

AUTOMATIC LAUNDRY SYSTEM

SOFTWARE REQUIREMENT SPECIFICATION DOCUMENT

Group: 05

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Revision History

Revision	Date	Author(s)	Description
1.0	05.03.2019		Chapter 1 - Introduction(Purpose,Scope)
2.0	12.03.2019		Chapter 2 - Overall Description(Context Diagram,Functional Requirement)
3.0	02.04.2019		Use Case Diagram,Tabular Description
4.0	09.04.2019		DFD, User characteristics
5.0	23.04.2019		Design Constraints, External User Requirement
5.0	18.09.2019		Non-functional requirements

Chapter 1

Introduction

Today in our modern world we have various types of technology to make our everyday life easier. We have washing machine for clothes, vacuum cleaners for cleaning, refrigerators for cooling and in some cases, even cooking machines. Ironing cloth is now an everyday task in our life. We have to keep the ironed cloth in a proper manner so that the cloth doesn't get wrinkle again in it. So we do a proper folding as well as packaging for this. To make ironing, folding and packaging easier and for saving time an automatic laundry system has been designed. In automatic laundry system ironing, folding and packaging have been integrated for cloths as well as a vending mechanism and mobile application for the user. Vending machine will scan a QR code which will be created by application. The QR code will contain the necessary user information as well as the balance information. Then it will check in the database for authentication and verification. A payment system will be included so that it can used in the industry. The whole system will be considered as a single automated system where the user will only place the cloth in the tray and the user will get the cloth in a packet with a proper ironing.

1.1 Purpose

- Introduce an automatic laundry system integrated with ironing, folding and packaging.
- Reduce the time it takes to do the task manually by human being.
- Design a cost effective way to do this automatic system.

1.2 Comparative Discussion

This design is focused to make the ironing, folding and packaging of cloths automated. Though there are three different tasks, it will be integrated together in the system. It can be used for home as well as industry. The system will be operated by user with the help of a mobile application. To find out the related literature, we have conducted searches in the major scholarly databases including ACM scholar, Google Scholar, IEEE explorer, Researchgate and ScienceDirect using suitable search strings.

Aman Kaushik and his team [1] had designed of an automatic ironing machine. It uses an innovative framework and motorized mechanism to effectively iron various clothes by minimizing the difficulties in the task of ironing. The movement of the iron is based upon chain and sprocket governed by motors. Their system uses mechanically driven motors but the proposed system will include electrically driven motors with the help of micro-controller.

Tholsee Naidoo [2] invented an automatic ironing machine. The ironing machine which automatically iron garments which are conveyed through the machine on hangers. The machine comprises an ironing zone to

receive a garment to be ironed. A cloth is hanging by the hangers in this system but in the proposed system the cloth will be mounted in a plate so that it will be easy to fold in the later sections.

Yiwei Liu, Dung Tran and Kexin Wang [3] in the mechanical design project made a portable automatic folding machine. This machine maintains two types of folding pattern. As it is a complex design it will be complicated and costly to integrate with the whole system.

Ted Selker, Palo Alto and Gal Rozov [4] designed a rotating rod in combination with a retractable concave/convex tape creates pairs of folds on a fabric article on a horizontal platform. This design uses a vertical system for the folding of cloths which makes our proposed system more complex. Our system follows a horizontal plate to move the plate for folding.

1.3 Scope

The idea of Automatic Laundry System is an innovative way to do ironing, folding and packaging more convenient. Here this automation technique will integrate the whole system as a single complete machine. When this tasks are done by human being manually it needs patience, hard work and time. Even when automatic ironing or automatic folding machine is used individually they would not be that much convenient as our proposed system.

- Target User
 - Textile industry owner.
 - Laundry Shop owner.
 - User who wants to use the system as a home appliance.
- Target Environment
 - Textile industry.
 - Laundry shop.
 - Home.

1.4 Definition

Automated Laundry System: A way of managing cloths by ironing, folding and packaging where without human effort an user can do the tasks. In a word after providing the necessary commands about the cloths and ensuring the necessary balance the system will do the tasks on behalf of the user.

1.5 References

- [1] Kaushik, Aman Mishra, Aakash Singh, Harsh , B.Hemalatha. (2014). Automatic Ironing Machine. Asian Academic Research of Multidisciplinary. 1. 268.
- [2] T. Naidoo, “Automatic Ironing Machine”, United States Patent US4980981A, May 29, 1998
- [3] Y. Liu, K. Wang, D. Tran, “Cloth Folding Machine”. Internet:<https://openscholarship.wustl.edu/cgi/viewcontent.cgi?article=1089context=mems411> , Oct. 10,2017
- [4] T. Selker, P. Alto, G. Rozov, “Fabric article folding machine and method”, United States Patent US8973792B1, Nov. 14,2012

1.6 Overview

To compete with the modern technologies that are making our life easier automatic laundry system is a good option. It can reduce the hustle of processing and managing cloth effectively. As it automates the complete system there will not be any human effort only for doing a specific job. User can directly interact with the system so that he/she can process the cloth by himself/herself. As the billing system is also automated there will not be any hustle of physical transaction. The hardware is designed in such a way that it can be used by any ages of people and the software is also made user friendly.

Chapter 2

Overall Description

A QR code will be generated to pass the information to the vending machine. It will then check if there is available balance in the account. After confirming the available balance it will start the procedure. Firstly it will be placed to a board which will be in a rod frame then the task of ironing will be done. Then the board will fold the cloth in the folding section. After proper folding it will be passed to the packaging section by one of the folding board. At the end balance will be modified in the account. The whole system will take maximum two minutes to do the task. This automated system can be used as a home appliance or for industry.

2.1 System Environment

The proposed system can be placed in different kinds of environment but the purpose of the system will be same for all types of environment. The system can be used as a home appliance where there will no billing system as well as in the garment industry. In the garment industry there will be hardly needing the billing system. But for the laundry shop the billing system is a must option. So by keeping the purpose same the system can act in different environment.

2.1.1 Context Diagram

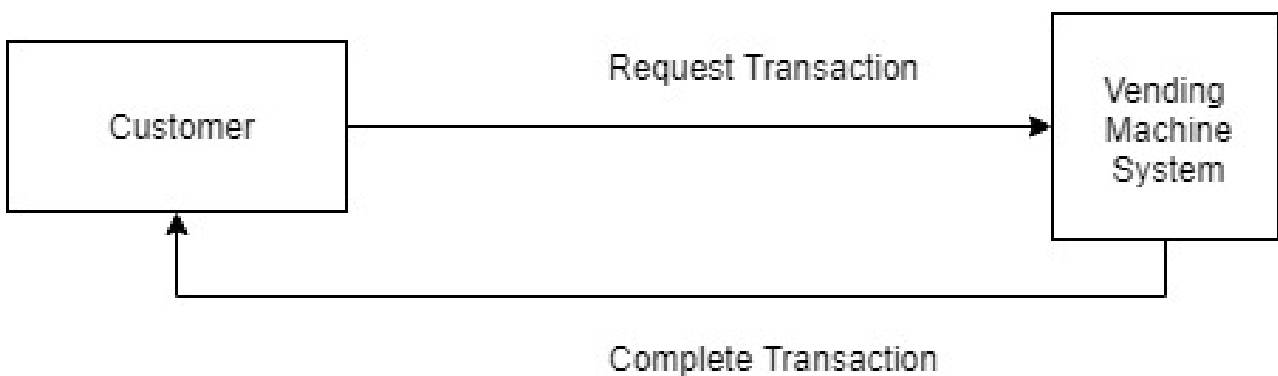


Figure 2.1: Vending Machine Context Diagram

In the vending mechanism the user application will generate a QR code which will be scanned by the vending machine through a camera. It will then connects with the database and verify and authenticate user and balance information.

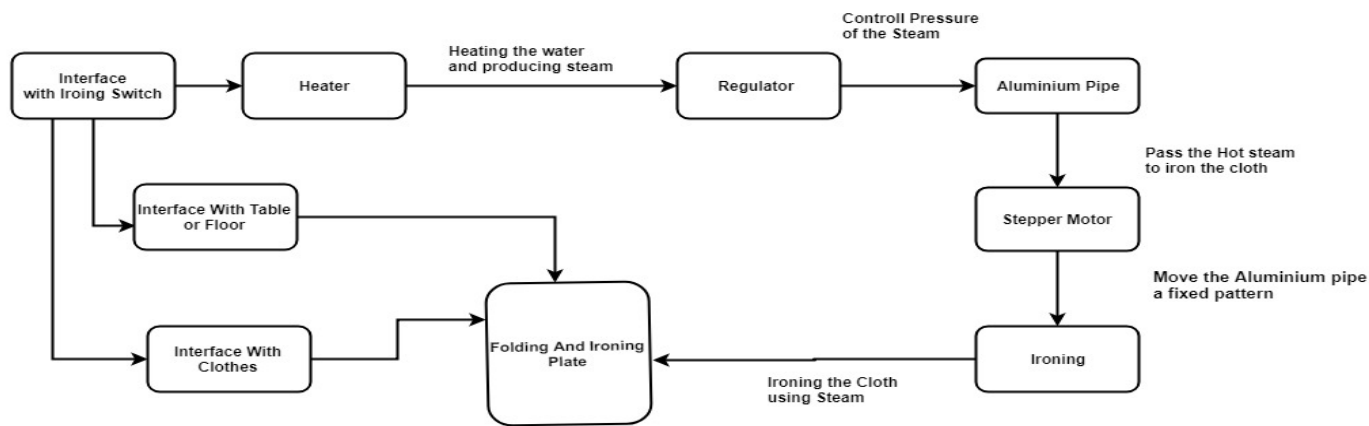


Figure 2.2: Ironing Context Diagram

In the ironing section of the proposed system after getting confirmation from the user about the cloth type and the balance verification from the database, the process of ironing will be started. As the proposed system use steam ironing technique for the ironing purpose. Firstly a heater will provide heat to the water that is kept in a closed water pot. It will produce steam for the ironing. A regulator will control the flow of the steam. Then the steam will be flown over the cloth. The ironing plate will be used as the folding plate for the efficiency of the system. Ironing and the folding plate will be placed in a table to organize the whole system. As the same plate will be used for ironing and folding, the user have to place the shirt/pant in the specific place of the plate.

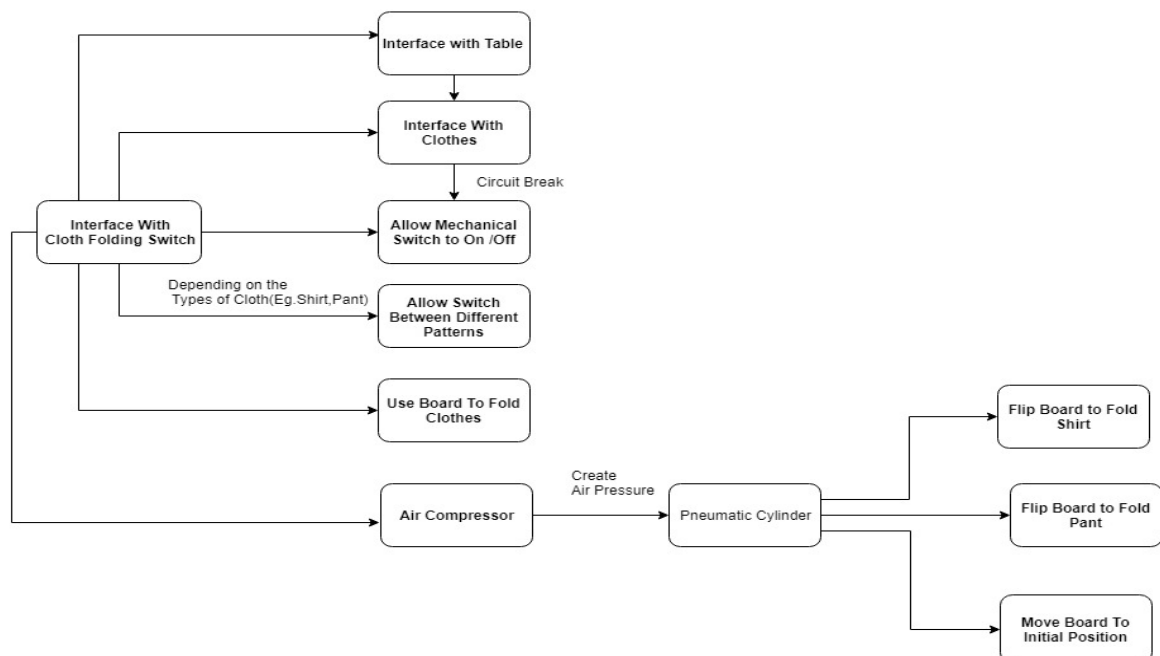


Figure 2.3: Folding Context Diagram

After getting release from ironing section the folding process starts. As user will place the shirt or pant in their specific section of the plate, it will fold the plate according to the choice of the cloth. The cloth will be folded by pneumatic cylinder. Pneumatic cylinder will rotate the parts of the folding plate to fold the cloth by getting air pressure from the air compressor which will be controlled by solenoid valve.

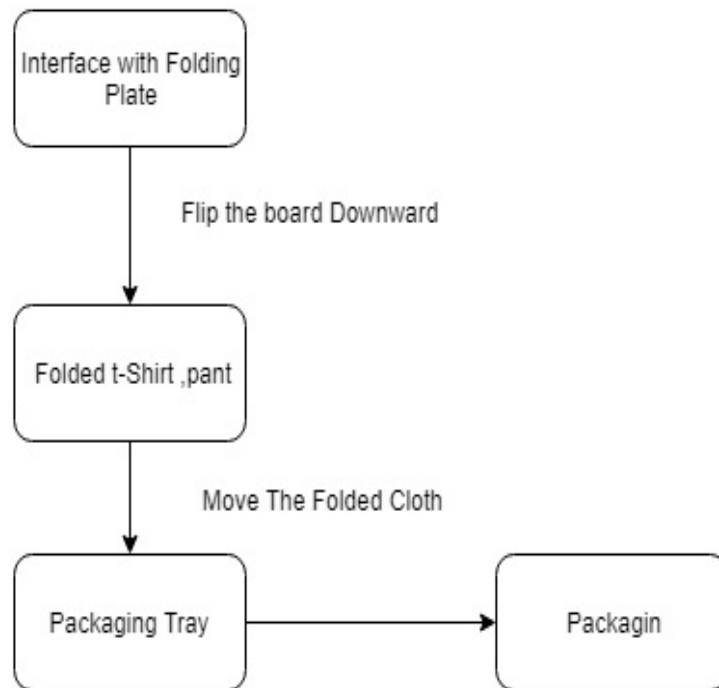


Figure 2.4: Folding Context Diagram

In the packaging section one of the folding plate will go downward with the help of pneumatic cylinder. It will slide the cloth to packaging tray. The packet will be set earlier manually.

2.2 Functional Requirements Specification

Ironing, folding, packaging and vending mechanism will be integrated in the proposed system.

2.2.1 Feature List

- Automatic folding machine.
- Automatic ironing machine.
- Automatic packaging machine.
- A vending mechanism for process and billing.
- A mobile application to use the system.

2.2.2 Use Case Diagram and Tabular Description

2.2.2.1 Laundry System

Use Case

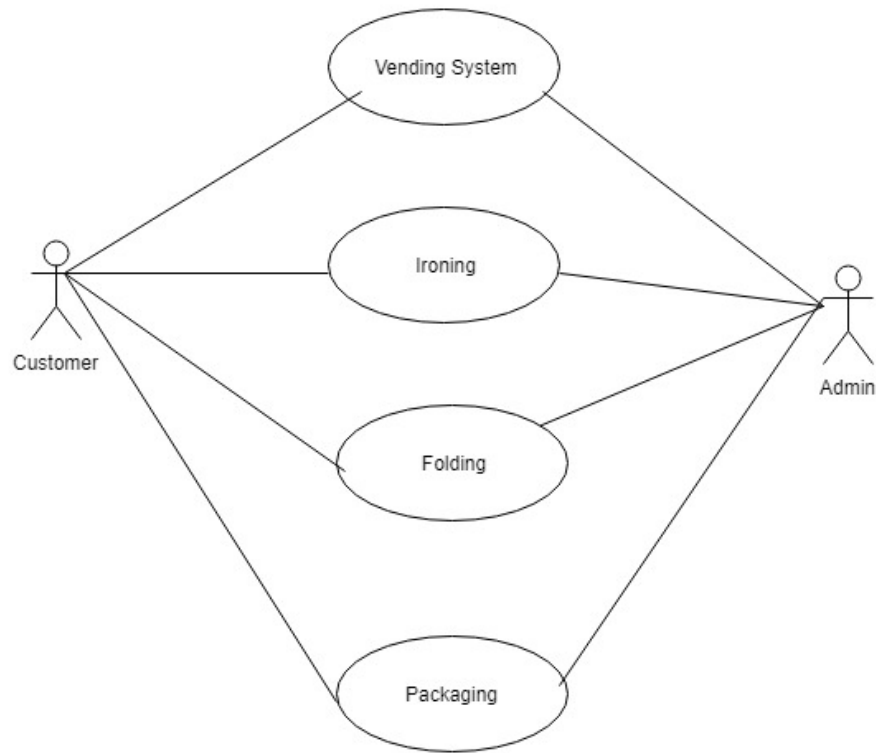


Figure 2.5: Laundry System Use Case

Tabular Description

Vending System	
Actors	Customer, maintenance engineer/people, admin.
Description	Customer can use the system by a mobile app. After verifying the transaction, customer can proceed.
Data	Customer's personal information, customer list with their respective balance.
Stimulus	When the QR code is ready for scanning.
Response	Shows a message whether customer can proceed or not.
Comments	Design should be user friendly. Information must be protected.

Ironing	
Actors	Machine operator, customer.
Description	Operator will place the clothes in the ironing plate and starts the machine. Machine will do ironing by using steam.
Data	Not needed.
Stimulus	When the authentication from the laundry data store is confirmed.
Response	After ironing, machine will sent the clothes to the next step.
Comments	Fully automated.

Packaging	
Actors	Machine operator, customer.
Description	Packing the folded clothes automatically.
Data	Not needed.
Stimulus	When the authentication from the laundry data store is confirmed and after the folding is completed.
Response	Process will be terminated.
Comments	Partially automated.

Folding	
Actors	Machine operator, customer.
Description	After ironing, clothes will be fold automatically. T-shirt, shirt, and pant can be folded. .
Data	Not needed.
Stimulus	When the authentication from the laundry data store is confirmed and after the ironing is completed..
Response	After folding, machine will sent the clothes to the next step. .
Comments	Fully automated.

2.2.2.2 User Use Case

Use Case

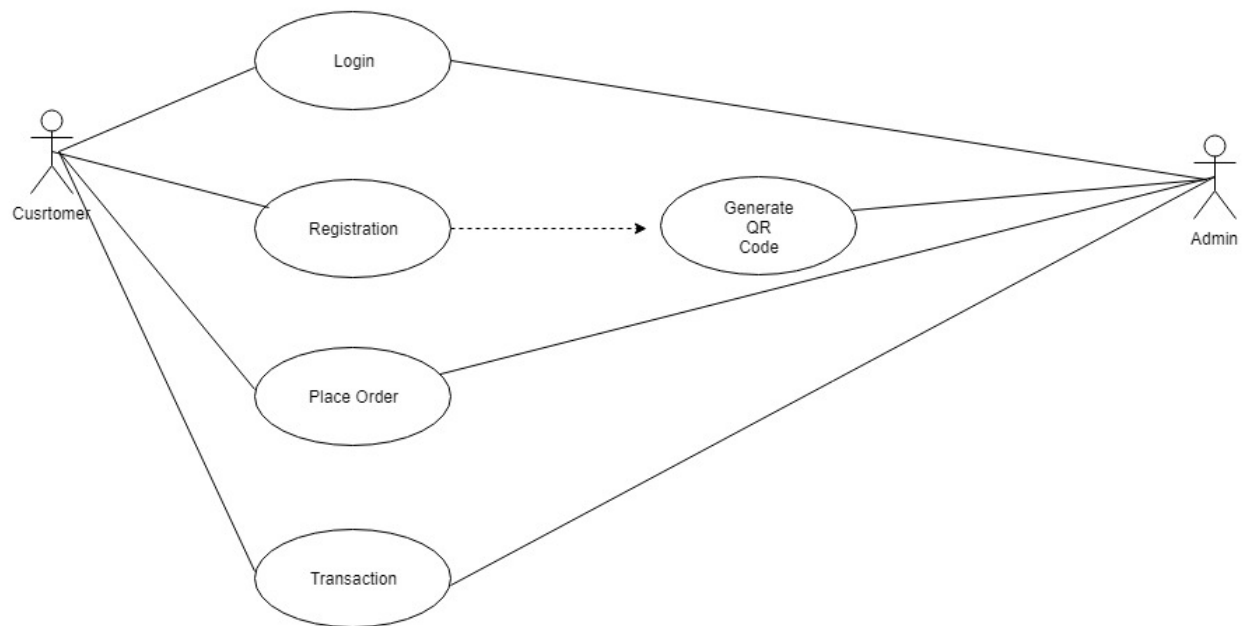


Figure 2.6: User Use Case

Tabular Description

Login	
Actors	Customer, system admin.
Description	Log in is required for customer when h/she wants to use the machine. It will be done by mobile app.
Data	User name, password.
Stimulus	After authenticated from the system by giving user id and password.
Response	A successful login will show a message and customer will be permitted to proceed. Unsuccessful loading will also show the message.
Comments	Android app

Registration	
Actors	Customer, system admin.
Description	Required when customer wants to open a new id.
Data	User name, password.
Stimulus	When the necessary information for the registration is given.
Response	A successful registration is done after email verification. Then customer can log in the app.
Comments	Android app

Generate QR code	
Actors	Customer, system admin.
Description	A fixed QR code is generated for every customer after registration.
Data	Data for QR code.
Stimulus	After the registration is completed.
Response	Can be logged in by scanning QR code.
Comments	Android app

Transaction	
Actors	Customer, system admin.
Description	If there is enough balance in customer's account, then customer can use the machine. After every use, a fixed amount of balance will be reduced. Customer can refill the balance.
Data	Balance detail for every customer.
Stimulus	When there is enough balance in the customer account.
Response	Show the message about the transaction and account balance.
Comments	Android app

2.2.2.3 Admin

Use Case

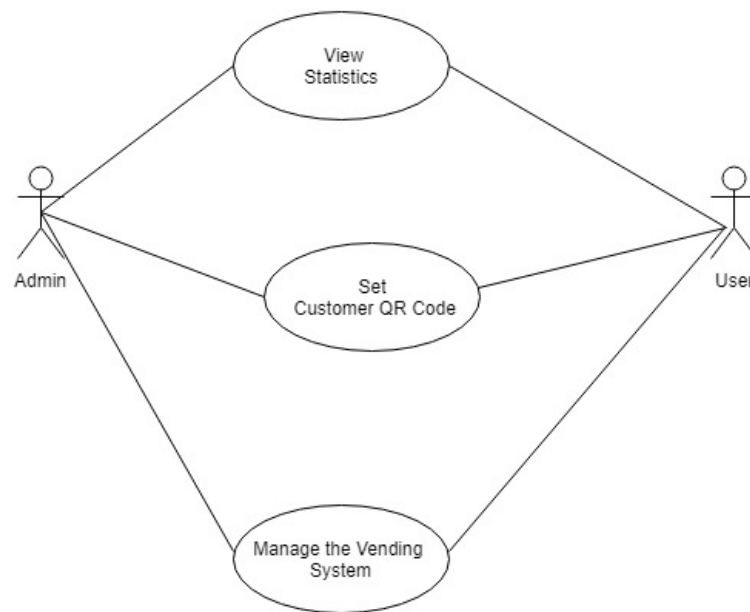


Figure 2.7: Admin Use Case

Tabular Description

View Statistics	
Actors	Admin, User.
Description	Statistical maintain of the customer money transaction, managing QR code of the customers.
Data	Amount of money customer transacts, QR code
Stimulus	The Laundry system should be developed by specialized programmer, technician and also Needs to maintain the database effectively .
Response	Show the statistical view of the whole system to admin.
Comments	Needs to maintain perfectly

Set QR Code	
Actors	Admin, User.
Description	When customer create an account in the laundry system, the system will set a QR code for the customer on basis of their unique information.
Data	Customer Unique information.
Stimulus	Generate QR code after customer make their registration.
Response	The generated QR code is given to the customer.
Comments	Needs to maintain perfectly

Manage the vending system	
Actors	Admin , User.
Description	The vending mechanism mainly consists of money transaction, QR code generating and QR code Processing and maintaining the database So it is necessary for the admin to manage the vending system .
Data	Not needed.
Stimulus	Maintain money transaction ,QR Code generate, QR code scan
Response	The laundry system gets very easy to maintain
Comments	Require effective maintenance

2.2.3 Data Flow Diagram

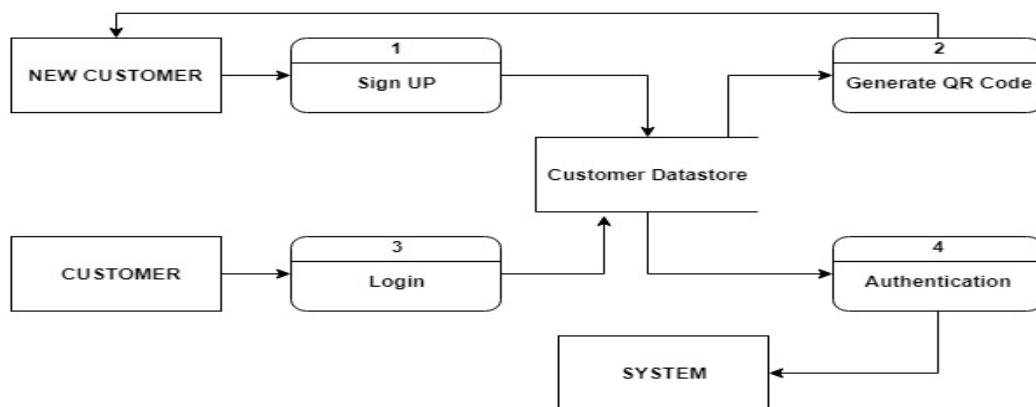


Figure 2.8: Sign Up / Login Data Flow Diagram

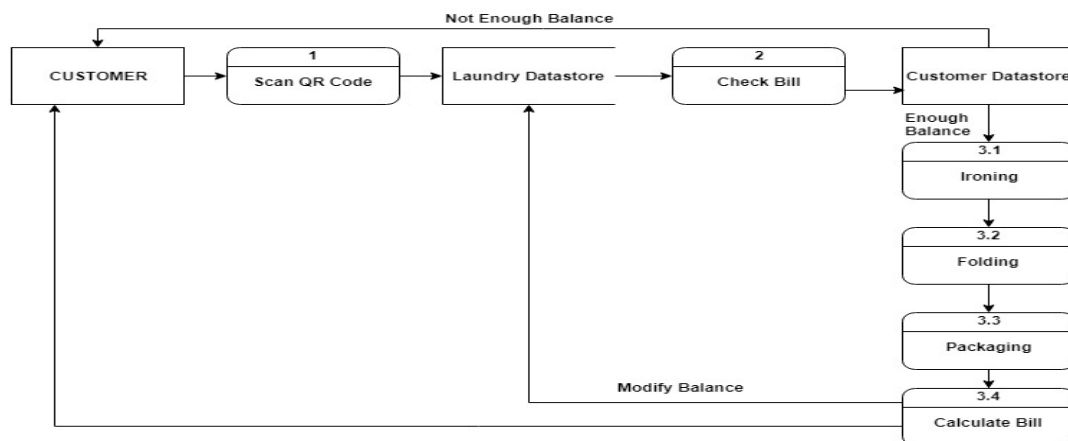


Figure 2.9: Laundry System Data Flow Diagram

2.3 User Characteristics

There are three kinds of user of the proposed system.

- *Individual*: The proposed system can be used as a home appliance. Any individual can use it in home to make the ironing, folding and packaging more easily and organize. The billing part of the system can be ignored here.
- *Industry*: In the garments industry the proposed system can be used to iron, fold and packet lots of cloths in a convenient way. It will reduce the time it takes to do the job in hand.
- *Laundry Shop*: It can be used in the laundry shop where without any human involvement from the shop side a user can do the task automatically and pay the bill.

2.4 Non-Functional Requirement

2.4.1 Performance Requirements

- **Name Of The Feature** : Scanning QR Code
 - **Input** : QR Code
 - **Expected Output** : User Information
- **Testing Type** : Integration Testing
 - Clearly scanning the QR code is important to fetch user information from the database.
- **Criteria Assessment** : Accuracy
- **Name Of The Feature** : Graphical View
 - **Input** : User usage information
 - **Expected Output** : Graphical view of user usage
- **Testing Type** : Integration Testing
 - While fetching lots of information to show in a graph it takes time to perfectly showing the points.
- **Criteria Assessment** : Response Time
- **Name Of The Feature** : Graphical View
 - **Input** : Navigation Button
 - **Expected Output** : Expected page of the application
- **Testing Type** : System Testing
 - After pressing the navigation button for moving to the next page or previous page of the application it shows blank page.
- **Criteria Assessment** : Responsiveness
- **Name Of The Feature** : Login System
 - **Input** : User name and Password
 - **Expected Output** : Successful login

- **Testing Type :** Unit Testing
 - When user name and password is provided in spite of being correct it sometimes doesn't authenticate.
- **Criteria Assessment :** Security
- **Name Of The Feature :** Billing System
 - **Input :** Usage information
 - **Expected Output :** Updated balance
- **Testing Type :** System Testing
 - After using the system the user bill has to be updated with the new balance sometimes it takes time to update with the new bill.
- **Criteria Assessment :** Reliability

2.4.2 Safety Requirements

- Online database is used to avoid physical database failure.
- Complex circuitry are not visible to the normal user to avoid any harm to the normal user.
- All ac current supply is handled properly to avoid accidents.

2.4.3 Security Requirements

- System will use secure database.
- Normal users can just read information but they cannot edit or modify anything except their personal and some other information.
- System will have different types of user and every user has access constraints.
- Payment method will be done only by the authorized person.
- All network transactions that involve financial information or personally identifiable information shall be encrypted.
- Users shall be required to log in to the system for all operations

2.4.4 Software Quality Attributes

- Accuracy
- Response time
- Responsiveness
- Security
- Reliability

Chapter 3

Specific Requirement

3.1 External Interface Requirement

3.1.1 Software Interface

User of the system will be provided with the GUI containing:

- A login page which accepts verified user name and password for registered user.
- A sign up page where unregistered user can register.
- View / Edit profile page will be shown to view / edit the user information.
- A balance page will be there to view the available balance in the account.
- The system usage information graph (monthly) will be shown in a page.

3.1.2 Hardware Interface

Hardware interface of the proposed system will be included with:

- Vending mechanism which can scan QR code to fetch the user information from the application.
- A database will be maintained which will be connected with the vending machine.
- Pneumatic cylinder will be controlled by solenoid valve. Solenoid valve will be controlled by relay and arduino.
- For generating steam an external steam generator will be used.
- The movement of the steam generator output inlet will be controlled by stepper motor.
- The packaging part will be maintained through the folding board.

3.2 Design Constraints

- In the proposed system steam generator is a constraint as for ironing, the system uses the steam ironing method. Since the proposed system needs a good amount of steam for ironing the steam generator must be less time consuming to convert water into steam.

- For folding part the proposed system uses pneumatic cylinder and for functioning the cylinder an air compressor is used. Air flow is a constraint. Air flow from the compressor must be controlled through regulator otherwise extra pressure of air can make the system fail.
- Position of the cylinder is a constraint. As the system have to lift up a part of the folding board, it must be more then 90-degree to fold a specific part of a cloth.
- One part of the folding board will be used for packaging. It is a constraint because this part must slippery to move the cloth.
- In the vending machine section, internet connection is a constraint. As the system have to update the database after a successful process completion.
- Database is a constraints as the system have to store the user information as well as the user usage information and billing.
- In the application (admin) part the control of the admin is a constraint so that the admin can view the overall usage information.
- In the application (user) part generating QR code is a constraint otherwise user can't communicate with the system.