have to assign stations to employees.	The new system would automatically assign stations to the employees 15 minutes before the shift.
The managers have to manually maintain an excel sheet to keep a track of employees.	The new system would have a website wherein the managers can enter employee data and that data would be stored in the employee database.
The existing system involves the use of papers for shift selection before a semester.	The new system would allow the managers to enter the information of employee shift selection directly into the database.
In the existing system station allocation are manually prioritized	The new system would enable automatic prioritization of station allocation.

Technical Feasibility:

Technical Feasibility is defined as the feasibility that is concerned with specifying equipment and software that will successfully satisfy the user requirement.

- It includes the technical needs of the system.
- Configuration of the system is given huge importance than the actual make of hardware while examining technical feasibility.

Our proposed system would have an in-house Java application since the majority of the working involves automation. Also, there would be a small web interface for the managers to maintain employee information.

Application Development:

1. First, we need to develop an application that would take the employee data, shift data and station priority data and combine these things to automatically assign a shift to an employee in a particular shift. The application would be developed in Java.
2. The next most important thing is to design a small web interface for the manager to enter the employee data.
3. Develop a prototype of the idea.
4. A beta test should be done to check the proper functioning of the application.
5. Keeping the application upto date by adding new features.

Back - End Requirements:

- Web Server [Linux.small]
- Application Server [Linux2.small]
- Test/Dev Server
- Database Storage
- SQL Server

Economic Feasibility

Project investment involves the expenditure of capital funds and other resources to generate future benefits, whether in the form of profits, cost savings, or social benefits. For an investment to be worthwhile, the future benefit should compare favorably with the prior expenditure of resources need to achieve them.

Economic forecasting is an integral facet of any project. A well written economic evaluation, outlining tangible and intangible benefits, future gains, realistic monetary funding and dispersion, effects the project from start to finish. When a company looks to for a project to undertake the financials are one of the most pivotal aspects of a sponsorship. A clear, calculated forecast is what will give the project the best chance of success. A cost-benefit analysis is the best way to outline what, financially, needs to be implemented into our project.

Using tools and methods to forecast our economic feasibility, we bring to light the monetary aspect of the project. Our Economic Analysis involves the calculation of development costs, maintenance costs, estimated lifetime benefits (since this application is a one-time investment), Estimated Lifetime Cost and Lifetime Return on Investment (ROI).

Below is the table that shows our economic analysis.
Total Costs involved in developing the application:

Economic Feasibility (in USD)

Benefits	Current	Estimated after 1 years	Estimated cost after 3 years	Estimated cost after 5 years
Total Increased Revenue from work scheduling automation	0	10000	35000	55000
Development Costs	20000	25000	25000	25000
Maintenance Cost	1000	2500	4500	7500
Total cost	21000	27500	29500	32500
Total	-21000	-17500	5500	22500

ROI Calculation:

Economic Feasibility (in USD)

Estimated Lifetime Benefits	55000
Estimated Lifetime Cost	32500
Lifetime ROI	69.23%

Lifetime ROI which is forecasted comes around 69.23% which would be very good for Syracuse Food Services in terms of profits gained.

Cultural Feasibility

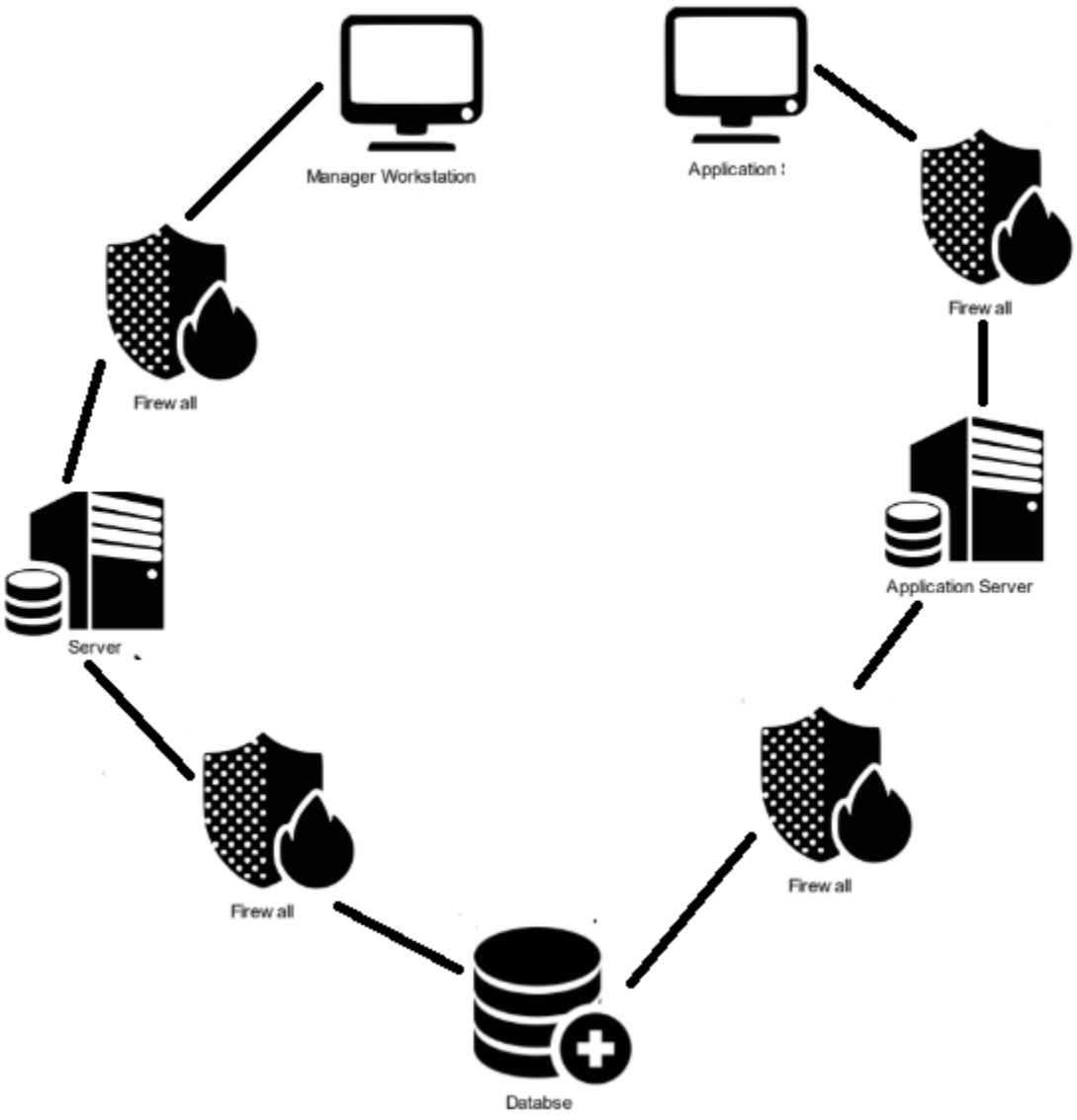
A cultural feasibility study is known as one that investigates all the environmental factors involved to successfully carry out a project. It is done to evaluate the impact of the project on the local culture.

We have considered this feasibility since it is important for the managers and the leadership of Syracuse Food Services to accept this change. The reason behind this is that the current system has been in use for many years.

To bring this change in a methodical way, our team proposes an idea of this new system to be initially used in one of the dining halls. Once people get accustomed to this new system then all the dining centers in Syracuse can incorporate the change. This would ensure that there isn't a sudden change in the culture which has been practiced for years.

System Architecture

The automated systems architecture is a three-tier architecture with the database, servers and the clients as the three layers. The database holds all the data. The servers fetch the data from the database and provide the information to the manager workstation. Similarly, the application servers fetch the data from the database and provide to the application. The application is the heart of the system as the actual processing is done here and the final output is displayed to the supervisor. There are firewalls present between all the main entities so that the system remains secure. Below is the diagrammatic representation of the system architecture.

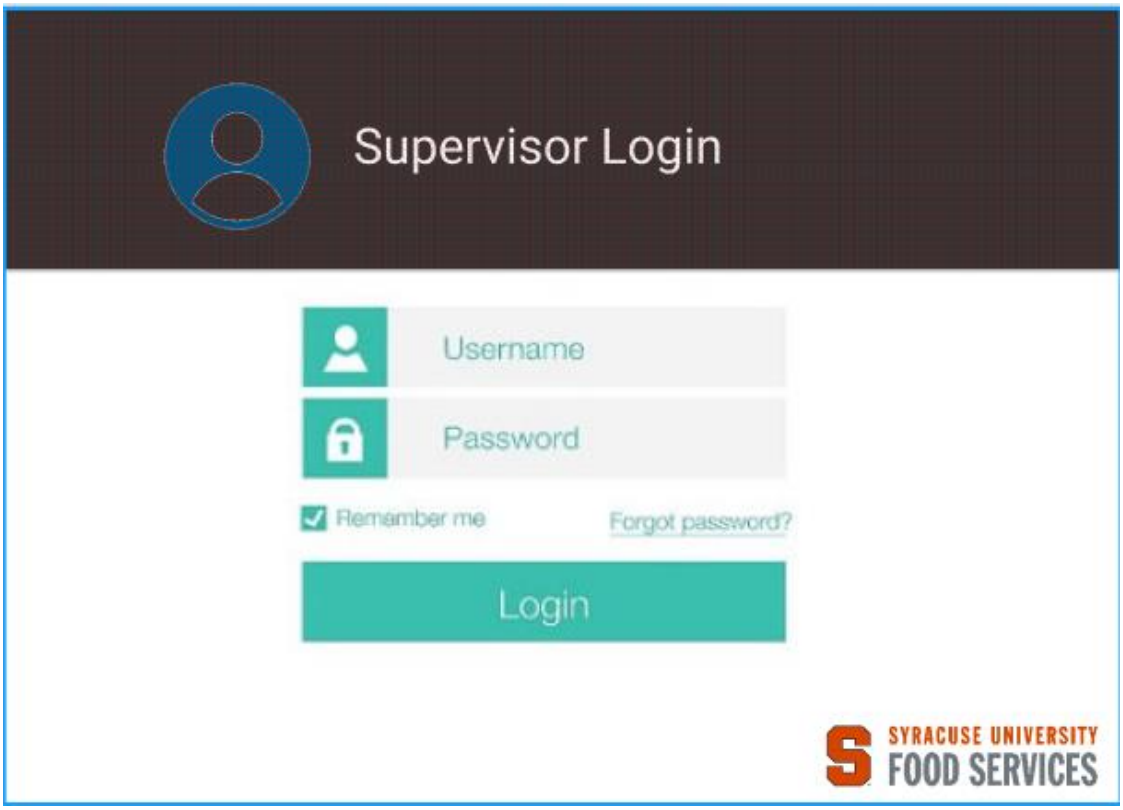


User Interface Design

The User Interface will allow the manager to effortlessly view the system. The commercial staff can use the UI to scan and update the inventory. The manager can add employee information, add and view shift information. A work allocation interface would be provided to the supervisor and it would show the station assigned to each employee. A printout of this interface would also be provided to the supervisor who will use this report to re-prioritize the stations if the need arises.

Below are 2 samples of the UI, one showing the login interface for the supervisor while the other showing the work allocation interface.

Login Interface:



Work Allocation Interface:

Work Allocation Interface

Ernie Davis Dining Hall

Supervisor Name: Anjaneya Shetty Date: 4/18/2019 Breakfast Shift

Sr. No	Clockin - Time	Employee Name	Station Assigned	Station Priority
1	08:00	Neil Munde	Dining	3
2	NA	Mehul Padwal	Checker	1
3	08:10	Srinath R.	Dishroom	5
4	07:55	Satyen Amonkar	Beverage	4
5	08:02	Nitin Nagpal	Gluten Free	2

Testing

System testing will be required to determine if it works as per the requirements and generates predicted results:

Unit Testing: There will be Individual testing for the system as well as the user interface. Testing should be done to check whether the integration of the management system has been done properly or not. Testing will be done to check if the allocations are properly by the system·

Integration-Testing: Testing will be done after testing of all the individual modules is done.

System Testing: In this phase, the complete application is tested. The goal is of this testing is to determine if the system satisfies all the requirements in order to pass the quality checks. In this phase, testing will be done to check if the user can login into the system, the user can enter/update the data, allocate the stations effectively and generate the necessary notifications.

Acceptance Testing: Acceptance testing will be performed to check if the system meets business requirements. If the system meets business requirements, then the software can be delivered to be deployed to all the dining halls step by step.

Training

Since this system is new, the general employees, supervisors and managers will require sufficient training for optimal utilization of the system

The training materials will be prepared by the team for all the required managers and developers. Moreover, training sessions will be provided to all three users. The training will be provided both before the deployment as well as after the deployment. The training documents will include the following –

- Use case scenarios – How to login, how to generate reports, how to manage available resources etc.
- Training Manual
- Tutorials
- Frequently Asked Questions

Maintenance

- Maintenance should be done as soon as the maintenance request is raised in order to avoid further issues in the system.
- A back up system needs to be maintained frequently in case of the server crashing

Key Performance Indicators

- Number of Employees dropping out of the shift.
- Ease of operation due to the implementation of the new system.
- Monetary Benefits from the system.

Comments and Insights

- Selecting a topic for the project and approaching higher officials for the company was a difficult part of our project. Since all our teammates were from a technical background, we decided to challenge ourselves by working on something we didn't know before.
- Gathering system requirements from higher officials at Syracuse Food Services was a good learning experience. We had familiarized with the way restaurants and cafe worked and understand the requirements for the system.
- Designing the use case diagram gave us a basic overview of different scenarios that we need to consider for the system.
- Designing data flow diagram helped us understand the detailed processes required to develop the system. This raised new questions which we had not thought of during the design of use case diagrams.
- Creating the feasibility report helped us look at the same problem with a totally new perspective, We realized how feasible our system would be in terms of operational, technical and economical cost for implementation.
- Future suggestions include a stepwise approach to implement the automation of work allocation throughout all dining halls and cafes.

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