



Quality Assurance Automation System for a biscuit manufacturing company

**A dissertation submitted for the Degree of
Master of Information Technology**

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Quality Assurance Automation System for a biscuit manufacturing company

Declaration

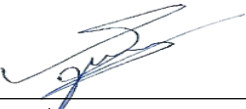
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Quality Assurance Automation System for a biscuit manufacturing company

Preface

This thesis presents my work on the topic of Quality Assurance Automation System for a biscuit manufacturing company. Following chapters are included in this thesis.

Introduction chapter which has basic information related the project is described. Motivation, objectives, scope, deliverables, Limitations and feasibility study about the proposed project are mainly focused areas in here. Background chapter which is basically discuss and compare about the other researchers work. Methodology chapter is use for the development of the system is given in here. Design structure need to be clearly defined in here. Testing and Evaluation chapter provides an overall evaluation of the system implementation. Whether the project objectives are met and lessons learnt while implementing project should be describe in here. Finally, conclusion includes the summary of the final implementation and future improvements.

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Abstract

The aim of this project is to develop an online web based computerized system called “Biscuit Quality Assurance Automation System”. Currently they don’t have computerized process to overlook entire biscuit manufacturing process. They are conducting the biscuits quality assurance process in a manual way to record details such as quality parameters (Color, Taste, Moisture etc) information and production related issues etc. Also, they don’t have previous QA related reports of each product. Due to those issues their process is time consuming and less efficient This causes many problems for all the employees including top management to operational level employees.

After the interviews and discussions had with management team, data are gathered and below mentioned system facilities are proposed.

This system facilitates interaction among the biscuit quality parameters, quality checker, Shift Manager, Production manager and System Administrator. By introducing the Quality Assurance Automation System, supervisors can take quick action when issues are found in quality related parameters in production, managers can access monthly and quarterly wise product reports. That will help to make future production decisions. There will be a dashboard that facilitates monitoring real time product line statistics for managers in the current process.

This project is following the waterfall model in order to develop the software application required. This consisted of gathering and analyzing the user’s requirements, and then through a number of iterations, designing, implementing, and testing the application to identify whether users’ requirements have been met.

Users can access the Quality assurance System after implementing and host the system with the above-mentioned features through the organization network (Intranet). All the allowed user can access their respective authorized working area of the system. After implemented the system each user having common user logging screen and their specific operation related screens.

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List of Acronyms

1. **QA** – Quality Assurance
2. **MVC Architecture** – Model View control Architecture
3. **On-Prem** – On Premises
4. **ER diagram** – Entity Relationship diagram
5. **PK** – Primary Key
6. **FK** – Foreign Key
7. **AWS** – Amazon web services
8. **GCP** – Google Cloud Platform
9. **IBM** – International Business Machines
10. **RAM** – Random Access Memory
11. **SSD** – Solid State Drive
12. **VPN** – Virtual Private Network
13. **UI** – User Interface
14. **NFR** – Non-Functional Requirement
15. **SLA** – Service Level Agreement
16. **OOD** – Object Oriented Design
17. **UAT** – User Acceptance Testing
18. **PM** – Production Manager
19. **QC** – Quality Checker
20. **SM** – Shift Manager

Chapter 1 - Introduction

1.1 Introduction

Ceylon Biscuits Limited (CBL) Group is a Sri Lankan company specializing in the food industry. CBL manufactures a wide range of products under their leading brands. Its award-winning products are internationally distributed and locally adored. CBL mainly concern about their biscuit products' quality thoroughly. Manufactured product can cost them greatly not just in terms of profit, but also in view of customers. They conducted the biscuits QA process in a manual way to record details such as quality parameters (Color, Taste, Moisture etc) information and production related issues etc. This manual process is time consuming and less efficient.

During the manufacturing process there are some problems like quality related issues, slowness of decision-making process and any other biscuits related manufacturing issues have to track properly. There is an online web-based system called "Quality Assurance Automation System" will be introduce to overcome these problems. By introducing the "Quality Assurance Automation System" following issues will be addressed, they are, supervisors can take quick action when issues are found in quality related parameters in production. If this happens manually, that might be a time-consuming task. Current manual process doesn't have previous QA related reports of each product. After introducing this system managers can access monthly and quarterly wise product reports. That will help to make future production decisions. There will be a dashboard that facilitates monitoring real time product line statistics for managers in the current process.

1.2 Project overview

CBL mainly concern about their biscuit products' quality thoroughly. Manufactured product can cost them greatly not just in terms of profit, but also in view of customers. For that reason, Quality Assurance Automation System will be introducing. The checking procedure takes place from raw material until the products are packed ready to be distributed.

There are two job roles are involving in this biscuit quality checking process. They are Operational level quality checker and shift manager. Shift manager needs to report production manager. This is the employee structure of biscuit production and quality assurance section in CBL.

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CBL Manual QA Flow

Shift managers are in charge of more than one product and quality checkers' works under them. Depending on the product, quality checkers checks the product flow every 30mins or every hour, etc.

Each product has different parameters such as weight, water level, moisture, thickness, texture, color, packaging and taste. It is important that each of these parameters are maintained to the expected standard. For example, if a weight of a single biscuit is 0.1grams greater than expected, since those are mass produced, a lot of materials will go to waste as well as an unnecessary expense.

If a change is reported in any of the above-mentioned parameters, the shift manager will be informed through quality checker. The shift manager will have to take necessary actions regarding the identified fault. These faults are also shown using lights. There are three indicators, red, amber and green are used to represent the data. Red represents that an error has been reported and it also beeps until necessary precautions are taken. Amber represents that a decision is in progress. Green indicated that all the manufacturing processes are going accordingly. This is the production and quality process of CBL.

Identified drawbacks in current flow and Introduce automation system

Biscuit's production is profitable business industry in Sri Lanka, most of the companies use manual ways to record details such as quality parameter (Color, Taste, Moisture etc) information and issues etc. This manual process is time consuming.

In order to overcome this identified slowness in manual process, web based computerized system called "Quality Assurance Automation System for CBL" is introduced. This system facilitates to interact among the biscuit quality checker, Shift Manager, Production manager and System Administrator. Because of this system their production will increase.

Need to improve in organizing the content and presentation.

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1.3 Motivation

Biscuit's manufacturing company, it's valuing their product quality thoroughly. Mistakes in their manufactured product can cost them greatly not just in terms of profit, but also in view of customers. For that reason, Quality Assurance Automation System will be introducing. The checking procedure takes place from raw material until the products are packed ready to be distributed.

By introducing "Quality Assurance Automation System" following issues will be addressing,

- Supervisors need to note quality related parameters manually and need to analyze those when issues are happening. This might be time consumable task. Due to this reason issue detection workflow will be slow. That may case to reduce efficiency of decision-making process.
- Current manual process doesn't have previous QA related reports of the products. If those are available that will be helping to make future decisions.
- There is no way to monitor real time product line statistics for managers in current process.
If it is in a centralized dashboard then it will become easy to access within the organization network.

1.4 Objectives

- Biscuits Products Quality Checking System will introduce to automate this manual QA process.
- Implement detection system for biscuit products which are not in expected condition (Color, Size, texture etc)
 - Identify quality biscuit product
 - Identify biscuit product with issues
- Facilitate to access the system through UI for Product manager, Supervisor and quality checker.
- Implement to Identify high occurrences of quality issues in biscuit products and what are the
- decision taken to overcome those issues by using reports.
- Facilitate centralized report view feature within the organization.

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1.5 Background of the study

1.5.1 Similar System Comparison

“Food Manufacturing Traceability Software for Food Safety & Quality Control” and “Food & Beverage Quality Management” systems are used to compare with my proposed system [1]. (Table 1.1)

Table 1.1: Similar Systems

Biscuits Products Quality Checking System Feature	Similar Systems	
	Food Manufacturing Traceability Software for Food Safety & Quality Control	Food & Beverage Quality Management
Add QA staff		
Create Product plan		✓
Add quality parameters [2]		
Add Product	✓	✓
Add decision [3]	✓	✓
Add complaint		
Generate issue detection notifications		✓
Create categories	✓	✓
Generate reports [4]	✓	
Web based system	✓	✓

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1.5.2 Scope of the study

- Automated System will be introduced only to biscuit products QA operational area.
- Always system will compare current biscuit product with good biscuit product parameters which are entered by quality checker.
- System will facilitate to identify bad quality products in convenient belt and just display notification.
- Generate reports which are including monthly product plan, what are decision taken to product issues and Quality parameter for each product.
- System can access by product managers, supervisors and quality checkers within organization network.

Assumptions

- Quality checker should input quality measurements without any mistakes.
- Biscuit's quality test performed properly.

1.6 Feasibility study

A feasibility study is part of the initial design stage of project. This can be described as prerequisites to initiate a project. There are few factors need to be study, these are economic, technical, legal, and scheduling feasibility. This study can be carried out analyzing whether the new system will realistically be affordable, beneficial, and feasible to put into practice by the business. After assessing these aspects for the biscuits manufacturing company, a decision can be made on whether to continue with further progression of the proposed system.

1.6.1 Economical feasibility

The web system to be developed for the business must be affordable by them, and the benefits of using the system in the biscuit manufacturing company must outweigh the costs associated with purchasing and using it. The tools required to develop the software application for the biscuit company will not cost them for directly.

When consider initial cost, that is very low because of this web based one, due to that reason this system can access through any web supported devices. If company decide to purchase desktop or tablet devices, again it will not require to high hardware specification (high end devices). That is case to reduce the initial purchasing cost. Addition to this, there is small cost related to the user training process.

If consider about recurrent cost that will be an amount with renewal cost. As a large-scale food production company that cost can be easily affordable for them.

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1.6.2 Technical feasibility

Technical feasibility considers about the technical requirements of the proposed system. This is a web-based system. All the Managers, Supervisors and Quality checkers facilitate to access the system through the web browser, which is capable of running the proposed web application.

Main tools used are “Microsoft visual studio” and “MySQL” server. These tools are providing adequate features and skills required is manageable. This website will be hosted in a free hosting service.

Therefore, technology to be chosen for the proposed system is sufficient.

1.6.3 Legal feasibility

The implementing system must oblige to the company requirements and conditions that have been legally imposed and not break any of their laws. There are no legal issues for the proposed system for biscuit company as the technologies used for the system can be obtained legally for free as they are available in official website.

When accessing their actual business data (Production data) to system testing purposes and design stages. That situation happens with legal agreement. Therefore, the project is legally feasible.

1.6.4 Scheduling feasibility

In scheduling feasibility describe about the timelines of the planned project. For this proposed web application, there is a pre-defined time plan to continue the project from start to end. There should be a no huge time gap when requirement gathering phases and get clarification for the unclear areas. Because of these reasons, this will badly affect to the project delivery timeline. Therefore, good understand is required with the both parties.

1.7 Summary

In this chapter describe about the process of biscuit manufacturing quality assurance and introduce online web solution. In this introduction section identify the issues/ drawbacks of existing process and how will overcome that the issues/ drawbacks after introduce the computerized system.

Chapter 2 - Background

2.1 Introduction

Biscuit products have been widely popular among consumers of different age groups for several centuries. The analysis of biscuit quality assurance has been subject to a number of studies focusing on the improvement of their taste properties by taking into account the impact of different factors. However, the application of biscuit product quality control in production plants during the technological process has not been analyzed in sufficient detail in the scientific literature.

Preliminary studies were designed to analyze the possibilities of replacing panels for analytical testing by expert appraisers with testing using nonexpert methods by manufacturing workers to control the quality of the final biscuit product. Many researchers have found that the results of evaluations conducted with untrained professionals are reliable and comparable to those conducted with panels of expert assessors. An argument to support the use of non-expert methods of sensory analysis in product control is the fact that some of the manufacturers typically cannot afford to use sensory assessment experts for a 24-hour production and control cycle. In this case, the use of available human resources (manufacturing workers) may be the only alternative for conducting objective sensory control of the product

In this chapter explained about the current biscuit products quality assurance systems (Under similar system with reference) and how those are functioning. By introducing “Biscuits Products Quality Checking System” this will help to improve some of area efficient and effective manner. In requirement analysis section mentioned about all the user needs and also explained about related technologies and related design strategies.

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By introducing “Biscuits Products Quality Checking System” following issues will be addressing,

- Supervisors need to note quality related parameters manually and need to analyze those when issue are happening. This might be time consumable task. Due to this reason issue
- detection workflow will be slow. That may case to reduce efficiency of decision-making process.
- Current manual process doesn't have previous QA related reports of the products. If those are available that will be helping to make future decisions.
- There is no way to monitor real time product line statistics for managers in current process. If it is in a centralized dashboard then it will become easy to access within the organization network.

2.2 Requirement Analysis

In requirement analysis phase, I will gather information about how biscuit production is going on, which parties will involve with that production process and how they will conduct quality assurance process. Get the clear understand about each task and each user role. Based on their business requirement I'll design the system front end and back end with business functionalities. If successfully collect the business needs, it'll help to implement client side and server-side design.

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2.2.1 User Requirements

- There should be a facility to enter biscuit product plan and product category to the system. Users are Shift manager or System administrator.
- Shift manager or System administrator need to add food quality parameters to the system.
- While the manufacturing process quality checker will add the product quality related issues to the system as a complaint. Then the system will assign it to the next available shift manger. So, shift manger should be taken decision for that issue. Those data should be handled through the software application.
- The system should have user registration facility to enter quality checker and shift manager information.
- System administrator, shift manager, quality checker and production manager who are the users of this system.
- The system should have facility to view following reports. These reports will view by all the users in system.
 - Monthly Product Plan Report.
 - Quality Parameter Report.
 - Decision Report.
 - Quality Checker Report.

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2.2.3 System Requirements

2.2.3.1 Functional

- System should have separate user interface for following workflows.
 - Add Product plan - Before starting the production process of a particular item respective task owner will create specific plan for that.
 - Add Product Category - System will have facility to enter each product category information.
 - Add Quality Checker - There is a facility to add users into proposed system. That will help to manage their work properly.
 - Add Quality Parameters - There are few parameters such as weight, water level, moisture, thickness, texture, color, packaging and taste.
 - Add Shift Manager - There is a facility to managers into proposed system. That will help to track QA staff task properly.
 - Add Product - After product planning process, client needs to add product plan to the system.
 - Add Complaint - During QA process they are doing inspection for their production lined items and enter their finding into the system if those are critical.
 - Add Decision - After the complaint for respective production item, then task owner need take necessary action for that.
 - Monthly Product Plan, Quality Parameter, Decision Report, Quality Checker Report - monthly and quarterly wise product report will generate through the system.
- Four users will access the system. System feature should be control in user level.
 - Administrator – All system functionalities.
 - Shift Manager – All system feature can be access without shift manager creation flow.
 - Quality Checker – Full access will allow for complaint module and report viewing functionality.
 - Production Manager - Full access will allow for decision module and report viewing functionality.

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- Each report required a facility to adjust the date.
- Each UI should have Add, update, delete, clear and cancel buttons.
- Required fields should be validated.

2.2.3.2 Non-functional (NFR)

- User interface should design as user friendly with light colors.
- Each user interfaces and report should be user friendly.
- System may support for Chrome and Firefox web browsers.
- System should respond without any delays. Client-side SLA value as below,
 - 50 Concurrent users.
 - 4 Second Page load time.
 - $\leq 3\%$ error rate.
- Concurrent access should be allowed. (multi-tenant)

2.3 Review of Similar Systems

2.3.1 Comparison of similar system features vs proposed system features

Add QA staff – There is a facility to add users into proposed system. That will help to manage their work properly. There no similar system with this feature.

Add Managers – There is a facility to managers into proposed system. That will help to track QA staff task properly. There no similar system with this feature.

Create Product plan – Before starting the production process of a particular item respective task owner will create specific plan for that. This facility will introduce this system.

Add quality parameters – There are few parameters such as weight, water level, moisture, thickness, texture, color, packaging and taste. Introducing system will have facility to enter these parameters.

Add Product – After product planning process, client needs to add product plan to the system. This is common feature in food related QA systems.

Add complaint – During QA process they are doing inspection for their production lined items and enter their finding into the system if those are critical. This is also common feature in food related QA systems.

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Add decision – After the complaint for respective production item, then task owner need take necessary action for that. That information will track through the proposed system.

Generate issue detection notifications – There is a notification will prompt to the production manager if not taken any decision to ongoing issues. This will be an added feature.

Create categories – System will have facility to enter each product category information. This is also common feature in food related QA systems.

Generate reports – Decision report, monthly and quarterly wise product report will generate through the system. This feature will help to make current and future situation of the business.

2.3.2 Quality of the Solution

Introducing new features in online web solution that are comparatively important when compare with existing features in biscuits quality assurance system. In current process they are doing these things in manually. New features as report generating, add complaint related to the current production and generate issue detection notification. These features will add the important value to the system.

2.4 Related Technologies

- Microsoft Visual Studio is the tool to implement this application and ASP.net will use as programming language.
- Microsoft SQL server as a Database Management System.
- This is Web-based System and need to use Model View Controller (MVC) architecture.
- This system/ web application should host using hosting service.
- System should allow to access through google chrome and Mozilla Firefox latest browser versions.

2.5 Related Design Strategies

According to the Object-oriented programming concept, create separate classes for each identified object. Classes will create based on priority list. Priority list will create depend on the system feature requirements. Before implement the User Interface planning to create main APIs and check it's functional and non-functional behavior. This phase is important to identify issues in early.

- The system will implement using waterfall model Because of system requirements are fixed.
- The system will apply Object Oriented Design (OOD) strategy.
- Identify each section of the system as classes.
- Implement Front end layer, Backend layer and middle layer separately. Finally, integrate the all layers together.
- Planning to conduct unit testing once each main module completed and finally conduct entire system testing.

2.6 Summary

This chapter includes the software development phase related details. Here explained about prior tasks to start system development process. For e.g., system requirements specification phase to deploy the system in client environment E2E tasks. In chapter 2 mentioned about the prerequisite tasks, comparison with existing system and conceptual design details.

Chapter 3 - Design

3.1 Introduction

This Software Design Architecture Document provides an architectural overview of the System including different type of design documents like use cases, ER diagrams and class diagram.

This section includes the design process of the project. A ‘bottom-up’ approach was taken, with a basic entity structure for the application being devised first and then the initial interface design being created based upon its capabilities. The purpose of this process was to take the knowledge gained from the background research that had been collected and use it to design an effective solution for the problem. Creating the design also gave better understanding as to what software development tools would be best suited for creating the solution.

3.2 System Architecture

3.2.1 Overview

This section discusses the overall logical flow of the Biscuit Quality Assurance Automation System.

Figure 3.1 illustrates the Quality Assurance System decision workflow. It starts with identifying the quality parameters of product which are in expected level or not. Here check the quality parameters as Weight, Taste, Moisture and Water level, then compare the actual parameter levels and expected parameter level by quality checker. First decision box will make decision based on that parameter. Product actual parameter are within defined threshold then continue the production flow. This is the meaning of path “T”. If the product actual parameters are not within defined threshold, then quality checker will raise complaint. continue the production flow. This is the meaning of path “F”.

If a make complaint by quality checker, then checks the validity of it through the system calculations. If it is true shift manager will take necessary action for that to recorrect it and continue the production flow, or else so if that complaint false then it will reject. These are meaning of “T” and “F” flows of second decision box.

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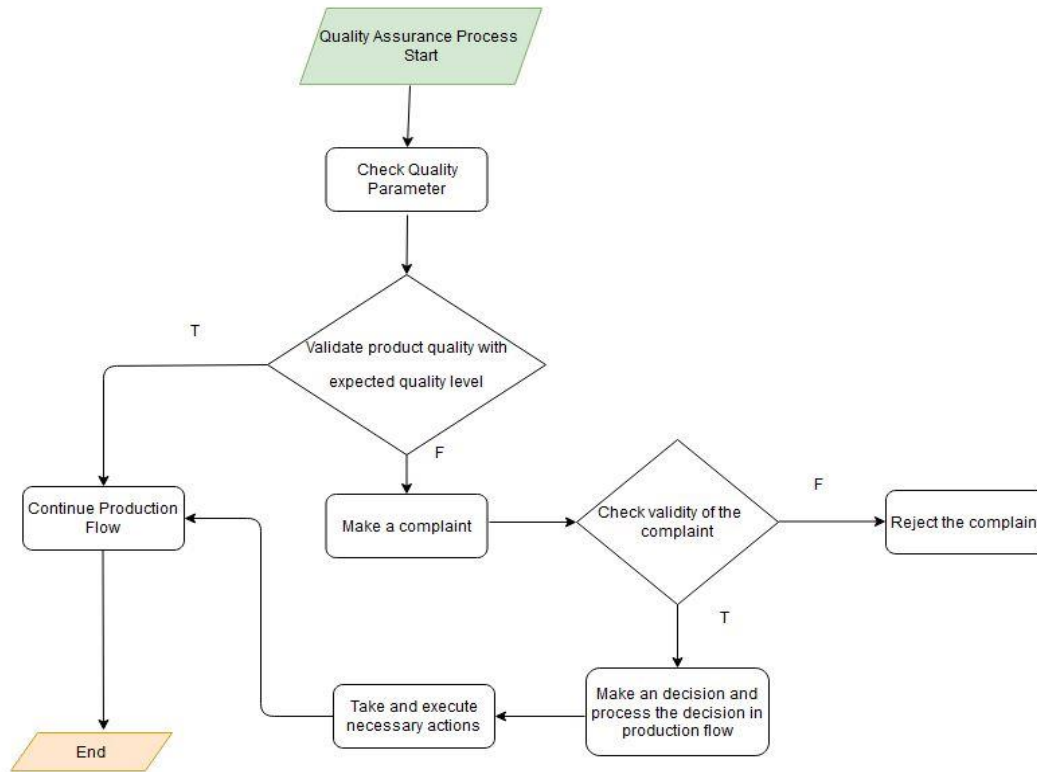


Figure 3.1: Decision Flow Chart

3.2.2 Architectural structure

Proposed system architecture is model-view-controller (MVC) architecture. This web application can be separate in to three basic functional sections which can be named as model, view and controller. Please refer to figure 3.2

The “model” section represents the business layer of the application. Create particular classes base on the required objects. This is created after clearly identify the object as classes. Here developer can define private variable in each class and apply encapsulation.

The “view” section represents the visual interface which gives a medium to web users to interact with the system. For an example, the Product view includes UI components such as text boxes, dropdowns, etc.

“Controller” section is use to make an interface between Model and View components to process all the business logic and incoming requests, manipulate data using the model component and interact with the views to render the final output into web browser. For an example, the quality checker controller will handle all the interactions and inputs from the quality checker view and update the database using the quality checker model. The same controller will be used to view the quality checker data.

Quality Assurance Automation System for a biscuit manufacturing company

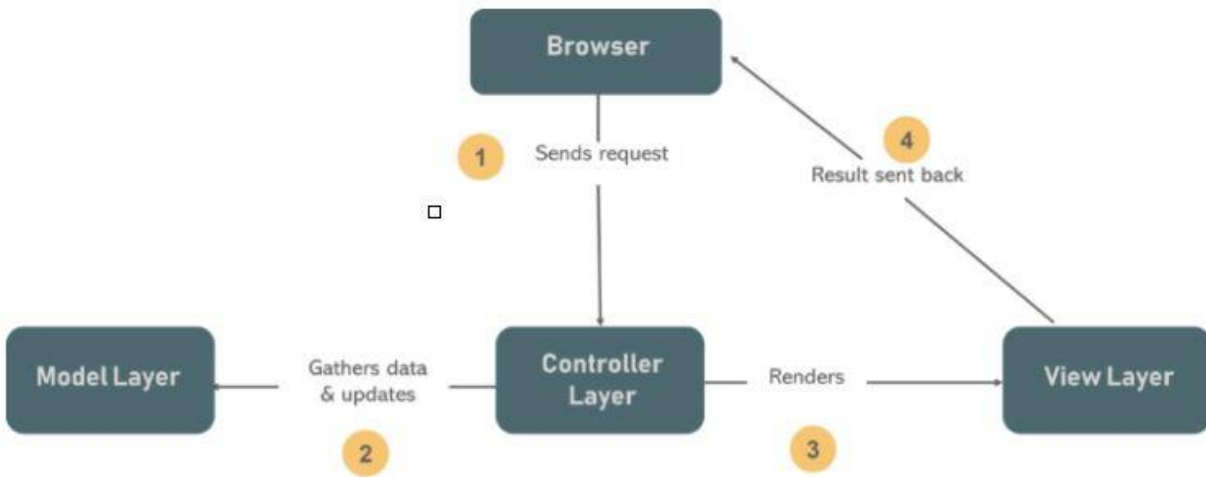


Figure 3.2: MVC Architecture

- Based on the requirement identify each section of the system as classes.
- After implanting the system, it will deploy in On-Prem server. (Hosting environment can be third party commercial hosting platform like AWS, GCP or IBM)
- According to the figure 3.3 when accessing the system from outsider network they should be logged into company/ Organization VPN. Within the organization, employees can directly access the system via company network.

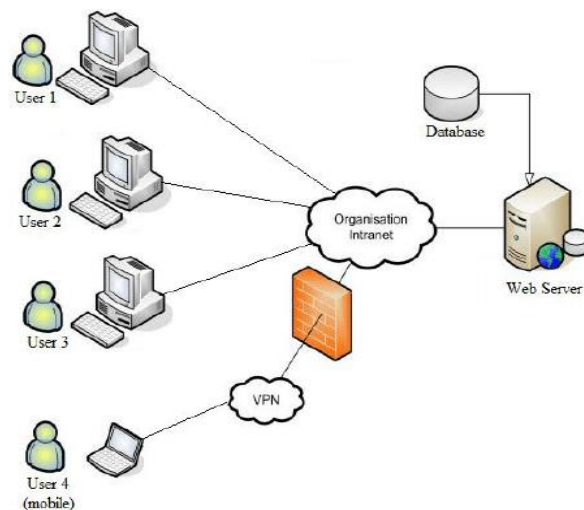


Figure 3.3: Client Server Architecture

Quality Assurance Automation System for a biscuit manufacturing company

3.3 UML Diagram

3.3.2 Use case diagram

Actions between Administrator and System

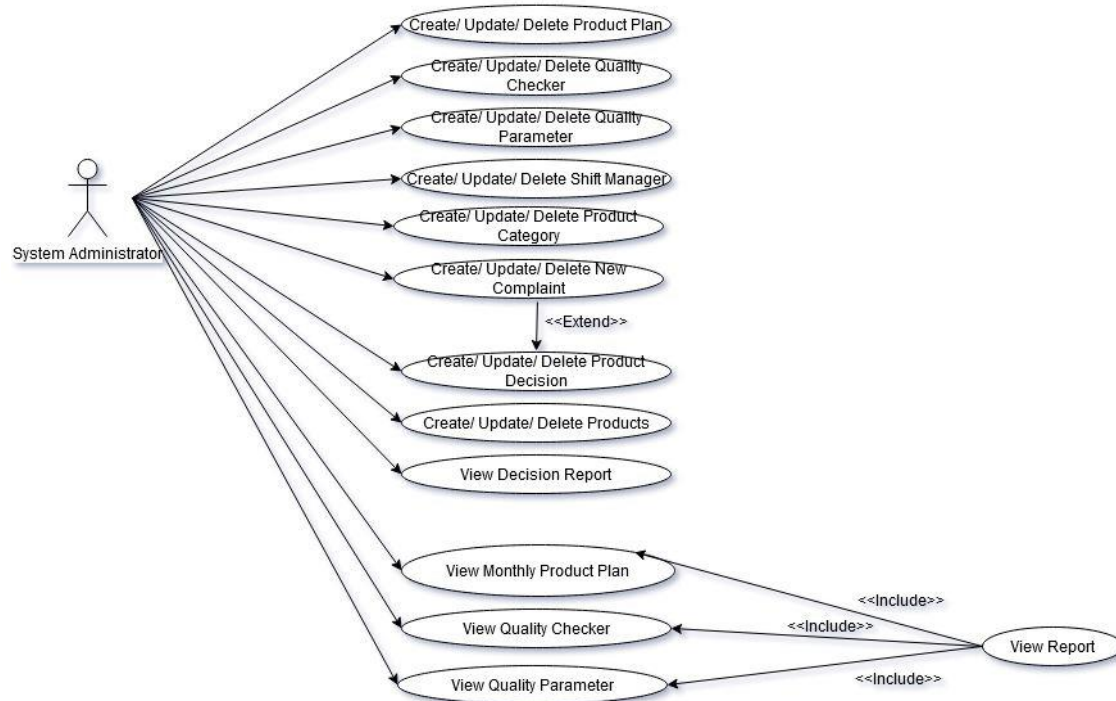


Figure 3.4: System Administrator

Quality Assurance Automation System for a biscuit manufacturing company

Actons between Production manager and System

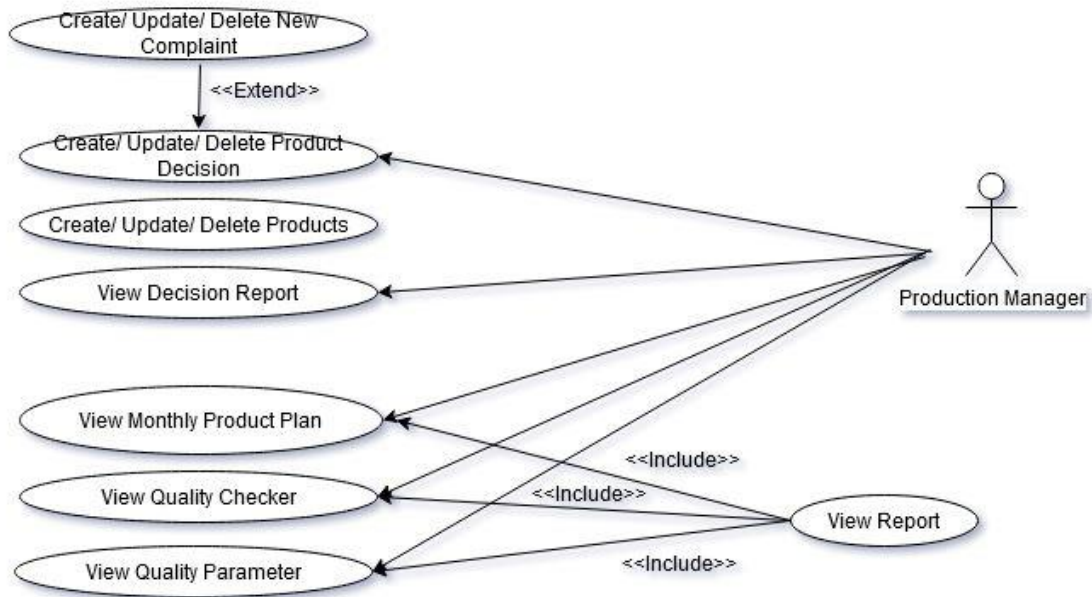


Figure 3.5: Production Manager

Actions between Quality Checker and System

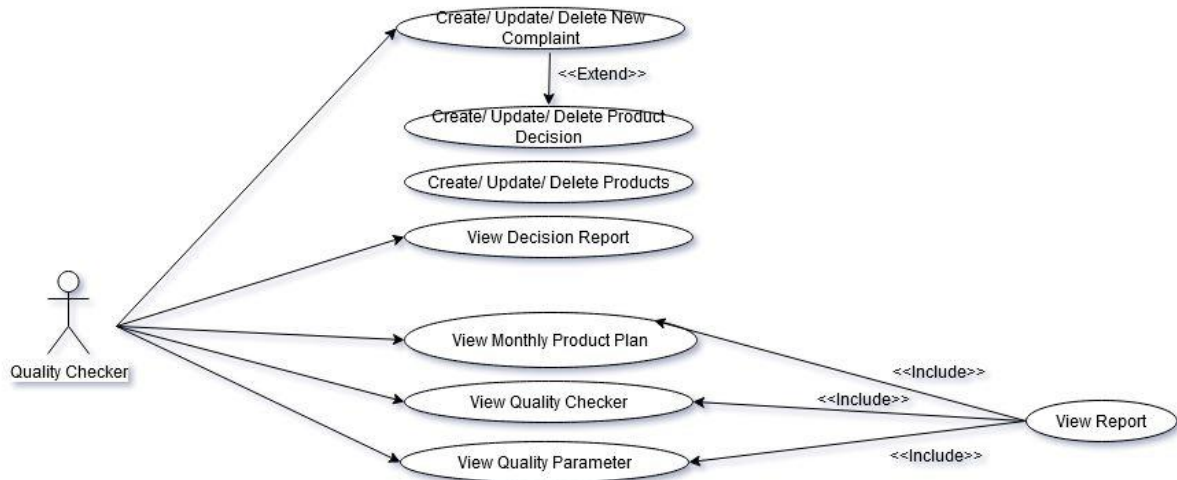


Figure 3.6: Quality Checker

Quality Assurance Automation System for a biscuit manufacturing company

Actions between Shift Manager and System

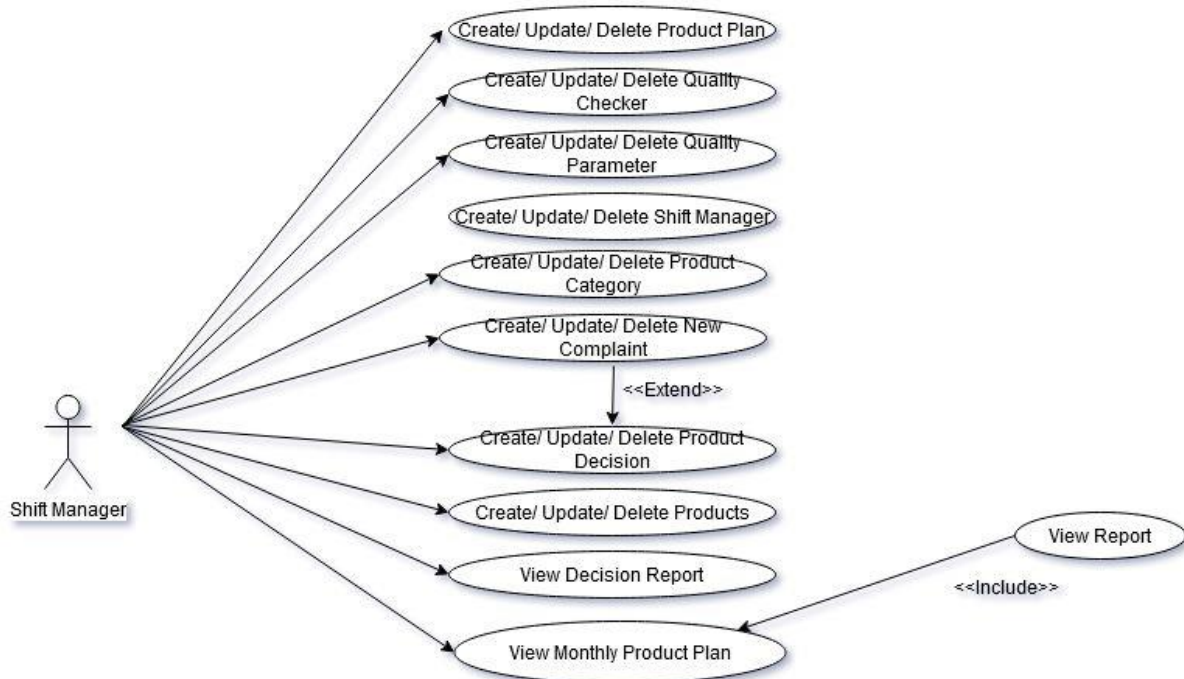


Figure 3.7: Shift Manager

Actions between all Users and System

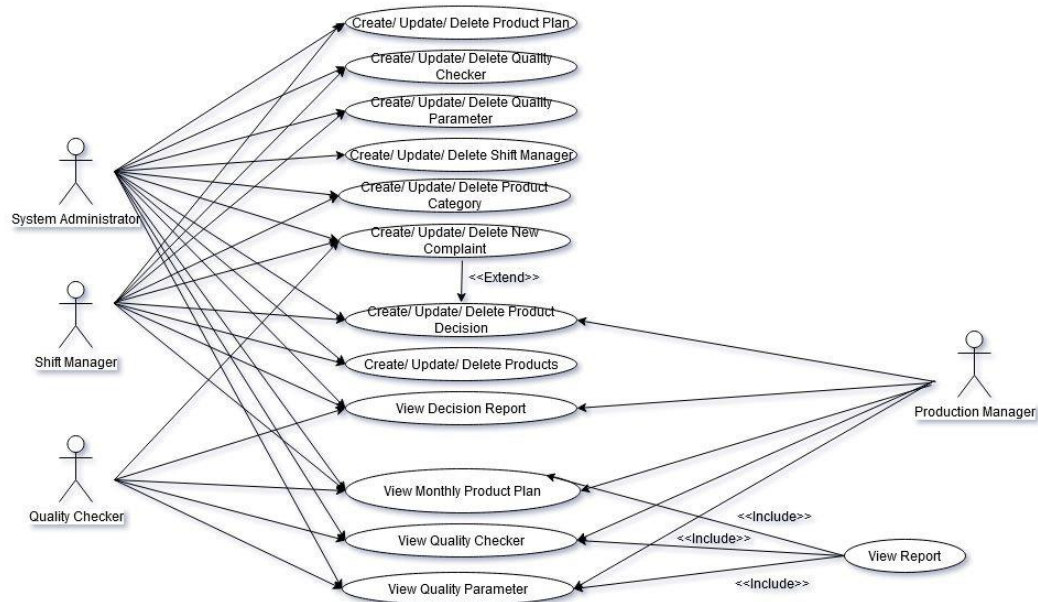


Figure 3.8: Entire System

Quality Assurance Automation System for a biscuit manufacturing company

Above mentioned use case (Figure 3.4, 3.5, 3.6, 3.7 and 3.8) business scenarios have explained below,

- There should be a facility to enter biscuit product plan and product category to the system. Users are Shift manager or System administrator.
- Shift manager or System administrator need to add food quality parameters to the system.
- While the manufacturing process quality checker will add the product quality related issues to the system as a complaint. Then the system will assign it to the next available shift manger. So, shift manger should be taken decision for that issue. Those data should be handled through the software application.
- The system should have user registration facility to enter quality checker and shift manager information.
- System administrator, shift manager, quality checker and production manager who are the users of this system.
- The system should have facility to view following reports. These reports will view by all the users in system.
 - o Monthly Product Plan Report.
 - o Quality Parameter Report.
 - o Decision Report.
 - o Quality Checker Report.

3.3.2 ER diagram

This biscuit production company is producing various types of biscuit products. These products having unique product category. Each product will produce based on its product plan. At the end of the production flow, there is activity call product quality assurance. In this phase each biscuit will check by quality checker who checks whether those biscuits are in expected quality level. Expected quality parameters are mentioned below.

If there any issue found related to the quality parameter in particular product, it will report as complaint during the product quality checking phase by quality checker. That reported complaint will be addressed by another employee call shift manager. Shift manger will take a necessary action/ decision for that complaint. These business workflow data going to keep track in database.

Identified entities and its attributes are mentioned below,

- Product – Product number (Unique), Product Name and Category.
- Product category – Category (Unique) and its description.
- Quality parameter – Quality parameter number (Unique), Weight, Water level1, Water level2, Taste and Moisture.

Quality Assurance Automation System for a biscuit manufacturing company

- Product plan – Plan number (Unique), Quantity, Expected quantity and Plan date.
- Quality checker – Quality checker ID (Unique), First name, Last name and NIC
- Shift manager – Shift manager ID (Unique), First name, Last name and telephone number.
- Complaint – Complaint ID (Unique), Description and date.
- Decision – Decision ID (Unique), Description and date.

Following ER diagram (Figure 3.9) indicates the mapping of relationship among each entity, cardinality ratio and its participation constraint.

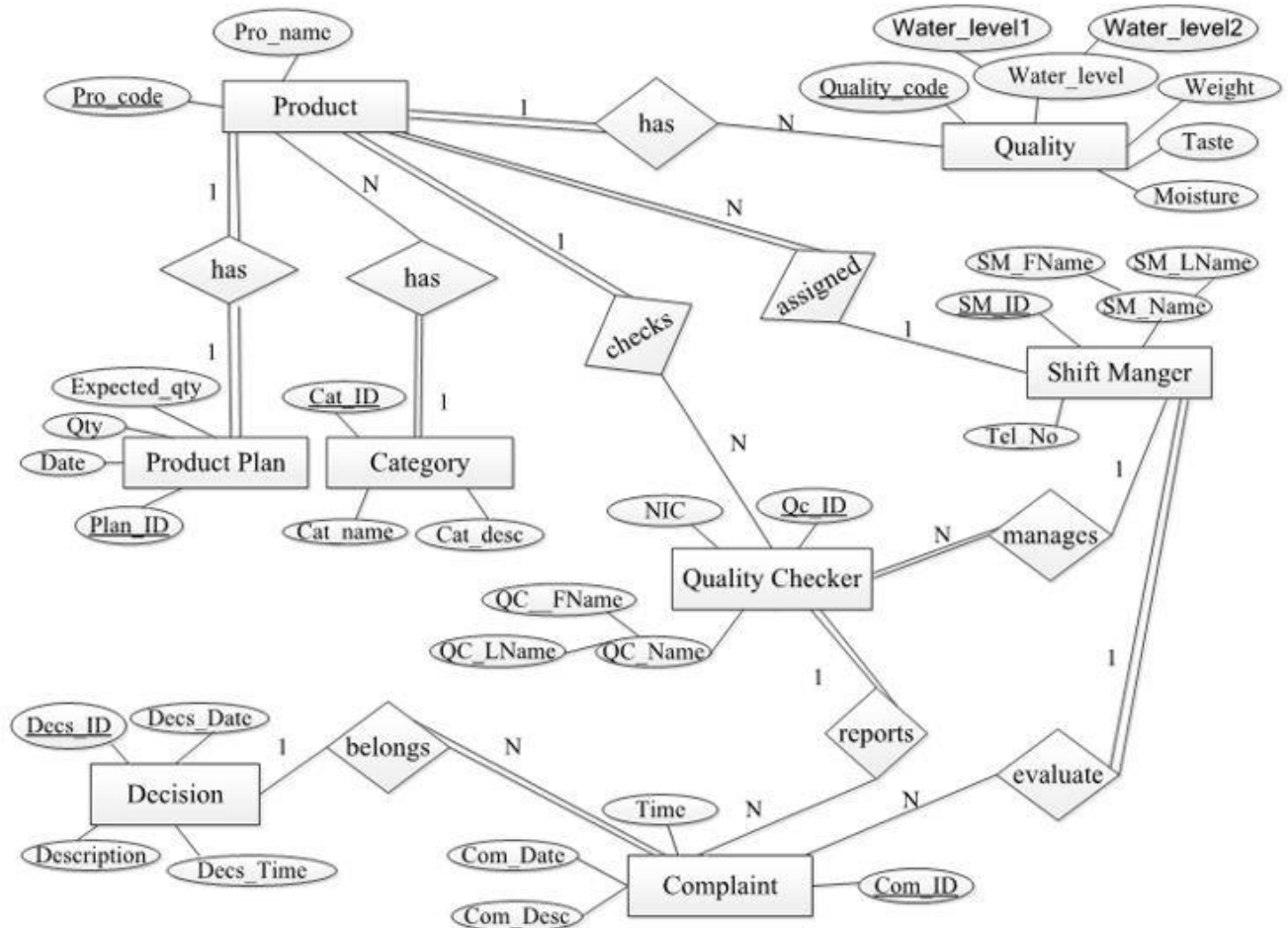


Figure 3.9: ER Diagram

Quality Assurance Automation System for a biscuit manufacturing company

Relational Schema

According to the ER diagram design the relationships among the entities by adding primary keys and foreign keys as below,

- Product {Product_code, Pro_name, Cat_ID (FK), SM_ID (FK)}
- Quality {Quality_code, Water_level1, Water_level2, Weight, Taste, Moisture, Product_code (FK)}
- ProductPlan {Plain_ID, Date, Qty, Expected_qty, Product_code (FK)}
- Category {Cat_name, Cat_desc}
- QualityChecker {Qc_ID, NIC, QC_F_Name, QC_L_Name, Product_code (FK), SM_ID (FK)}
- ShiftManager {SM_ID, SM_F_Name, SM_L_Name, Tel_No}
- Complaint {Com_ID, Com_Date, Com_Desc, SM_ID (FK), Qc_ID (FK)}
- Decision {Decs_ID, Decs_Date, Description}
- Complaint_dec {Com_ID, Decs_ID}

3.3.4 Database Table Structure

Base on the “Relational Schema” (Figure 3.10) design the database structure as below [5],

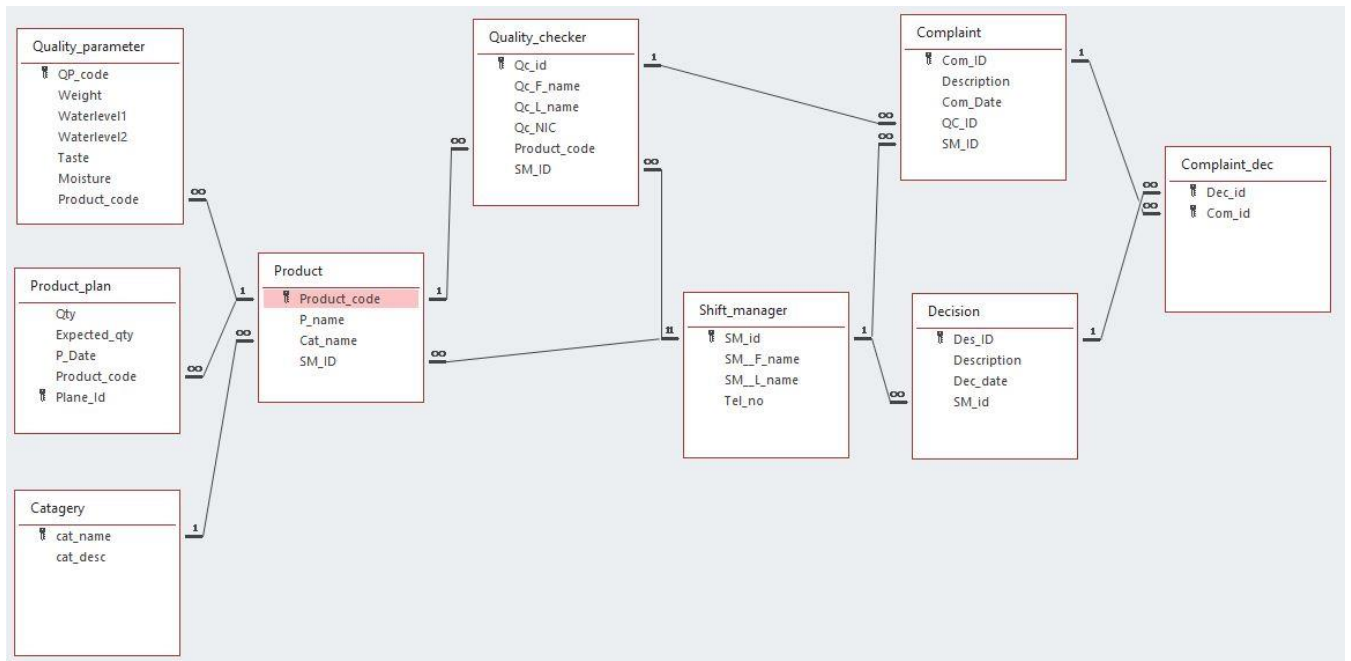


Figure 3.10: Database Table Structure

Quality Assurance Automation System for a biscuit manufacturing company

3.3.5 Class diagram

Based on the database table structure, identified the classes and its member variable. Method of the classes are identified according to the business functional requirements. (Figure 3.11) Based on these aspects designed the class diagram as below [6],

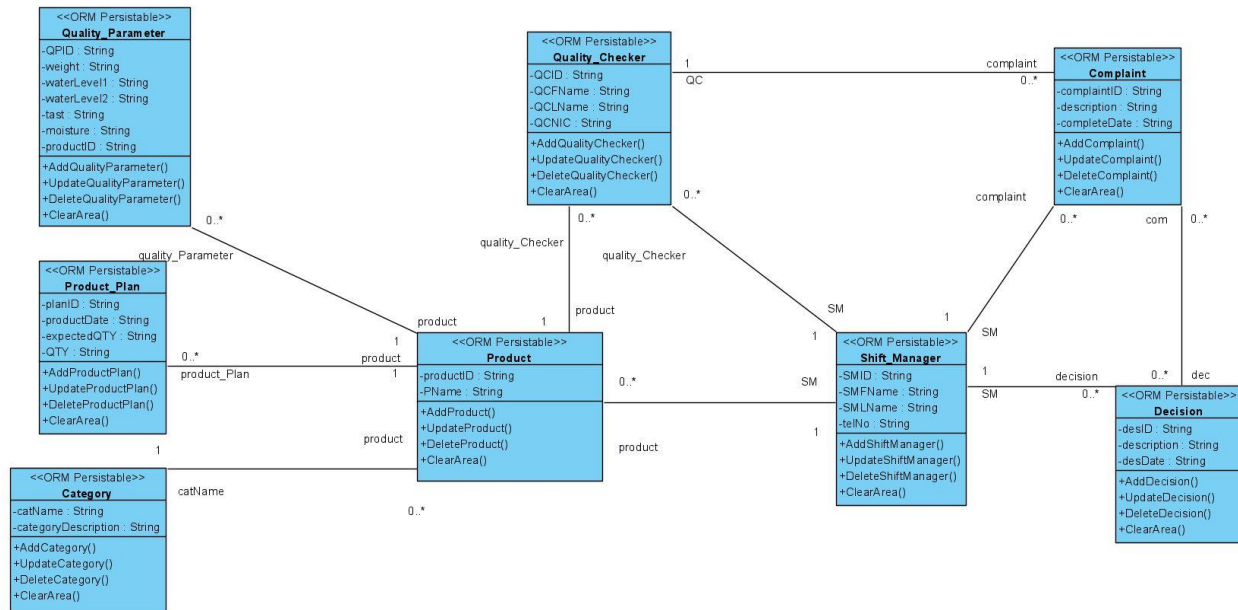


Figure 3.11: Class Diagram

3.4 Summary

In this chapter includes all the software design related tasks such as system requirements specification phase to deploy the system in client environment E2E tasks. Here explained about how users were interacting with the system using use case diagrams, how database was created (Used ER diagram with relation schema, Diagram of database table structure with relation) and system design architecture details using class diagrams.

Chapter 4 - Implementation

4.1 Introduction

This proposed Quality Assurance System hopes to implement using .net language, MSSQL database for storing data, front-end implementation planned to use JavaScript, Bootstrap, CSS technologies. In here Model View Controller (MVC) architecture is using for code design. Selected the system implementation life cycle as waterfall model because of system requirements are fixed.

4.2 Methodology

Software development methodology follows processes involved when working on a project. It is included conceptual and logical design patterns. The goal of methodology is providing a systematic approach to software development process.

4.2.1 Programming Language - ASP.net

ASP.net programming language is used to implement this web system. Asp.Net is purely server-side technology, so the code is processed on the windows server before it is displayed in the web browser. Therefore, ASP.net applications execute more quickly than interpreted scripts. ASP.NET provides full support for XML, CSS and other new as well as established web standards. To implement backends C#.net will be use.

4.2.2 Frontend Design – Bootstrap

Bootstrap is a front-end framework that is used to create modern websites and web apps. It's open-source and free to use. Here razor .cshtml pages are used for UI interface elements such as buttons, text fields, links and forms etc. It's also an open-source technology which helps and allow websites and applications to be responsive across various devices. Another advantage of bootstrap are Several JavaScript plugins using the jQuery and low browser related bugs. Also, Bootstrap is Easy to use. It is very easy and quite simple to use for designing and development. If start a new framework there is a lot to learn from it. This is developer friendly and can be customized as per the project requirements.

4.2.3 Backend Design – MS MSQL SERVER

Microsoft SQL server used as database. When developing computerized system database is key important factor. Collected data should be store with more security because of stored information is more important and able to easily retrieve it whenever needed is required. MS SQL management studio (RDBMS) that uses SQL database helps to automate data retrieving and provide good connectivity with ASP.net web application development. MSSQL is widely used in nowadays all over the world and easy to gather knowledge.

4.2.4 Implementation Environment

Implementation environment selection is very important task in software development process. When selecting the appropriate programming language to implement the application it should be easy to handle all the E2E operations of the system and it should be easy coding and language should be user friendly. These things are very helpful when challenges face during the implementation then programmer can discuss their issue through the online web forums. That is very helpful to find solution quickly.

Software environment – This system has been implemented by using following software and tools.

1. Operating system – Windows 10
2. Coding environment – Visual Studio 2019
3. Database - MS MSQL SERVER 2018

Hardware environment – Following hardware specification should be included to develop the system

1. Processor – 4 Core
2. RAM – 16 GB
3. Capacity – 500 GB SSD
4. Screen resolution – 1920 * 1080

4.2.5 System Design Life Cycle – Waterfall Model

The system will implement by using waterfall model (Figure 4.1) because of system requirements are fixed.

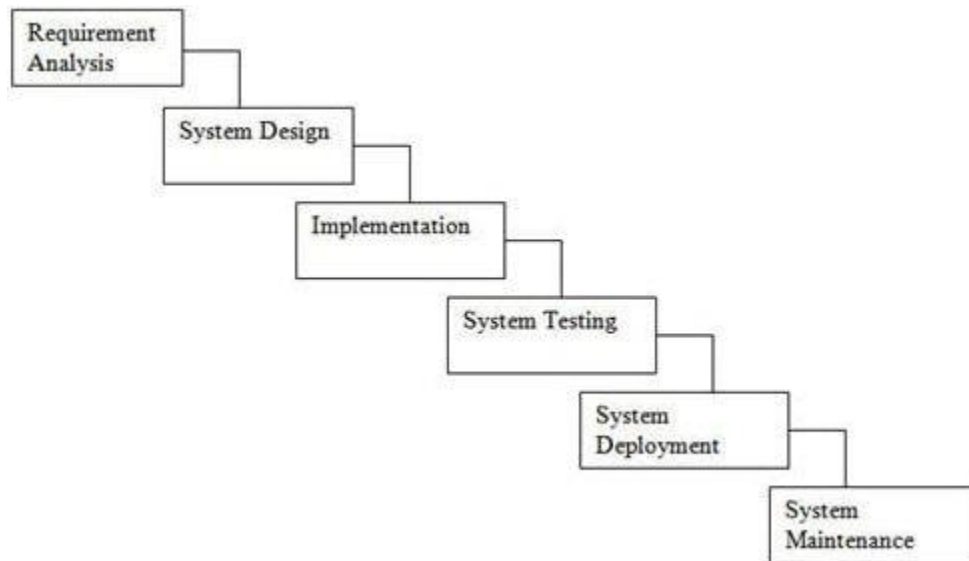


Figure 4.1: Waterfall Model

Following sequential phases in Waterfall model are –

- **Requirement Gathering and analysis** – All the requirements of this system to be developed are captured in this phase and mentioned in requirement specification section (Refer 2.2.1 User Requirements).
- **System Design** – The identified requirement specifications from first phase are studied in this phase and the system design is prepared. This prepared system design helps in specifying hardware and system requirements and helps in defining the overall system architecture (Refer 3.2 System Architecture).
- **Implementation** – With inputs from the system design phase, the system is first developed in small programs called units, At the end of the development these units will integrate together. Each module of this system such as “QA staff, Product Plan, Quality Parameters, Products, Complaints, Decisions, Categories, Reports, Issue detection notifications are developed separately and conduct unit testing.

Quality Assurance Automation System for a biscuit manufacturing company

- System programming language is ASP.net. Here system code will implement by using MVC architecture.
- Database is implementing by using MSSQL Server. (Refer Figure 4: Database table structure)
- Reporting module will be developed by using RDLC reports.
- **Integration and Testing** – All the units developed in the implementation phase are integrated into a system after testing of each unit. After integrate the entire system and conduct integration testing and system testing to find out any faults and failures. After conducting functional related testing then conduct non-functional testing. Planning to conduct API performance test.
- **Deployment of system** – Once the functional and non-functional testing is done; the product is deployed in the client/ Production environment.
- **Maintenance** – There are some issues which come up in the client/ Production environment. To fix those issues/ bugs, patches are released. Also, to enhance the product some improved versions are released. Maintenance is done to deliver these changes in the customer environment.

4.3 Summary

In this chapter describe about the system implementation methodology related details. Here mentioned about the system implementation architecture, implementation model, programming language, database structure and frontend implementation technologies.

Chapter 5 - Testing and Evaluation

5.1 Introduction

This chapter describes the testing and evaluation of the biscuit product quality assurance system. Testing is used to reduce system bugs and improve the quality of product. Section 2.2 describe about the all the objective, system functional and non-functional requirements (Cosmetic, Performance and Security etc.).

Section 4.2 mentioned two functional test types and one non-functional test type. Software testing verify whether the web page's functions are working as expected. When conduct software testing, important task is identified high priority and high severity workflows. Based on that, testing scenarios can be documented and execute. This is how to conduct testing task. If test non-functional related test such as performance or security then need extra tool.

In this system conducted unit level testing and system testing as functional testing. API performance testing done for the selected business critical workflows. Following sections will describe those in detailly.

5.2 Related Testing Types

Following diagram (Figure 5.1) shows applied software testing approach.

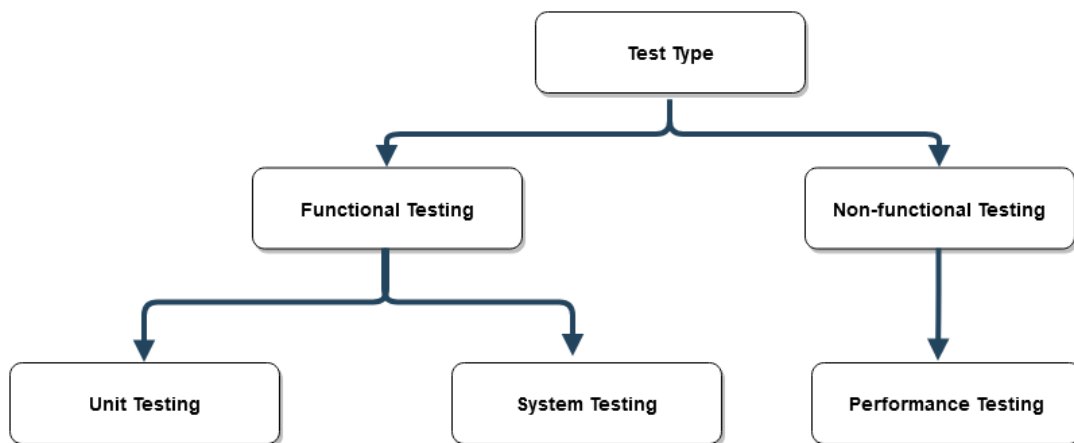


Figure 5.1: Applied Software Test Types

5.2.1 Unit Level Testing

Unit testing done in each function's implementation phase. Unit level test was done after developing data insert, delete, update and view functionality in each section. If there are functional wise bugs/ issues occurred during this testing phase that is easy to fixed because of that feature is in initial stage.

5.2.2 Integration Testing and System Testing

After implementing each section's features that was linked in home page together that is called "Biscuit Quality Assurance system". Main objective of this testing is identifying the bugs when integrate all sections together and identify bugs in each individual module. There are 11 main sections included this application. System and integration testing done for the all-main workflows mentioned as below. (Please refer section 5.4.1 Functional Testing Results)

- User Login flow
- User Registration flow
- Add/ Update/ Delete and View details for following sections
 - Product Plan
 - Product Category
 - Product
 - Quality Parameters
 - Shift Manager
 - Quality Checker
 - Make Complaint
 - Make Decision
- View Reports
 - Decision
 - Shift manger wise
 - Product wise
 - Monthly Product Plan
 - Quality Parameter
 - Quality Checker Details

5.2.3 User Interface Testing

User interface testing is used to identify the presence of defects in a product/software under test by using Graphical user interface [GUI].

Following area considered in GUI Testing:

- During execution, the values of the properties of each object of a GUI define the GUI state.
- It has capabilities to exercise GUI events like key press/mouse click.
- Able to provide inputs to the GUI Objects.
- To check the GUI representations to see if they are consistent with the expected ones.
- Check all the UI (Text boxes, Buttons, Dropdowns and Label font/ color) in the system are consistent.

5.2.4 Performance Testing

Selected the business-critical workflows of the system. There is tool is required to conduct performance test. There are two approaches available for conduct performance test. They are record the user journey or configure the particular API. (Please Refer [\[7\]](#))

Performance testing main objective is to identify client-side and server-side matrices/ counters utilization when access the system by multiple users through the network. When hosting a web-system in server, there should be an environment requirement for that. After conducting performance test that client-side requirement and server-side requirements can be identified.

There are concurrent users will be accessing the “Biscuit Quality Assurance System” through the network. Work load distribution can be defined for user login flows as bellow.

- Admin user - 5% users will be login to the system.
- Production Manager - 5% users will be login to the system.
- Shift Manager - 10% users will be login to the system.
- Quality Checker - 80% users will be login to the system.

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Performance test conduct against following matrices/ counters (Table 5.1)

Table 5:1: Client-Side and Server-Side matrices

Client-side matrices	Server-side matrices
Request response time (90 th percentile)	CPU utilization (%)
Request error rate (%)	Memory utilization (%)
Transaction per seconds (Count)	Disk utilization (%)

5.3 User Evaluation

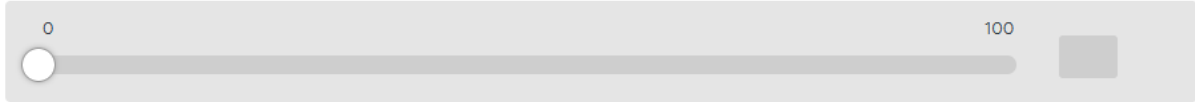
Mainly validate the client requirements in this evaluation section. After developing the system most of the business requirements should be meet and get the user experience via questionnaire. (Figure 5.2 to 5.6)

When developing the system mainly focused on the requirements document by their own understanding and further required changes during development may not be effectively implemented, so for user evaluation is require to the evaluate the system by end user. There are few questions mention below as questionnaire. Refer (figure 5.7) to overall result of the questionnaire.

Quality Assurance Automation System for a biscuit manufacturing company

Biscuit Quality Assurance System Questionnaire

* 1. How likely is this "Biscuit Quality Assurance" system user friendly as a Quality Checker?

A horizontal slider interface for a questionnaire. It features a light gray background with a darker gray track. A white circular knob is positioned at the far left, labeled '0'. The far right is labeled '100'. A small gray square button is located at the right end of the track.

* 2. How likely is this "Biscuit Quality Assurance" system user friendly as a Shift Manager?

A horizontal slider interface for a questionnaire. It features a light gray background with a darker gray track. A white circular knob is positioned at the far left, labeled '0'. The far right is labeled '100'. A small gray square button is located at the right end of the track.

* 3. How likely is this "Biscuit Quality Assurance" system user friendly as a Production Manager?

A horizontal slider interface for a questionnaire. It features a light gray background with a darker gray track. A white circular knob is positioned at the far left, labeled '0'. The far right is labeled '100'. A small gray square button is located at the right end of the track.

4. How likely is this "Biscuit Quality Assurance" system you would recommend this company as Quality Checker?

A horizontal slider interface for a questionnaire. It features a light gray background with a darker gray track. A white circular knob is positioned at the far left, labeled '0'. The far right is labeled '100'. A small gray square button is located at the right end of the track.

Figure 5.2: Questionnaire 1

Quality Assurance Automation System for a biscuit manufacturing company

5. How likely is this "Biscuit Quality Assurance" system you would recommend this company as Shift Manager?

0

100

6. How likely is this "Biscuit Quality Assurance" system you would recommend this company as Production Manager?

0

100

7. The content of the "Decision report" represent the adequate information to the end user as Shift Manager?

0

100

8. The content of the "Decision report" represent the adequate information to the end user as Quality Checker?

0

100

Figure 5.3: Questionnaire 2

Quality Assurance Automation System for a biscuit manufacturing company

9. The content of the "Decision report" represent the adequate information to the end user as Shift Manger?



A horizontal slider control with a light gray background. On the left, there is a white circle with a black outline, labeled '0' above it. A dark gray line extends from this circle to the right, ending at a point labeled '100'. To the right of the '100' label is a small, solid gray square. The slider is currently positioned at the '0' mark.

10. The content of the "Monthly Product Plan report" represent the adequate information to the user as Quality Checker?



A horizontal slider control with a light gray background. On the left, there is a white circle with a black outline, labeled '0' above it. A dark gray line extends from this circle to the right, ending at a point labeled '100'. To the right of the '100' label is a small, solid gray square. The slider is currently positioned at the '0' mark.

11. The content of the "Monthly Product Plan report" represent the adequate information to the user as Shift Manager?



A horizontal slider control with a light gray background. On the left, there is a white circle with a black outline, labeled '0' above it. A dark gray line extends from this circle to the right, ending at a point labeled '100'. To the right of the '100' label is a small, solid gray square. The slider is currently positioned at the '0' mark.

12. The content of the "Monthly Product Plan report" represent the adequate information to the user as Production Manager?

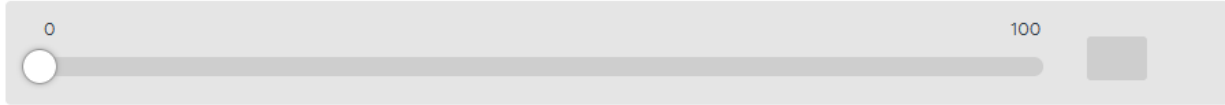


A horizontal slider control with a light gray background. On the left, there is a white circle with a black outline, labeled '0' above it. A dark gray line extends from this circle to the right, ending at a point labeled '100'. To the right of the '100' label is a small, solid gray square. The slider is currently positioned at the '0' mark.

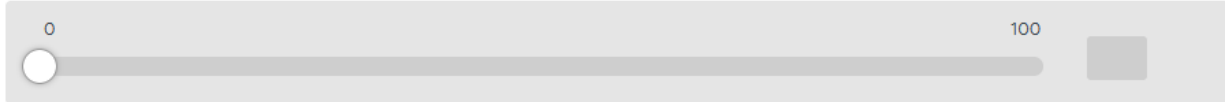
Figure 5.4: Questionnaire 3

Quality Assurance Automation System for a biscuit manufacturing company

13. The content of the "Quality Checker Details report" represent the adequate information to the user as Quality Checker?



14. The content of the "Quality Checker Details report" represent the adequate information to the user as Shift Manager?



15. The content of the "Quality Checker Details report" represent the adequate information to the user as Production Manager?



16. The content of the "Quality Parameter Details report" represent the adequate information to the user as Quality Checker?



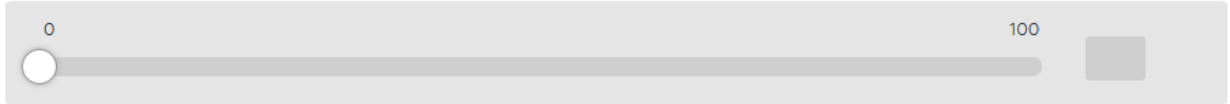
Figure 5.5: Questionnaire 4

Quality Assurance Automation System for a biscuit manufacturing company

17. The content of the "Quality Parameter Details report" represent the adequate information to the user as Shift Manager?

A horizontal slider bar with a light gray background. On the left, there is a white circle with a black outline, labeled '0'. On the right, there is a gray square, labeled '100'. The slider bar itself is a thin gray line.

18. The content of the "Quality Parameter Details report" represent the adequate information to the user as Production Manager?

A horizontal slider bar with a light gray background. On the left, there is a white circle with a black outline, labeled '0'. On the right, there is a gray square, labeled '100'. The slider bar itself is a thin gray line.

19. Does Quality checker can submit complaint through system as expected?

A horizontal bar with a light gray background. It contains five white stars arranged evenly across the bar.

20. Does Shift Manager inform the issue immediately by the system?

A horizontal bar with a light gray background. It contains five white stars arranged evenly across the bar.

21. Does user can identify functional workflow in the system?

A horizontal bar with a light gray background. It contains five white stars arranged evenly across the bar.

Figure 5.6: Questionnaire 5

Quality Assurance Automation System for a biscuit manufacturing company

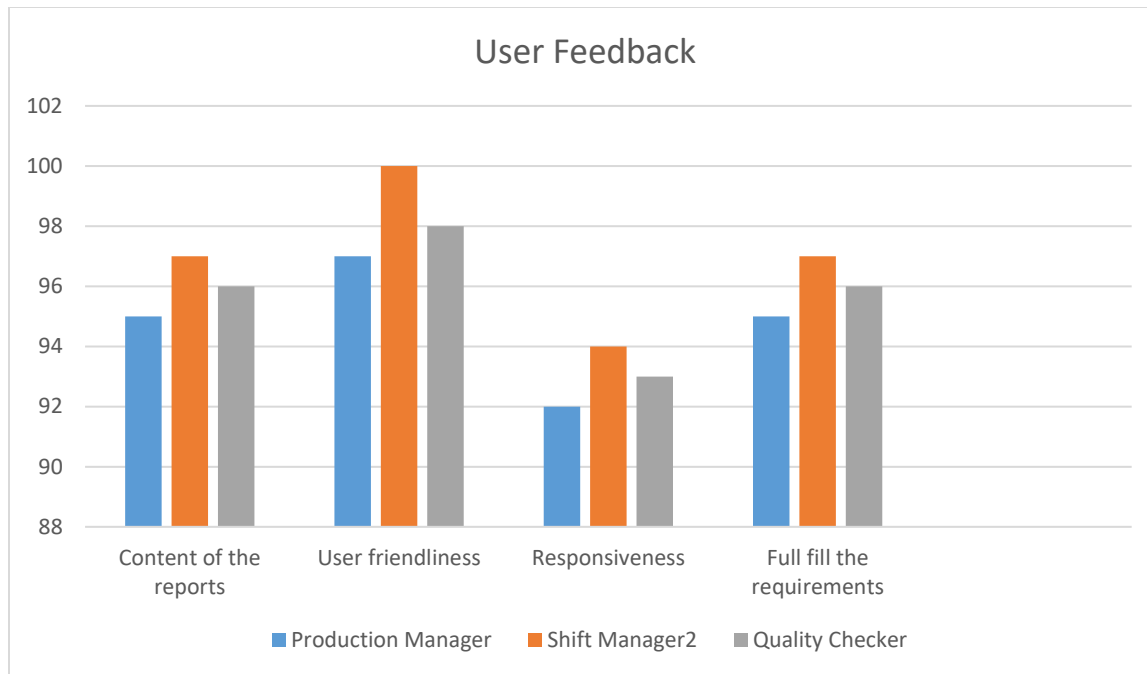


Figure 5.7: Questionnaire Statistics

Quality Assurance Automation System for a biscuit manufacturing company

5.4 Test Cases and Results of the Testing

5.4.1 Functional Testing Results (Figure 5.8 to 5.13)

User Login TCs (Admin, Production Manager, Shift Manager and Quality Checker)

1	2	3	A	B	C	D	E	F	G	H	I	J	K	L
1			Project Name: Biscuite Auality Assurance System TCs											
2			Test Cases											
3														
4														
5														
6			Test Case ID	Description	Pre-condition	Test Steps	Test Data	Actual Result	Expected Results	Status	Severity	Priority	Defect ID	Comments
7			Functional Tcs											
8			Login Screen											
9			Admin User											
14			Production Manager											
19			Shift Manager											
24			Quality Checker											
25			TC_LG_13	verify whether Quality Checker can logging to the system using correct credential	user should be in login screen	1. Enter username 2. Enter Password 3. Click the login button	1. User Name- user3 2. Password- user3	1. The system is allowed to enter username 2. The system is allowed to enter password 3. system is navigated to the home page	1. user should be allowed to enter username into username textfield. 2. The user should be allow to enter password into password textfield. 3. The user should be navigate to the home page.	pass	High	High		
26			TC_LG_14	Verify whether Quality Checker can logging to the system using incorrect username and correct password	user should be in login screen	1. Enter username 2. Enter Password 3. Click the login button	1. User Name- abc 2. Password- user3	1. The system is allowed to enter username 2. The system is allowed to enter password 3. The system displays "Invalid Username or Password".	1. user should be allowed to enter username into username textfield. 2. The user should be allow to enter password into password textfield. 3. The system should be display "Invalid Username or Password".	pass	High	High		
27			TC_LG_15	Verify whether Quality Checker can logging to the system using correct username and incorrect password	user should be in login screen	1. Enter username 2. Enter Password 3. Click the login button	1. User Name- user3 2. Password-123	1. The system is allowed to enter username 2. The system is allowed to enter password 3. The system displays "Invalid Username or Password".	1. user should be allowed to enter username into username textfield. 2. The user should be allow to enter password into password textfield. 3. The system should be display "Invalid Username or Password".	pass	High	High		
28			TC_LG_16	Verify whether Quality Checker can logging to the system using both incorrect username and password	user should be in login screen	1. Enter username 2. Enter Password 3. Click the login button	1. User Name- abc 2. Password-123	1. The system is allowed to enter username 2. The system is allowed to enter password 3. The system displays "Invalid Username or Password".	1. user should be allowed to enter username into username textfield. 2. The user should be allow to enter password into password textfield. 3. The system should be display "Invalid Username or Password".	pass	High	High		

Figure 5.8: Test Cases 1

Quality Assurance Automation System for a biscuit manufacturing company

User Registration TCS

1	2	3	A	B	C	D	E	F	G	H	I	J	K	L
1			Project Name: Biscuite Auality Assurance System TCS											
2			Test Cases											
3														
4														
5														
6			Test Case ID	Description	Pre-condition	Test Steps	Test Data	Actual Result	Expected Results	Status	Severity	Priority	Defect ID	Comments
9			User Registration											
10			TC_USR_01	verify whether Admin can access User Registration page in welcome screen	Admin should be in welcome screen	1. Admin needs to clicks on "Registration" link 2. Very whether admin user can access "Registration" link and load the page	NA	1. The system is allowed to access the registration link 2. The system is allowed to access and navigate the registration page	1. The system should be allowed to access the registration link 2. The system should be allowed to access and navigate the registration page	pass	High	High		
11			TC_USR_02	verify whether Admin can create new product through product screen	Admin should be in "Registration" screen	1. Click Create new link 2. Enter required fields 3. Click the Create button 4. Verify newly added record in both UI and database	2. User ID - USR1 User Name - Sam001 First Name - Sam Last Name - rock User Email - sam123@gmail.com Contact Number - 07xxxxxxxx User Role - Select preferred one User Passwords - sam@1234 Re-enter Password - sam@1234 Date - Select date from date time picker	1. The system is navigated to new registration page 2. The system is allowed to enter values to the text fields 3. System is navigated to the registration home page 4. System is displayed the entered registration in both UI and database	1. The system should be navigated to new registration page 2. The system should be allowed to enter values to the text fields 3. System should be navigated to the registration home page 4. System should be displayed the entered registration in both UI and database	pass	High	High		
12			TC_USR_03	verify whether Admin can update new product through product screen	Admin should be in "Registration" screen	1. Click Edit link 2. Enter required fields 3. Click the save button 4. Verify updated fields in both UI and database	2. User ID - USR1 User Name - Sam002 First Name - Sam Last Name - rock User Email - sam123@gmail.com Contact Number - 07xxxxxxxx User Role - Select preferred one User Passwords - sam@12345 Re-enter Password - sam@12345 Date - Select date from date time picker	1. The system is navigated to new registration page 2. The system is allowed to enter values to the text fields 3. System is navigated to the registration home page 4. System is displayed the updated registration in both UI and database	1. The system should be navigated to new registration page 2. The system should be allowed to enter values to the text fields 3. System should be navigated to the registration home page 4. System should be displayed the updated registration in both UI and database	pass	High	High		
13			TC_USR_04	verify whether Admin can delete product through product screen	Admin should be in "Registration" screen	1. Click delete link 2. Click the delete button 3. Verify deleted record remove from both UI and database	NA	1. The system is navigated to delete page 2. The system is allowed to delete the record 3. System is navigated to the registration home screen and removed record from both UI and database	1. The system should be navigated to delete page 2. The system should be allowed to delete the record 3. System should be navigated to the registration home screen and removed record from both UI and database	pass	High	High		
14			TC_USR_05	verify whether Admin can view entered product through product screen	Admin should be in "Registration" screen	1. Verify user can view previously entered products in product home screen	NA	1. The system is navigated to the registration home screen 2. The registration home screen displays prevously entered product user registration details as expected	1. The system should be navigated to the registration home screen 2. The registration home screen should be displayed prevously entered product user registration details as expected	pass	High	High		

Figure 5.9: Test Cases 2

Quality Assurance Automation System for a biscuit manufacturing company

Products TCs

1	2	3	A	B	C	D	E	F	G	H	I	J	K	L
1			Project Name: Biscuite Auality Assurance System TCs											
2			Test Cases											
3														
4														
5														
6			Test Case ID	Description	Pre-condition	Test Steps	Test Data	Actual Result	Expected Results	Status	Severity	Priority	Defect ID	Comments
8														
9			Product Screen											
10			TC_PRD_01	verify whether Admin, Production Manager and Shift Manager can access product tab in home screen	Each user should be in home screen at a time	1. User need to clicks on "Product" tab 2. Very each user can access and navigate "Product" module	NA	1. The system is allowed to login the system 2. System is allowed to access and navigate the product module for all users	1. The system should be allowed to login the system 2. System should be allowed to access and navigate product module for all users	pass	High	High		
11			TC_PRD_02	verify whether Admin, Production Manager and Shift Manager can create new product through product screen	Each user should be in "Product" screen at a time	1. Click Create new link 2. Enter required fields 3. Click the Create button 4. Verify newly added record in both UI and database	2. Product Code - PRD01 Product Name - Cream Product Category Name - select one of category SM_ID - Select Shift manager id for entered product	1. The system is navigated to new product page 2. The system is allowed to enter values to the text fields 3. System is navigated to the product home page 4. System is displayed the entered product in both UI and database	1. The system should be navigated to new product page 2. The system should be allowed to enter values to the text fields 3. System should be navigated to the product home page 4. System should be displayed the entered product in both UI and database	pass	High	High		
12			TC_PRD_03	verify whether Admin, Production Manager and Shift Manager can update new product through product screen	Each user should be in "Product" screen at a time	1. Click Edit link 2. Enter required fields 3. Click the Create button 4. Verify updated fields in both UI and database	2. Product Code - PRD01 Product Name - Cream Product Category Name - select one of category SM_ID - Select Shift manager id for entered product	1. The system is navigated to edit product page 2. The system is allowed to edit values to the text fields 3. System is navigated to the product home page 4. System is displayed the edited product in both UI and database	1. The system is navigated to edit product page 2. The system is allowed to edit values to the text fields 3. System is navigated to the product home page 4. System is displayed the edited product in both UI and database	pass	High	High		
13			TC_PRD_04	verify whether Admin, Production Manager and Shift Manager can delete product through product screen	Each user should be in "Product" screen at a time	1. Click delete link 2. Click the delete button 3. Verify deleted record remove from both UI and database	NA	1. The system is navigated to delete product page 2. The system is allowed to delete the record 3. System is navigated to the product home screen and removed record from both UI and database	1. The system should be navigated to delete product page 2. The system should be allowed to delete the record 3. System should be navigated to the product home screen and removed record from both UI and database	pass	High	High		
14			TC_PRD_05	verify whether Admin, Production Manager and Shift Manager can view entered product through product screen	Each user should be in "Product" screen at a time	1. Verify user can view previously entered products in product home screen	NA	1. The system is navigated to the product home screen 2. The complaints home screen displays prevolusly entered product details as expected	1. The system should be navigated to the product home screen 2. The complaints home screen should be displayed prevolusly entered product details as expected	pass	High	High		

Figure 5.10: Test Cases 3

Quality Assurance Automation System for a biscuit manufacturing company

Product Category TCs

Q11												
1	Project Name: Biscuite Auality Assurance System TCs											
2	Test Cases											
3												
4												
5												
6	Test Case	Description	Pre-conditions	Test Steps	Test Data	Actual Result	Expected Results	Status	Severity	Priority	Defect	Comments
7	Functional Test											
8	Product Category											
9	Product Category											
10	TC_CAT_01	verify whether Admin, Production Manager and Shift Manager can access complaint tab in home screen	Each user should be in home screen at a time	1. User need to clicks on "Product Category" tab 2. Verify each user can access and navigate "Product Category" module	NA	1. The system is allowed to login the system 2. System is allowed to access and navigate the product category module for all users	1. The system should be allowed to login the system 2. System should be allowed to access and navigate product category module for all users	pass	High	High		
11	TC_CAT_02	verify whether Admin, Production Manager and Shift Manager can create new product through product screen	Each user should be in "Product Category" screen at a time	1. Click Create new link 2. Enter required fields 3. Click the Create button 4. Verify newly added record in both UI and database	2. Product Category Name - Biscuit Product Category Description - Enter new description	1. The system is navigated to new product category page 2. The system is allowed to enter values to the text fields 3. System is navigated to the product category home page 4. System is displayed the entered product category in both UI and database	1. The system should be navigated to new product category page 2. The system should be allowed to enter values to the text fields 3. System should be navigated to the product category home page 4. System should be displayed the entered product category in both UI and database	pass	High	High		
12	TC_CAT_03	verify whether Admin, Production Manager and Shift Manager can update new product through product screen	Each user should be in "Product Category" screen at a time	1. Click Edit link 2. Enter required fields 3. Click the Create button 4. Verify updated fields in both UI and database	2. Product Category Name - Biscuit Product Category Description - Enter new description	1. The system is navigated to edit product category page 2. The system is allowed to edit values to the text fields 3. System is navigated to the product category home page 4. System is displayed the edited product category in both UI and database	1. The system is navigated to edit product category page 2. The system is allowed to edit values to the text fields 3. System is navigated to the product category home page 4. System is displayed the edited product category in both UI and database	pass	High	High		
13	TC_CAT_04	verify whether Admin, Production Manager and Shift Manager can delete product through product screen	Each user should be in "Product Category" screen at a time	1. Click delete link 2. Click the delete button 3. Verify deleted record remove from both UI and database	NA	1. The system is navigated to delete product category page 2. The system is allowed to delete the record 3. System is navigated to the product category home screen and removed record from both UI and database	1. The system should be navigated to delete product category page 2. The system should be allowed to delete the record 3. System should be navigated to the product category home screen and removed record from both UI and database	pass	High	High		
14	TC_CAT_05	verify whether Admin, Production Manager and Shift Manager can view entered product through product screen	Each user should be in "Product Category" screen at a time	1. Verify user can view previously entered products in product home screen	NA	1. The system is navigated to the product category home screen 2. The complaints home screen displays previously entered product category details as expected	1. The system should be navigated to the product category home screen 2. The complaints home screen should be displayed previously entered product category details as expected	pass	High	High		

Figure 5.11: Test Cases 4

Quality Assurance Automation System for a biscuit manufacturing company

Complaint TCs

1	A	B	C	D	E	F	G	H	I	J	K	L
2	Project Name: Biscuite Auality Assurance System TCs											
3	Test Cases											
4												
5												
6	Test Case ID	Description	Pre-conditions	Test Steps	Test Data	Actual Result	Expected Results	Status	Severity	Priority	Defect	Comments
7	Functional Tcs											
8												
9	Complaint screen											
10	TC_COM_01	verify whether Quality Checker can create complaint through complaint screen	Quality Checker should be in complaint screen	1. Click Create new link 2. Enter required fields 3. Click the Create button 4. Verify newly added record in both UI and database	2. Complaint ID - COM01 Complaint Description - some text Complaint Date - select date from datetime picker QC_ID - Select Quality Checker id SM_ID - Select Shift manager id Complaint Status - Select Open Product Code - Select Product which have an issue	1. The system is navigated to new complaint page 2. The system is allowed to enter values to the text fields 3. System is navigated to the complaints home page 4. System is displayed the entered record in both UI and database	1. The system should be navigated to new complaint page 2. The system should be allowed to enter values to the text fields 3. System should be navigated to the complaints home page 4. System should be displayed the entered record in both UI and database	pass	High	High		
11	TC_COM_02	verify whether Quality Checker can update complaint through complaint screen	Quality Checker should be in complaint screen	1. Click Update link 2. Enter required fields 3. Click the Create button 4. Verify newly added record in both UI and database	2. Complaint ID - COM01 Complaint Description - some text Complaint Date - select date from datetime picker QC_ID - Select Quality Checker id SM_ID - Select Shift manager id Complaint Status - Select Open Product Code - Select Product which have an issue	1. The system is navigated to update complaint page 2. The system is allowed to enter values to the text fields 3. System is navigated to the complaints home page 4. System is displayed the updated record in both UI and database	1. The system should be navigated to update complaint page 2. The system should be allowed to enter values to the text fields 3. System should be navigated to the complaints home page 4. System should be displayed the updated record in both UI and database	pass	High	High		
12	TC_COM_03	verify whether Quality Checker can delete complaint through complaint screen	Quality Checker should be in complaint screen	1. Click delete link 2. Click the delete button 3. Verify deleted record remove from both UI and database	NA	1. The system is navigated to delete complaint page 2. The system is allowed to delete the record 3. System is navigated to the complaint home screen and removed record from both UI and database	1. The system should be navigated to delete complaint page 2. The system should be allowed to delete the record 3. System should be navigated to the complaint home screen and removed record from both UI and database	pass	High	High		
13	TC_COM_04	verify whether Quality Checker can view entered complaint through complaint home screen	Quality Checker should be logged in to the system	1. Click complaint tab 2. Very user can view previously entered complaints in complaints home screen	NA	1. The system is navigated to the complaints home screen 2. The complaints home screen displays previously entered complaints details as expected	1. The system should be navigated to the complaints home screen 2. The complaints home screen should be displayed previously entered complaints details as expected	pass	High	High		
14	TC_COM_05	verify whether Admin, Production Manager, Shift Manager and Quality Checker can access the complaint page	user should be in login screen	1. Login to the system using each user 2. Very user can view and access complaints module	NA	1. The system is allowed to login the system. 2. System is allowed to access complaints home screen for all users	1. The system should be allowed to login the system. 2. System should be allowed to access complaints home screen for all users	pass	High	High		
15	TC_COM_06	Verify whether email is trigger when new complaint entered to the product by Quality Checker	user should be in login screen	1. Click complaint tab 2. Enter new complaint to a particular product 3. Very email is recieved to the complaint's assigned shift manager mail box.	NA	1. The system is allowed to navigate complaint page. 2. System is allowed to enter complaint details. 3. Shift manager Inbox indicates new mail from system which included product complaint	1. The system should be allowed to navigate complaint page. 2. System should be allowed to enter complaint details. 3. Shift manager Inbox should be indicated new mail from system which included product complaint	pass	High	High		
16	TC_COM_07	verify whether all dropdowns load the relevant data and datetime picker working correctly in complaint screen	Quality Checker should be in complaint screen	1. Click Create new link 2. Click on datetime picker 3. Click on the QC_ID dropdown and verify correct data load for dropdown 4. Click on the SM_ID and verify correct data load for dropdown 5. Click on the Complaint Status and verify correct data load for dropdown 6. Click on the Product code and verify correct data load for dropdown	2. Complaint Date - select date from datetime picker 3. QC_ID - Select Quality Checker id 4. SM_ID - Select Shift manager id 5. Complaint Status - Select Open 6. Product Code - Select Product which have an issue	1. The system is navigated to new complaint page. 2. The system is allowed to select values to the field. 3,4,5,6. The system is allowed to select values to the fields.	1. The system should be navigated to new complaint page. 2. The system should be allowed to select values to the date field. 3,4,5,6. The system should be allowed to select values to the fields.	pass	High	High		
17	TC_COM_08	verify whether "My task" link in appear home screen and it's behaviour	Quality Checker should be logged into the system	1. Verify "My Task" link in home screen 2. Click on the "My Task" link	NA	1. System is displayed "My Task" link in home screen 2. System is navigated complaint page and displayed complaints which are entered by logged quality checker.	1. System should be displayed "My Task" link in home screen 2. System should be navigated complaint page and displayed complaints which are entered by logged quality checker.	pass	High	High		

Figure 5.12: Test Cases 5

Quality Assurance Automation System for a biscuit manufacturing company

Decision TCs

1	2	3	A	B	C	D	E	F	G	H	I	J	K	L
1			Project Name: Biscuite Auality Assurance System TCs											
2			Test Cases											
3														
4														
5														
6			Test Case ID	Description	Pre-condition	Test Steps	Test Data	Actual Result	Expected Results	Status	Severity	Priority	Defect ID	Comments
7			Functional Tcs											
8														
9			Decision screen											
10			TC_DES_01	verify whether Shift Manager can create complaint through complaint screen	Shift Manager should be in Decision screen	1. Click Create new link 2. Enter required fields 3. Click the Create button 4. Verify newly added record in both UI and database	2. Complaint ID - DES01 Decision Description - some text Decision Date - select date from datetime picker SM_ID - Select Shift manager id COM_ID - Select a complaint Decision Status - Select a status	1. The system is navigated to new decision page 2. The system is allowed to enter values to the text fields 3. System is navigated to the decision home page 4. System is displayed the entered record in both UI and database	1. The system should be navigated to new decision page 2. The system should be allowed to enter values to the text fields 3. System should be navigated to the decision home page 4. System should be displayed the entered record in both UI and database	pass	High	High		
11			TC_DES_02	verify whether Shift Manager can update complaint through complaint screen	Shift Manager should be in Decision screen	1. Click Update link 2. Enter required fields 3. Click the save button 4. Verify updated fields in both UI and database	2. Complaint ID - DES01 Decision Description - some text Decision Date - select date from datetime picker SM_ID - Select Shift manager id COM_ID - Select a complaint Decision Status - Select a status	1. The system is navigated to update decision page 2. The system is allowed to enter values to the text fields 3. System is navigated to the decision home page 4. System is displayed the updated record in both UI and database	1. The system should be navigated to update decision page 2. The system should be allowed to enter values to the text fields 3. System should be navigated to the decision home page 4. System should be displayed the updated record in both UI and database	pass	High	High		
12			TC_DES_03	verify whether Shift Manager can delete complaint through complaint screen	Shift Manager should be in Decision screen	1. Click delete link 2. Click the delete button 3. Verify deleted record remove from both UI and database	NA	1. The system is navigated to delete decision page 2. The system is allowed to delete the record 3. System is navigated to the decision home screen and removed record from both UI and database	1. The system should be navigated to delete decision page 2. The system should be allowed to delete the record 3. System should be navigated to the complaint home screen and removed record from both UI and database	pass	High	High		
13			TC_DES_04	verify whether Shift Manager can view entered complaint through complaint home screen	Shift Manager should be logged in to the system	1. Click complaint tab 2. Verify user can view previously entered decisions in decision home screen	NA	1. The system is navigated to the decision home screen 2. The complaints home screen displays previously entered decision details as expected	1. The system should be navigated to the decision home screen 2. The complaints home screen should be displayed previously entered decision details as expected	pass	High	High		
14			TC_DES_05	verify whether Admin, Production Manager and Shift Manager can access the complaint page	user should be in login screen	1. Login to the system using each user 2. Very user can view and access decision module	NA	1. The system is allowed to login the system 2. System is allowed to access decision home screen for all users	1. The system should be allowed to login the system 2. System should be allowed to access decision home screen for all users	pass	High	High		
15			TC_DES_06	Verify whether email is recieved when new complaint entered to the product by Quality Checker	user should be in login his/her email account	1. Login to the email and verify email	NA	1. The system generated email is received from quality checker. Email content is in as expected	1. The system generated email should be received from quality checker. Email content is in as expected	pass	High	High	DEF_1	Bug is fixed
16			TC_DES_07	verify whether all dropdowns load the relevant data and datetime picker working correctly in complaint screen	Shift Manager should be logged in to the system	1. Click Create new link 2. Click on datetime picker 3. Click on the SM_ID dropdown and verify correct data load for dropdown 4. Click on the COM_ID and verify correct data load for dropdown 5. Click on the Decision Status and verify correct data load for dropdown	2. Complaint ID - DES01 Decision Description - some text Decision Date - select date from datetime picker SM_ID - Select Shift manager id COM_ID - Select a complaint Decision Status - Select a status	1. The system is navigated to new decision page. 2. The system is allowed to select values to the field. 3,4,5. The system is allowed to select values to the fields.	1. The system should be navigated to new decision page. 2. The system should be allowed to select values to the date field. 3,4,5. The system should be allowed to select values to the fields.	pass	High	High		
17			TC_DES_08	verify whether "My task" link in appear home screen and it's behaviour	Shift Manager should be logged in to the system	1. Verify "My Task" link in home screen 2. Click on the "My Task" link	NA	1. System is displayed "My Task" link in home screen 2. System is navigated decision page and displayed decision	1. System should be displayed "My Task" link in home screen 2. System should be navigated decision page and displayed decision which are entered by logged shift Manager.	pass	High	High		

Figure 5.13: Test Cases 6

Quality Assurance Automation System for a biscuit manufacturing company

Defects Declarations

Defect ID: DEF_1

Defect Summary: System does not send the email when complaint is raised by quality checker.

State: Closed **Bug Type:** Functional

Form Name: Complaint

Severity: High **Priority:** High

Prerequisite:

1. Quality checker should have navigated to the add new complaint page.

Steps to reproduce the bug:

1. Enter all mandatory fields.
2. Click on the save button.
3. Verify whether the email is received for shift manager inbox.

Actual result:

System does not generate the email and received the mail in shift manager inbox.

Expected result:

System should be generating the email and received the mail in shift manager inbox.

Quality Assurance Automation System for a biscuit manufacturing company

5.4.2 Non-Functional Testing Results

5.4.2.1 Performance Test Results summary (Table 5.2)

Table 5:2: Performance Test Strategy

Test Strategy	
Environment	Localhost
Test Type	Load Test
User Load	• Login API (Admin, Production Manager, Shift Manager and Quality Checker), Used 10 Vusers
Test Duration	• Ramp up – 2 minutes • Sustained the load - 10 Minutes • Ramp down – 1 minutes
Servers Monitored	• App and Database server
Servers Monitoring tool	• Perfmon tool in windows 10
Performance Testing tool	• Apache JMeter 5.3

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Client Side

5.4.2.1.1 Response time:

- Based on the load test result analysis of “Localhost”, 3 APIs respond in less than 1 seconds (Admin, Production Manager and Quality Checker Login APIs) and “Shift Manager Login” API respond in more than 1 seconds.
- Based on the load test result analysis, identified application maximum supported TPS as approximately 12 TPS. (Please refer figure 5.14 and 5.15).

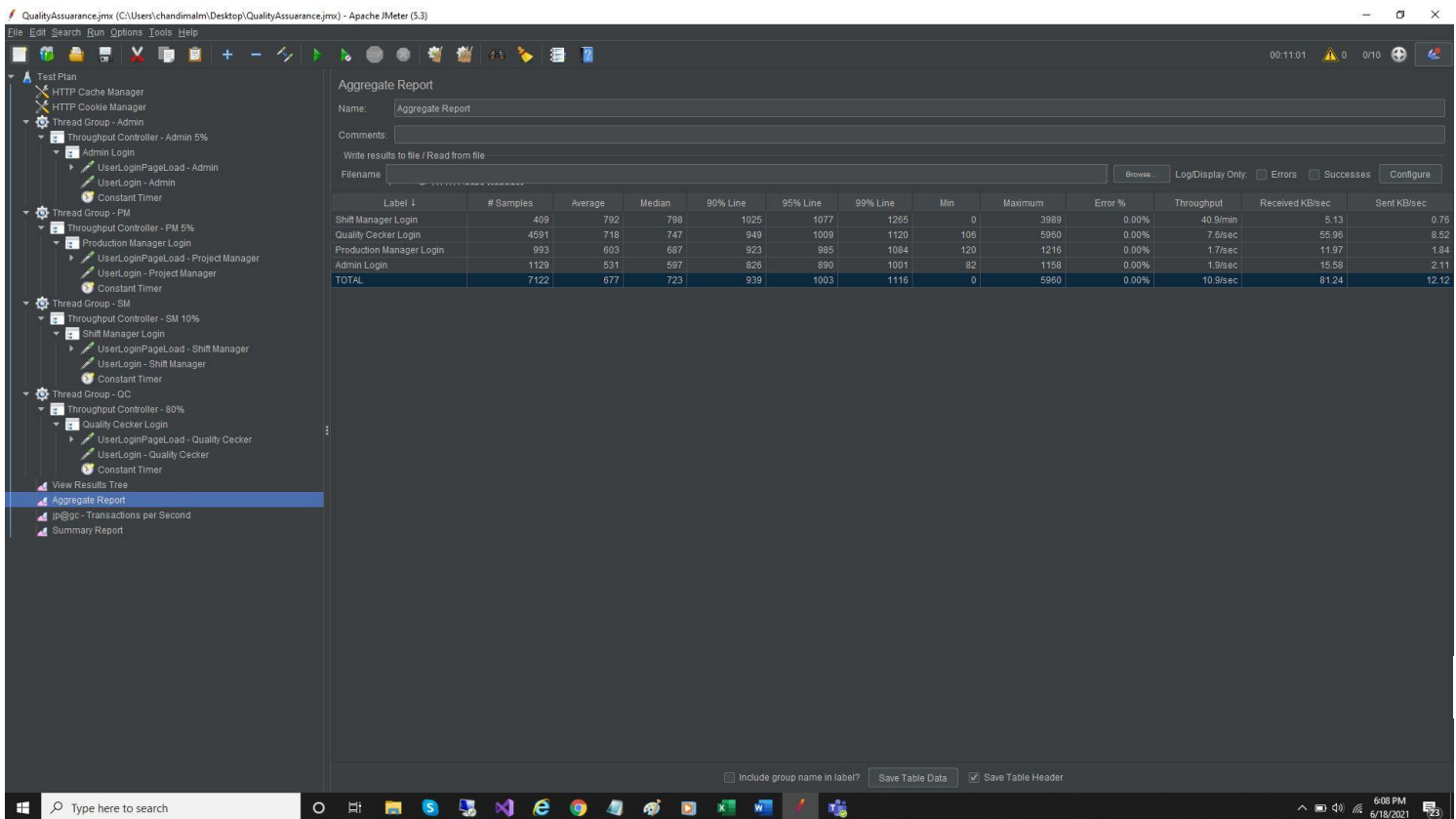


Figure 5.14: JMeter Statistics

Quality Assurance Automation System for a biscuit manufacturing company

5.4.2.1.2 Error Rate:

- There were no error rates observed for all login APIs. (Please refer Figure 5.15).

Load Test Duration 10 Minutes 10 Vuser

Transactions	Samples	90 Percent in ms	Error Rate (%)	TPS	Rec KB/Sec	Sent KB/Sec
Shift Manager Login	409	1025	0	0.68	5.13	0.76
Quality Cecker Login	4591	949	0	7.65	55.96	8.52
Admin Login	1129	826	0	1.88	15.58	2.11
Production Manager Login	993	923	0	1.65	11.97	1.84
Total requests to the server				11.86		

Figure 5.15: Client-side statistics summary from JMeter

Server Side

5.4.2.1.3 Server Resources:

- Web-APP and DB servers CPU and Memory utilization were within $\leq 75\%$. (Please refer figure 5.16).
- Production environment need 4-time large environment based on the analysis of server resources utilization in localhost counters. (Please refer figure 5.17).

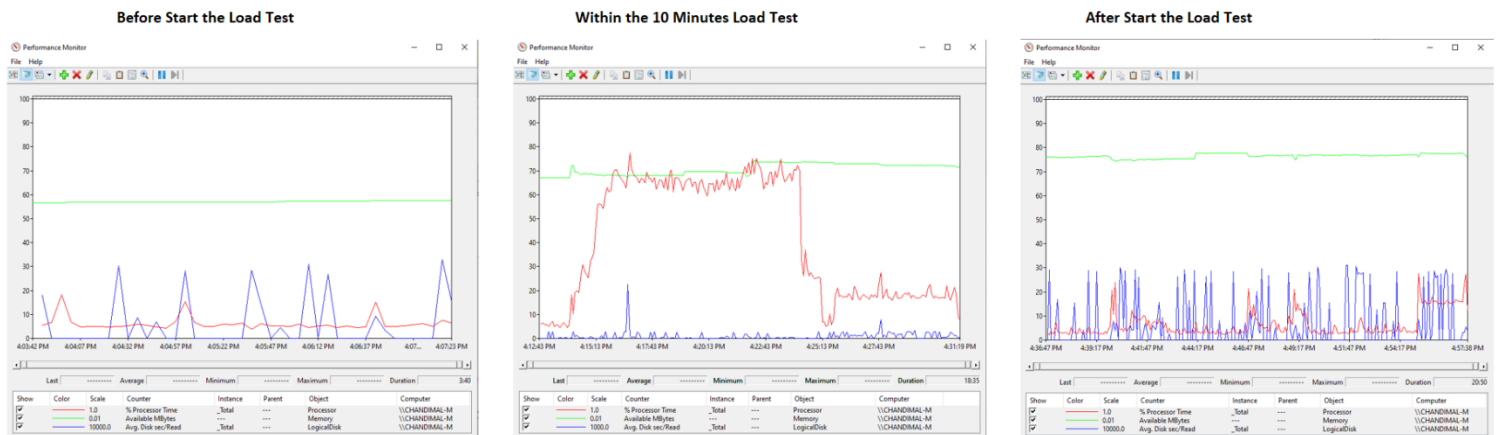


Figure 5.16: Server Utilization

Quality Assurance Automation System for a biscuit manufacturing company

Component/ Containers	Service name	Description	Production Environment	Performance Environment (Localhost)
Web App	IIS Express	Processor	TBD	4 core 8 thread CPU 1.6 GHz
		Memory	TBD	16 GB
		Disk IOPs	TBD	Read : Up to 530MB/s, Write : Up to 370MB/s
Database	SQL Server	Processor	TBD	4 core 8 thread CPU 1.6 GHz
		Memory	TBD	16 GB
		Disk IOPs	TBD	Read : Up to 530MB/s, Write : Up to 370MB/s
Environment Configuration ratio			1:1/4	

Environment	Resources	SLA
Performance	CPU	<= 75%
	Memory	
Production	CPU	<= 75%
	Memory	

Figure 5.17: Server Environment Configuration

5.4.2.2 Performance Test Results summary (Figure 5.18)

Platform										Work flow/ User journey										Method										API										Need performance test										Comments										Concurrent user										Test Results										SLA										Error Rate									
Release 1 Features																																																																																																			
Create New user																																																																																																			
User Login																																																																																																			
Login page load																																																																																																			
Login Admin																																																																																																			
Navigates to home screen																																																																																																			
Login Production Manager																																																																																																			
Navigates to home screen																																																																																																			
Login Shift manager																																																																																																			
Navigates to home screen																																																																																																			
Login Quality Checker																																																																																																			
Navigates to home screen																																																																																																			
Quality Checker																																																																																																			
Shift Manager																																																																																																			
Product Plan																																																																																																			
Product																																																																																																			
Product Category																																																																																																			
Quality Parameter																																																																																																			
View Reports																																																																																																			

Figure 5.18: Performance Test Result Summary

Quality Assurance Automation System for a biscuit manufacturing company

5.4.2.3 UI Test Results summary (Figure 5.19)

1	2	3	A	B	C	D	E	F	G	H	I	J	K	L
1			Project Name: Biscuite Auality Assurance System TCs											
2			Test Cases											
3														
4														
5														
6			Test Case ID	Description	Pre-condition	Test Steps	Test Data	Actual Result	Expected Results	Status	Severity	Priority	Defect ID	Comments
7			Non-Functional Tcs											
8														
9			Common features in UI											
10			TC_UI_01	verify whether texts for textfields in login screen	Admin should be in welcome screen	1. User needs to click on the login link 2. Verify user name text in login screen 3. Verify password text in login screen	NA	1. The system is allowed to access the login link 2. The system is displayed "User Name" as expected 3. The system is displayed "User Password" as expected	1. The system should be allowed to access the login link 2. The system should be displayed "User Name" as expected 3. The system should be displayed "User Password" as expected	pass	Medium	Medium		
11			TC_UI_02	verify whether texts for textfields in user registration screen	Admin should be in welcome screen	1. User needs to click on the registration link 2. Verify Employee ID text in registration screen 3. Verify User Password text in registration screen 4. Verify First Name text in registration screen 5. Verify Last Name text in registration screen 6. Verify User Email text in registration screen 7. Verify Contact Number text in registration screen 8. Verify User Role ID text in registration screen 9. Verify Date text in registration screen	NA	1. The system is allowed to registration login link 2. The system is displayed Employee ID text in registration screen as expected 3. The system is displayed User Password text in registration screen as expected 4. The system is displayed First Name text in registration screen as expected 5. The system is displayed Last Name text in registration screen as expected 6. The system is displayed User Email text in registration screen as expected 7. The system is displayed Contact Number text in registration screen as expected 8. The system is displayed User Role ID text in registration screen as expected 9. The system is displayed Date text in registration screen as expected	1. The system should be allowed to registration login link 2. The system should be displayed Employee ID text in registration screen as expected 3. The system should be displayed User Password text in registration screen as expected 4. The system should be displayed First Name text in registration screen as expected 5. The system should be displayed Last Name text in registration screen as expected 6. The system should be displayed User Email text in registration screen as expected 7. The system should be displayed Contact Number text in registration screen as expected 8. The system should be displayed User Role ID text in registration screen as expected 9. The system should be displayed Date text in registration screen as expected	pass	Medium	Medium		
12			TC_UI_03	verify whether buttons in each screen	User should be logged into the system	1. User have to logging to the each module and verify Save button 2. User have to logging to the each module and verify Back to list button	NA	1. The system is displayed save button in each module as expected 2. The system is displayed Back to list button in each module as expected	1. The system should be displayed save button in each module as expected 2. The system should be displayed Back to list button in each module as expected	pass	Medium	Low		
13			TC_UI_04	verify whether links in each screen	User should be logged into the system	1. User have to logging to the each module and verify Edit link 2. User have to logging to the each module and verify Update link 3. User have to logging to the each module and verify Details link	NA	1. The system is displayed Edit link in each module as expected 2. The system is displayed Update link in each module as expected 3. The system is displayed Details link in each module as expected	1. The system should be displayed Edit link in each module as expected 2. The system should be displayed Update link in each module as expected 3. The system should be displayed Details link in each module as expected	pass	Medium	Low		
14			TC_UI_05	verify whether UI colors and components alignments	User should be logged into the system	1. Users have to logged into each modules and verify colors and component's alignment	NA	1. The system is displayed colors and componets alignments are in as expected	1. The system should be displayed colors and componets alignments are in as expected	pass	Medium	Low		

Figure 5.19: UI Test cases

5.5 Summary

This chapter includes the software testing phase related details. Here explained functional and non-functional test related tasks. For e.g., Identify the testing scenarios of the system and execute those. Then check the all the test cases meet its expectation otherwise that test case is failed. That's how the testing tasks are going on the software system implementation.

Chapter 6 - Conclusion

By introducing “Quality Assurance Automation System”, section 1.3 mentioned objectives were addressed successfully.

The biscuit product company can track their production flows, what are the issue they found, how their quality checkers and Production manager working and track the quality of their biscuit product using one centralized system. These areas were not captured properly in current system. By introducing this “Quality Assurance Automation System”, above mentioned areas are covering successfully. Planning to integrate this system with automated hardware. Which automatically detect the biscuit product parameter like color, dimension and weight.

Using this centralized web system clients can handle their day today business traction in efficient and effective way. Reason is this web system hosted in cloud environment and clients can access the system by using their mobile, tab and organization PCs at any time and every where. When managers assign some product complaints/ bugs, they can immediately address the issue due to this infrastructure. Quality checker and shift manager roles having special functionality call ed “My Tasks” button in their home screen. By accessing this function, they can easily access their task. That feature is user friendly and high effectiveness. Due to the new features in this system, clients are happier on their product quality assurance tasks.

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Appendix A

Management Reports

1.0 Decision Report

Here user can view all the decisions details linked with complaints which generate from "Decision Report" feature. This report can be generated by applying shift manager or product. User can get understand about the which products had more issues during the production. Based on this information, company can get the understand about future products.

If select filter as “shift manager” – Decision report generated which include decision information related to particular shift managers. (Figure A.1)

If select filter as “Product” – Decision report generated which include decision information related to particular products. (Figure A.2)

Referenced table in Database

1. Product table
2. Shift manager table
3. Quality checker table
4. Complaint table
5. Decision table

Filters

Month of Year	Dropdown
Shift manager	Dropdown
Product	Dropdown

Access granted for following users

- Admin
- Production Manager
- Shift Manager
- Quality Checker

Quality Assurance Automation System for a biscuit manufacturing company

1.1 Decision Report - Shift Manager view

Decision Report

Month June

☒ Shift Manager 6
☐ Product

Product	Quality Checker Name	Complaint	Complaint Date	Shift Manager Name	Decision	Decision Date
Maari	Jhone Smith	Issue in surface color	6/28/2021	Kamal Perera	Check heater temp level	6/28/2021

View

Cancel

Figure A.1: Decision Report - Shift Manager view

1.2 Decision Report - Product view

Quality Assurance Automation System for a biscuit manufacturing company

Product	Quality Checker Name	Complaint	Complaint Date	Shift Manager Name	Decision	Decision Date
Rovello	Kasun Perera	Weigh Issue	6/24/2021	Samantha	Check Main Mixture	6/24/2021
Rovello	Lasitha L	Issue on taste	5/03/2021	Lasantha	Check the initial ingredients	6/03/2021

Figure A.2: Decision Report - Product view

2.0 Monthly Product Plan Report

Here user can view all the product plans details which generate from "Monthly Product Plan" feature. Using this report user can get understand about the month wise their products plans.

User have to select filter as "month" of desired year – Monthly Product Plan report generated which are allocated for selected month. (Figure A.3)

Referenced table in Database

1. Product table
2. Product plan table

Filters

Month of Year	Dropdown
---------------	----------

Quality Assurance Automation System for a biscuit manufacturing company

Access granted for following users

- Admin
- Production Manager
- Shift Manager
- Quality Checker

2.1 Monthly Product Plan Report view

Monthly Product Plan Report

MONTHLY PRODUCT PLAN DETAILS

Select Month

Month June

Product Name	Expected quantity	Produced Quantity
Maari	200	50
center shok	2000	500

Clear Cancel

Figure Error! No text of specified style in document..3: Monthly Product Plan Report view

3.0 Quality Checker Details Report

Quality Assurance Automation System for a biscuit manufacturing company

Here user can view all the quality checker employee details linked with particular shift manager which generate from "Quality Checker Details Report" feature. This report can be accessed by applying shift manager ID. From this report user can get understand about the quality checker employees who assigned with which shift manager. (Figure A.4)

Referenced table in Database

1. Shift manager table
2. Quality Checker table
3. Product table

Filters

Shift Manager ID	Dropdown
------------------	----------

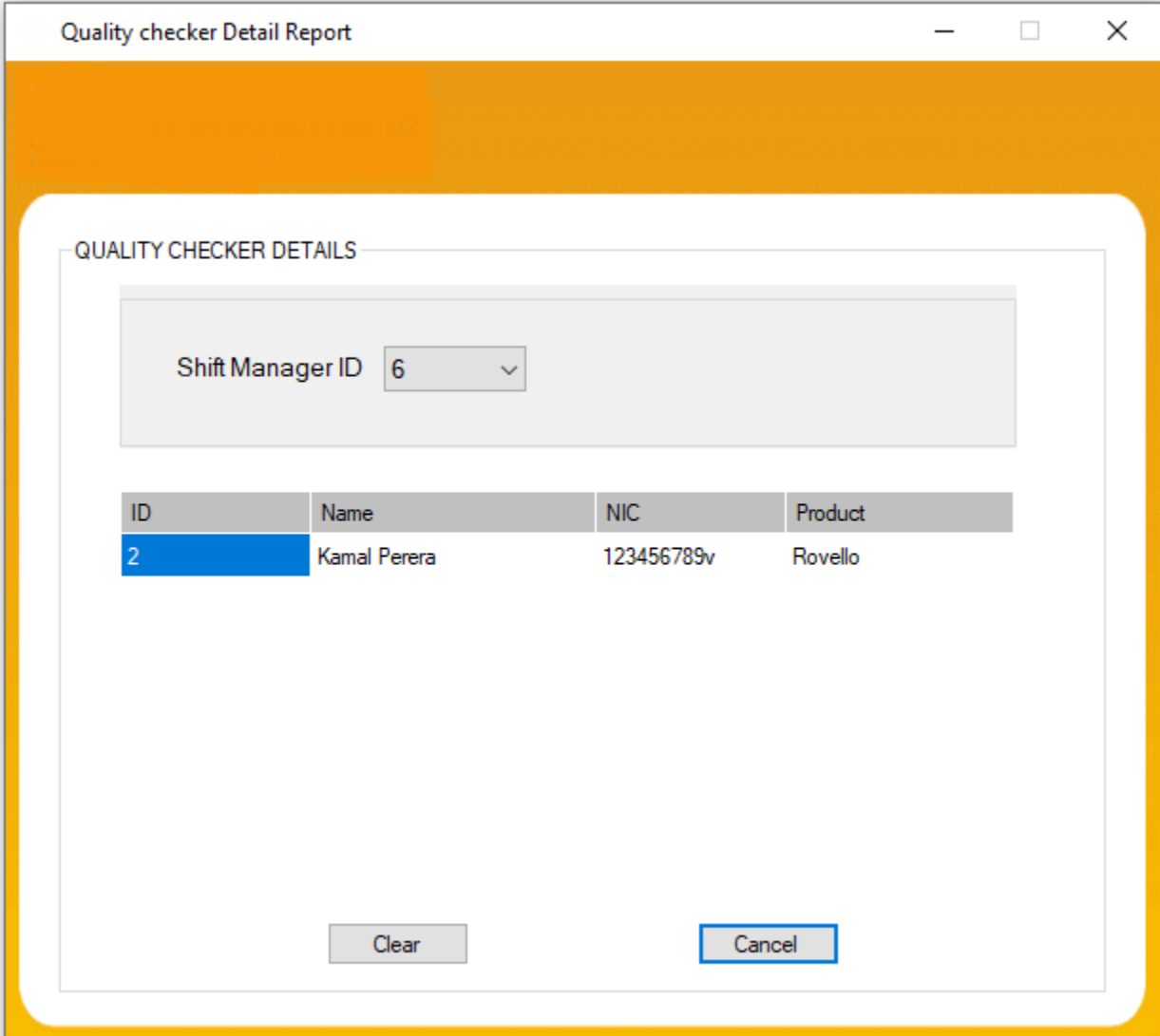
Quality Checker Details Report

Access granted for following users

- Admin
- Production Manager
- Shift Manager

3.1 Quality Checker Details Report view

Quality Assurance Automation System for a biscuit manufacturing company



The image shows a software window titled "Quality checker Detail Report". It has a yellow header bar and a white content area. Inside the content area, there is a section titled "QUALITY CHECKER DETAILS". Below this title, there is a form with a "Shift Manager ID" label and a dropdown menu showing the value "6". Below the form, there is a table with four columns: "ID", "Name", "NIC", and "Product". The first row of the table has the values "2", "Kamal Perera", "123456789v", and "Rovello". The "ID" column is highlighted in blue. At the bottom of the window, there are two buttons: "Clear" and "Cancel".

Quality checker Detail Report

QUALITY CHECKER DETAILS

Shift Manager ID 6

ID	Name	NIC	Product
2	Kamal Perera	123456789v	Rovello

Clear Cancel

Figure A.4: Quality Checker Details Report view

Quality Assurance Automation System for a biscuit manufacturing company

Here user can view all the quality parameter details which generate from "Quality Parameter Report" feature. This report can be accessed by applying product category. Using this report user can get the summary of quality parameter which are linked with each product category. (Figure A.5)

Referenced table in Database

1. Product table
2. Product Category table
3. Quality Parameter table

Filters

Product Category	Dropdown
------------------	----------

Quality Parameter Report

Access granted for following users

- Admin
- Production Manager
- Shift Manager

4.1 Quality Parameter Details Report view

Quality Assurance Automation System for a biscuit manufacturing company

Quality Parameter Report

QUALITY PARAMETER DETAILS

Product CategoryCakes

Product Name	Weight (g)	Water Level 1 (ml)	Water Level 2 (ml)	Moisture
okey	150	3	8	As expected

Clear

Cancel

Figure *Error! No text of specified style in document..5*: Quality Parameter Details Report view

Appendix B

Logic to control user access features (in .cshtml view) after logged in to the system (Figure B.1)

```

24  // Clickable "Home" text till user logged in
25  if (User.Identity.IsAuthenticated)
26  {
27      <button type="button" class="btn btn-primary" onclick="location.href=@Url.Action("Index", "Home")" style="margin-top:7px">
28          <span class="glyphicon glyphicon-home"></span>
29      </button>
30  }
31  </div>
32  <div class="navbar-collapse collapse">
33      <ul class="nav navbar-nav">
34          if (User.Identity.IsAuthenticated)
35          {
36              if (User.IsInRole("Admin"))
37              {
38                  <li><Html.ActionLink("User Registration", "Index", "UserRegistration")</li>
39                  <li><Html.ActionLink("Products", "Index", "Products")</li>
40                  <li><Html.ActionLink("Product Plans", "Index", "Product_Plan")</li>
41                  <li><Html.ActionLink("Product Categories", "Index", "Categories")</li>
42                  <li><Html.ActionLink("Quality Parameter", "Index", "Quality_Parameter")</li>
43                  <li><Html.ActionLink("Quality Checker", "Index", "Quality_Checker")</li>
44                  <li><Html.ActionLink("Shift Manager", "Index", "Shift_Manager")</li>
45                  <li><Html.ActionLink("Complaints", "Index", "Complaints")</li>
46                  <li><Html.ActionLink("Decisions", "Index", "Decisions")</li>
47
48                  //CreateInstanceFromVirtualPath Report dropdown
49                  <li class="dropdown">
50                      <a class="dropdown-toggle" data-toggle="dropdown" href="#">
51                          Reports
52                      <span class="caret"></span>
53                      </a>
54                      <ul class="dropdown-menu" role="menu">
55                          <li><Html.ActionLink("Decisions Report", "ReportDecisionsFilter", "Decisions")</li>
56                          <li><Html.ActionLink("Product Plan Report", "ReportProductPlanFilter", "Product_Plan")</li>
57                          <li><Html.ActionLink("Quality Checker Report", "ReportQualityCheckerFilter", "Quality_Checker")</li>
58                          <li><Html.ActionLink("Quality Parameter Report", "ReportQualityParameterFilter", "Quality_Parameter")</li>
59                      </ul>
60                  </li>
61              }
62              else if (User.IsInRole("Production Manager"))
63              {
64                  <li><Html.ActionLink("Products", "Index", "Products")</li>
65                  <li><Html.ActionLink("Product Plans", "Index", "Product_Plan")</li>
66                  <li><Html.ActionLink("Product Categories", "Index", "Categories")</li>
67                  <li><Html.ActionLink("Quality Parameter", "Index", "Quality_Parameter")</li>
68
69                  //CreateInstanceFromVirtualPath Report dropdown
70                  <li class="dropdown">
71                      <a class="dropdown-toggle" data-toggle="dropdown" href="#">
72                          Reports
73                      <span class="caret"></span>
74                      </a>
75                      <ul class="dropdown-menu" role="menu">
76                          <li><Html.ActionLink("Decisions Report", "ReportDecisions", "Decisions")</li>
77                          <li><Html.ActionLink("Product Plan Report", "ReportProductPlan", "Product_Plan")</li>
78                      </ul>
79                  </li>
80              }
81              else if (User.IsInRole("Shift Manager"))
82              {
83                  <li><Html.ActionLink("Products", "Index", "Products")</li>
84                  <li><Html.ActionLink("Product Plans", "Index", "Product_Plan")</li>
85                  <li><Html.ActionLink("Product Categories", "Index", "Categories")</li>
86                  <li><Html.ActionLink("Quality Parameter", "Index", "Quality_Parameter")</li>
87                  <li><Html.ActionLink("Quality Checker", "Index", "Quality_Checker")</li>
88                  <li><Html.ActionLink("Decisions", "Index", "Decisions")</li>
89
90                  //CreateInstanceFromVirtualPath Report dropdown
91                  <li class="dropdown">
92                      <a class="dropdown-toggle" data-toggle="dropdown" href="#">
93                          Reports
94                      <span class="caret"></span>
95                      </a>
96                      <ul class="dropdown-menu" role="menu">
97                          <li><Html.ActionLink("Decisions Report", "ReportDecisions", "Decisions")</li>
98                          <li><Html.ActionLink("Product Plan Report", "ReportProductPlan", "Product_Plan")</li>
99                      </ul>
100                  </li>
101              }
102              else if (User.IsInRole("Quality Checker"))
103              {
104                  <li><Html.ActionLink("Quality Parameter", "Index", "Quality_Parameter")</li>
105                  <li><Html.ActionLink("Quality Checker", "Index", "Quality_Checker")</li>
106                  <li><Html.ActionLink("Complaints", "Index", "Complaints")</li>
107              }
108          }
109          <li>
110              <button type="button" class="btn btn-danger" onclick="location.href=@Url.Action("Logout", "User")" style="margin-top:7px">
111                  <span class="glyphicon glyphicon-off"></span>
112              </button>
113          </li>
114      </ul>
115  </div>

```

Figure B.1: Control User access

Quality Assurance Automation System for a biscuit manufacturing company

Generate systematic email code in controller class (Figure B.2)

```
178 //reference
179 public void SendEmail(string SM_F_Name, string QC_F_Name, string Com_prd_name, string Com_Descrip, string email)
180 {
181     var smtpClient = new SmtpClient("smtp.gmail.com")
182     {
183         Port = 587,
184         Credentials = new NetworkCredential("projectucqualitybiscuit@gmail.com", "Project@KCS123"),
185         EnableSsl = true,
186     };
187     string subject = "New complaint added by " + QC_F_Name + " for the product " + Com_prd_name + "";
188     string body = "Hi " + SM_F_Name + ", " + Environment.NewLine + "There is new issue found on " + Com_prd_name + ". Issue is describe bellow, " + Com_Descrip + ". Please put your attention on this."
189     + Environment.NewLine + Environment.NewLine + "Thanks & Regards, " + Environment.NewLine + QC_F_Name + Environment.NewLine + "(Quality Checker) ";
190     smtpClient.Send("projectucqualitybiscuit@gmail.com", email, subject, body);
191 }
192
193
194
195
```

Figure B.2: Generate email

Password Encryption by using MD5 (Figure B.3)

```
10 //3 references
11 public class Encription
12 {
13     //3 references
14     public static string GetMD5(string str)
15     {
16         MD5 md5 = new MD5CryptoServiceProvider();
17         byte[] fromData = Encoding.UTF8.GetBytes(str);
18         byte[] targetData = md5.ComputeHash(fromData);
19         string byte2String = null;
20
21         for (int i = 0; i < targetData.Length; i++)
22         {
23             byte2String += targetData[i].ToString("x2");
24         }
25         return byte2String;
26     }
27 }

```

Figure Error! No text of specified style in document..3: MD5 Password Encryption

Generate Report code in controller class (Figure B.4)

```
176 // Collect data for decision report from Product,Complaint, Decision, Quality Checker and Shift Manager tables
177 //reference
178 public ActionResult ReportDecisions()
179 {
180     ReportViewer reportViewer = new ReportViewer();
181     reportViewer.ProcessingMode = ProcessingMode.Local;
182     reportViewer.SizeToReportContent = true;
183     reportViewer.Width = Unit.Percentage(1000);
184     reportViewer.Height = Unit.Percentage(1000);
185     var connectionString = ConfigurationManager.ConnectionStrings["ModelQualityAssuranceDB1"].ConnectionString;
186     SqlConnection conn = new SqlConnection(connectionString);
187     conn.Open();
188     string query = "SELECT d.Des_ID,p.Product_name, qc.QC_F_name, c.Description, c.Com_Data, sm.SM_F_name, sm.SM_L_name, d.Dec_date, d.Des_Description FROM Product AS p, Quality_Checker AS qc,Shift_Manager AS sm, Complaint AS c, Decision AS d " +
189     "WHERE p.Product_code = c.Product_code and qc.QC_id = c.QC_ID and sm.SM_id = c.SM_ID and c.Com_ID = d.Com_ID";
190     SqlCommand cmd = new SqlCommand(query, conn);
191     SqlDataReader rd = cmd.ExecuteReader();
192     DataTable dt = new DataTable();
193     dt.Load(rd);
194     reportViewer.LocalReport.ReportPath = Request.MapPath(Request.ApplicationPath) + @"Reports\DecisionReport.rdlc";
195     reportViewer.LocalReport.DataSources.Add(new ReportDataSource("ProductDataSet", dt));
196     reportViewer.LocalReport.DataSources.Add(new ReportDataSource("ComplaintDataSet", dt));
197     reportViewer.LocalReport.DataSources.Add(new ReportDataSource("DecisionDataSet", dt));
198     reportViewer.LocalReport.DataSources.Add(new ReportDataSource("SMDataSet", dt));
199     reportViewer.LocalReport.DataSources.Add(new ReportDataSource("QCDataSet", dt));
200     ViewBag.ReportViewer = reportViewer;
201     conn.Close();
202     return View();
203 }
204
205
206
```

Figure B.4: Generate Report

Appendix C

User Manual

System workflows are mentioned below. Please refer (Figure C.1 to C.53).

Login Screen (Figure C.1)

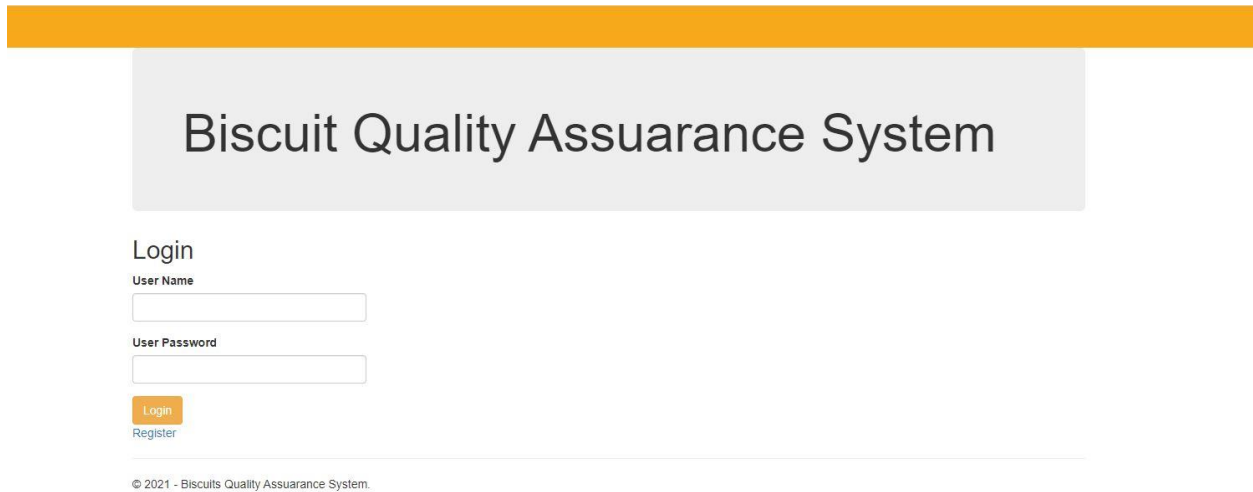


Figure CError! No text of specified style in document..1: Login Screen

Admin – Welcome Screen (Figure C.2)

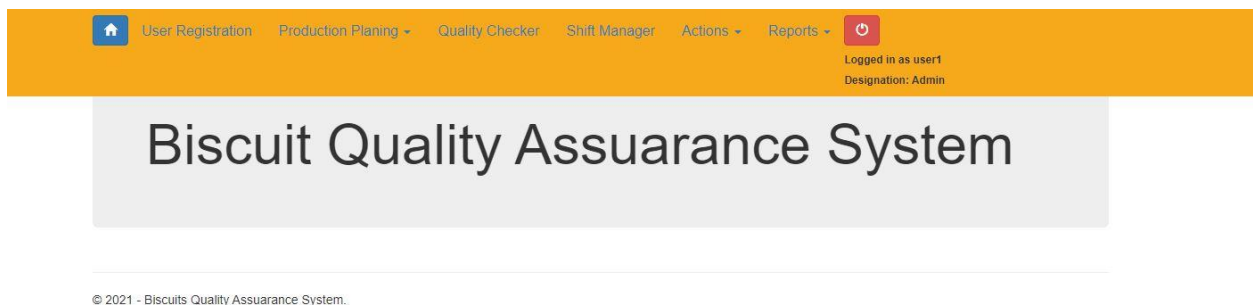


Figure CError! No text of specified style in document..2: Welcome Screen - Admin

Quality Assurance Automation System for a biscuit manufacturing company

Production Manager - Welcome Screen (Figure C.3)

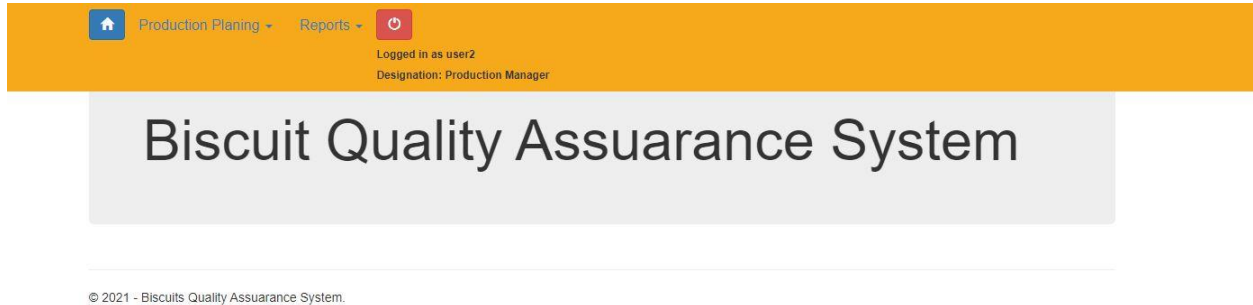


Figure C.3: Welcome Screen - PM

Production Manager – Production Planning Activities Screen (Figure C.4)

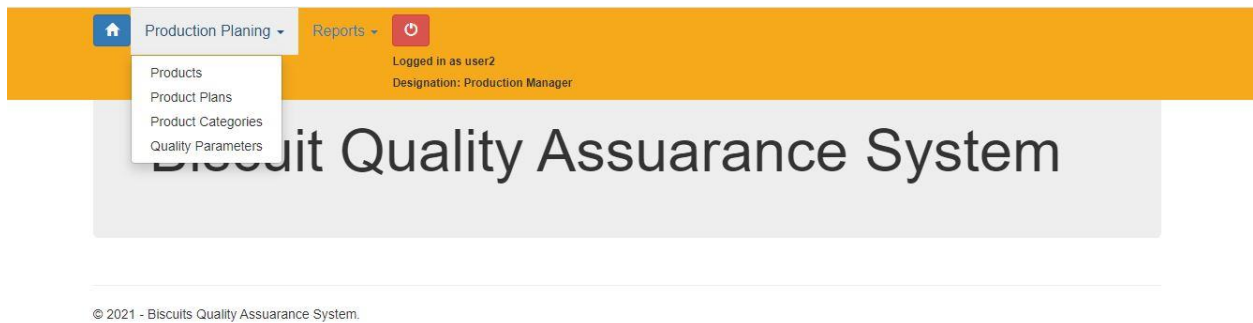


Figure C.4: Production Planning Activities - PM

Production Manager – Reports Screen (Figure C.5)

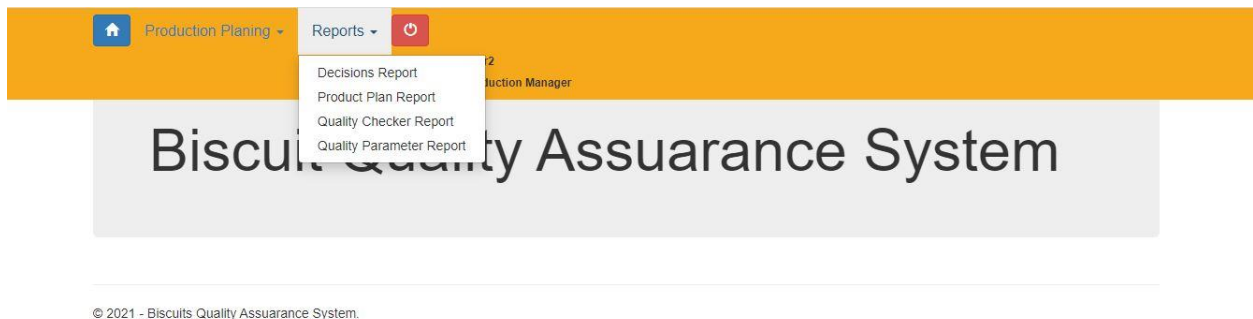


Figure C.5: Report Screen - PM

Quality Assurance Automation System for a biscuit manufacturing company

Shift Manager - Welcome Screen (Figure C.6)

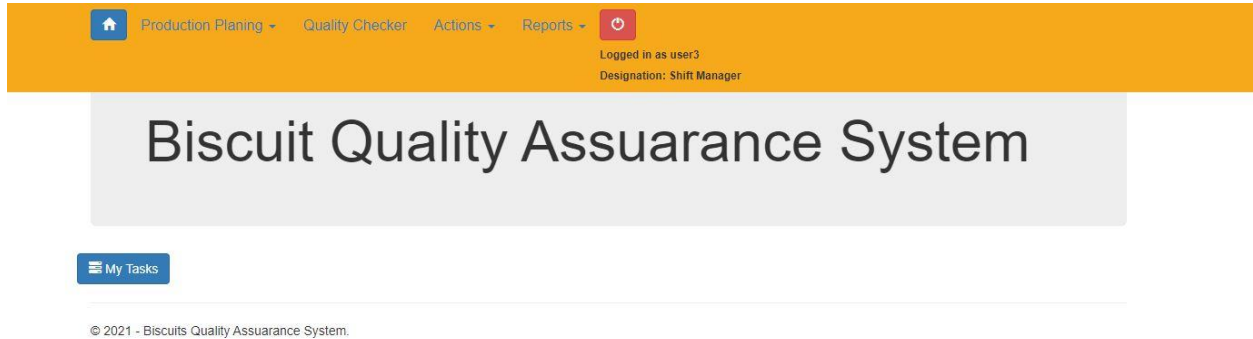


Figure C.6: Welcome Screen - SM

Shift Manager - Home Screen (Figure C.7)

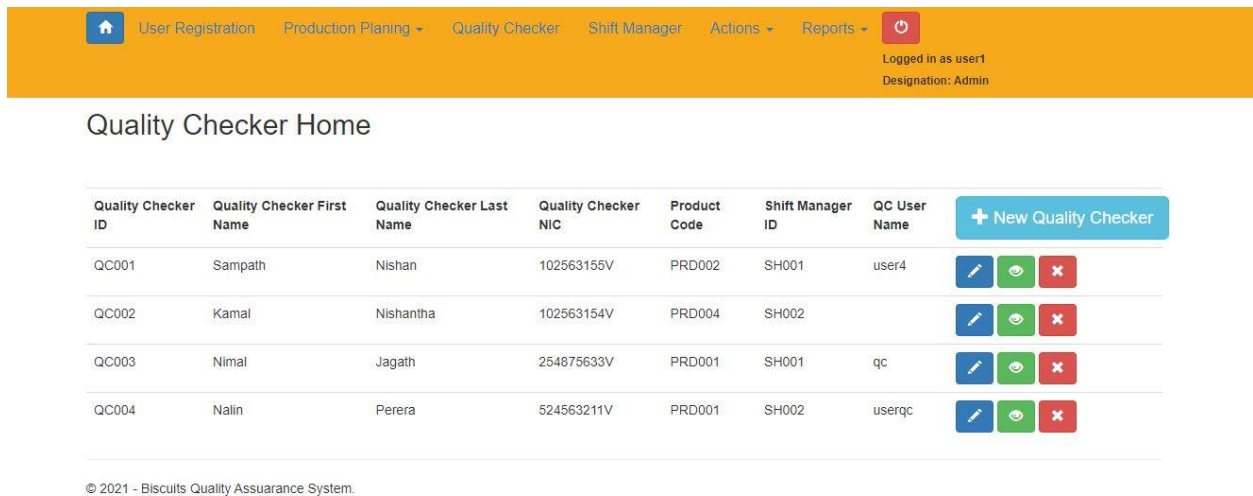


Figure C.7: Home Screen - SM

Quality Assurance Automation System for a biscuit manufacturing company

Shift Manager – Production Planning activities Screen (Figure C.8)

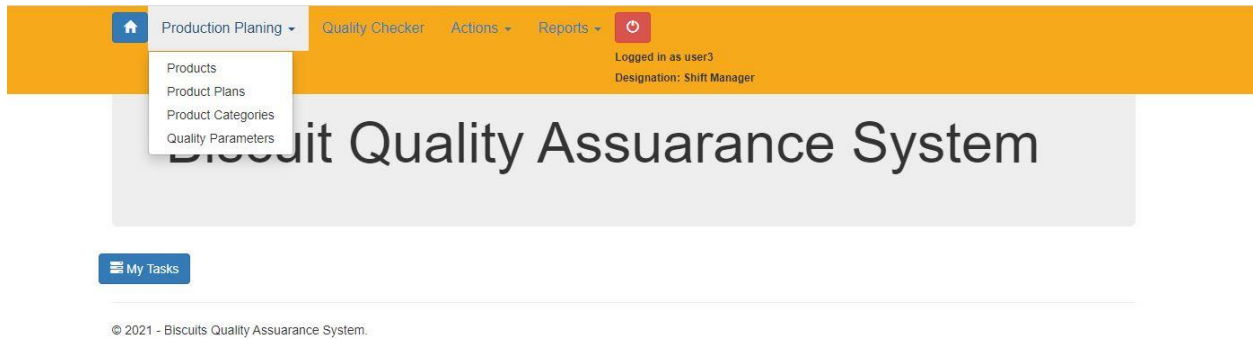


Figure C.8: Production Planning Activities - SM

Shift Manager – Actions Screen (Figure C.9)

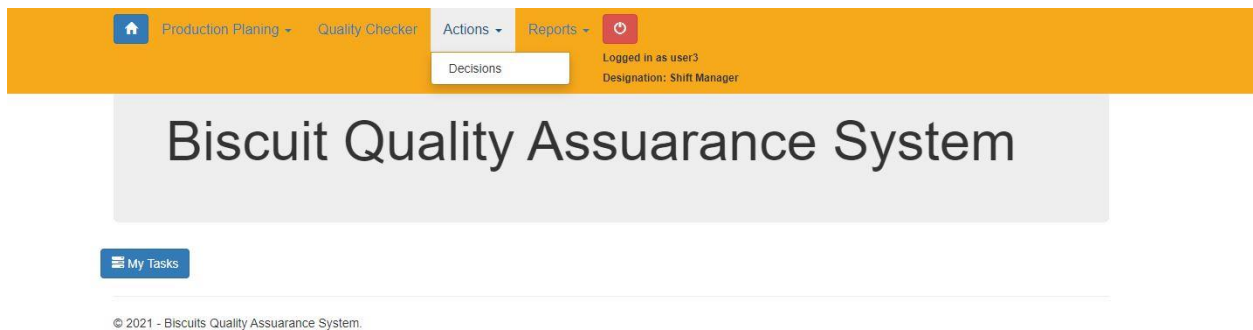


Figure C.9: Actions Screen - SM

Shift Manager – Reports Screen (Figure C.10)

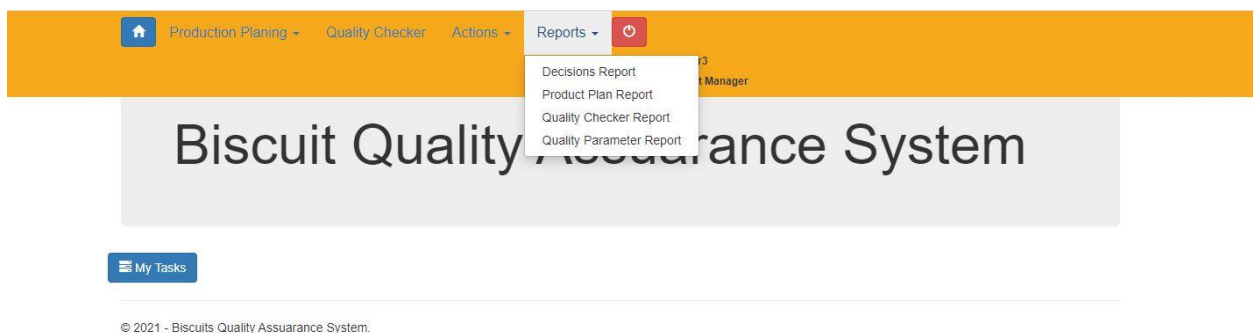


Figure C.10: Report Screen - SM

Quality Assurance Automation System for a biscuit manufacturing company

Shift Manager – Assigned Tasks Screen (Figure C.11)

 Production Planning ▾ Quality Checker ▾ Actions ▾ Reports ▾ 

Logged in as user3
Designation: Shift Manager

My Pending Tasks

Product Name	Quality Checker First Name	Shift Manager First Name	Complaint Description	Complaint Date	Complaint Status	
Cream Cracker	Sampath	Sam	Walter level issue_Update	6/1/2021 12:00:00 AM	Inprogress	
Cream Cracker	Sampath	Sam	Test	6/19/2021 4:20:00 PM	Open	
Cream Cracker	Sampath	Sam	Walter level issue - Email test	6/20/2021 12:05:00 AM	Open	
Cream Cracker	Sampath	Sam	Walter level issue - Email test2	6/20/2021 12:05:00 AM	Open	
Wafas	Sampath	Sam	Walter level issue-Email test2	6/20/2021 1:12:00 AM	Open	
Cream Cracker	Sampath	Sam	Walter level issue-Email test2-qc name test	6/20/2021 1:27:00 AM	Open	
Wafas	Sampath	Sam	Walter level issue-Email test2 sender name test	6/20/2021 1:34:00 AM	Open	
Cream Cracker	Sampath	Sam	Walter level issue-Email test2 sender name test2	6/20/2021 1:36:00 AM	Open	
Maari	Nimal	Sam	Moisture Issue_new	8/31/2021 4:06:00 PM	Open	
Chocolate biscuit	Nimal	Sam	Walter level issue22	8/31/2021 4:13:00 PM	Open	
Wafas	Nalin	Sam	Walter level issue-Email test2	8/31/2021 4:14:00 PM	Open	
Cream Cracker	Nimal	Sam	Walter level issue2	9/3/2021 1:04:00 AM	Open	

Figure CError! No text of specified style in document..11: Assigned Task Screen - SM

Quality Checker – Welcome Screen (Figure C.12)

 Production Planning ▾ Quality Checker ▾ Actions ▾ Reports ▾ 

Logged in as user4
Designation: Quality Checker

Biscuit Quality Assurance System

 My Complaints

© 2021 - Biscuits Quality Assurance System.

Figure CError! No text of specified style in document..12: Welcome Screen - QC

Quality Assurance Automation System for a biscuit manufacturing company

Quality Checker – Production Planning Screen (Figure C.13)

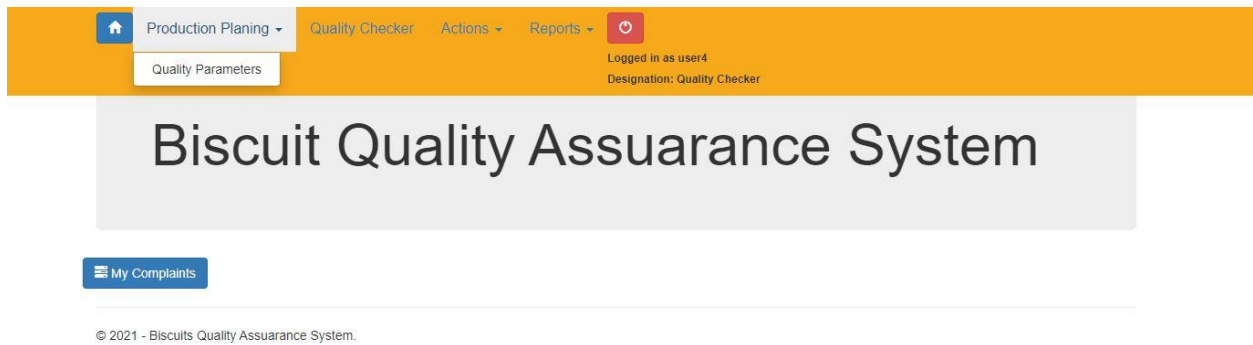


Figure Error! No text of specified style in document.C.13: Production Planning Screen - QC

Quality Checker - Actions Screen (Figure C.14)

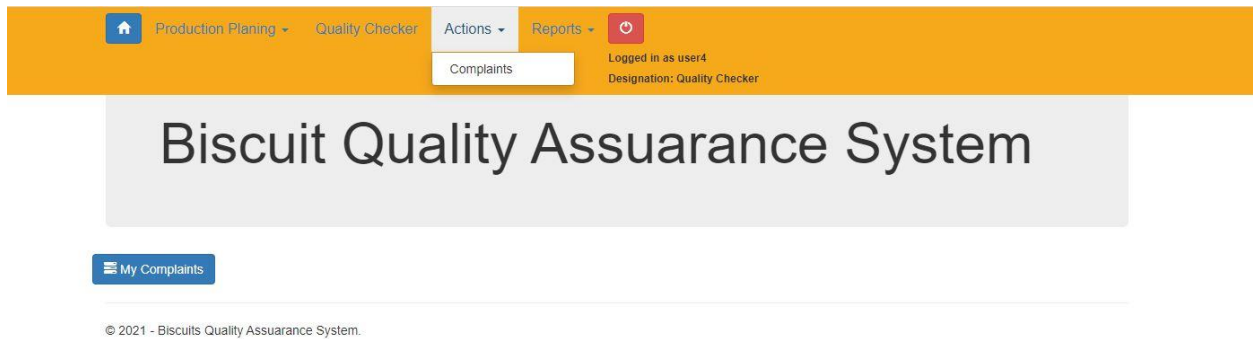


Figure CError! No text of specified style in document..14: Actions Screen - QC

Quality Checker – Reports Screen (Figure C.15)

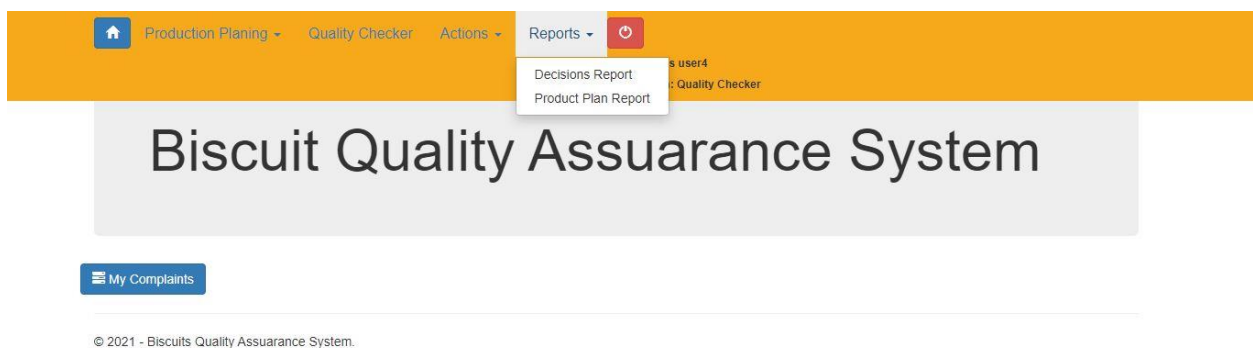


Figure CError! No text of specified style in document..15: Report Screen - QC

Quality Assurance Automation System for a biscuit manufacturing company

Quality Checker – Home Screen (Figure C.16)

 User Registration

 Production Planning

 Quality Checker

 Shift Manager

 Actions

 Reports



Logged in as user1
Designation: Admin

Figure C.16: Home Screen - QC

Quality Checker – Tasks Screen (Figure C.17)

 Production Planning

 Quality Checker

 Actions

 Reports



Logged in as user4
Designation: Quality Checker

Figure C.17: Logged Complaints by QC

Quality Assurance Automation System for a biscuit manufacturing company

Product – Home Screen (Figure C.18)

The screenshot shows the 'Product Home' screen. At the top is an orange navigation bar with a home icon, 'User Registration', 'Production Planning', 'Quality Checker', 'Shift Manager', 'Actions', 'Reports', and a power icon. Below the navigation bar, it says 'Logged in as user1' and 'Designation: Admin'. The main heading is 'Product Home'. Below this is a table with columns: 'Product Name', 'Category Name', 'Shift Manager ID', and a '+ New Product' button. The table contains four rows of product data. Each row has three action buttons: a blue pencil icon, a green eye icon, and a red 'X' icon. At the bottom left, there is a copyright notice: '© 2021 - Biscuits Quality Assurance System.'

Product Name	Category Name	Shift Manager ID	+ New Product
Cream Cracker	Biscuits	SH001	  
Wafas	Biscuits	SH002	  
Maari	Biscuits	SH001	  
Chocolate biscuit	Biscuits	SH002	  

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Figure C.18: Home Page - Product

Add Product Screen (Figure C.19)

The screenshot shows the 'Add Product' screen. At the top is an orange navigation bar with a home icon, 'User Registration', 'Production Planning', 'Quality Checker', 'Shift Manager', 'Actions', 'Reports', and a power icon. Below the navigation bar, it says 'Logged in as user1' and 'Designation: Admin'. The main heading is 'Create Product'. Below this is a form with four fields: 'Product Code', 'Product Name', 'Product Category name' (with a dropdown menu showing 'Low sugar'), and 'Shift Manager ID' (with a dropdown menu showing 'Jhone'). There is a 'Create' button at the bottom right. At the bottom left, there is a copyright notice: '© 2021 - Biscuits Quality Assurance System.'

Create Product

Product Code

Product Name

Product Category name

Shift Manager ID

Create

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Figure C.19: Add Product Page

Quality Assurance Automation System for a biscuit manufacturing company

Edit Product Screen (Figure C.20)

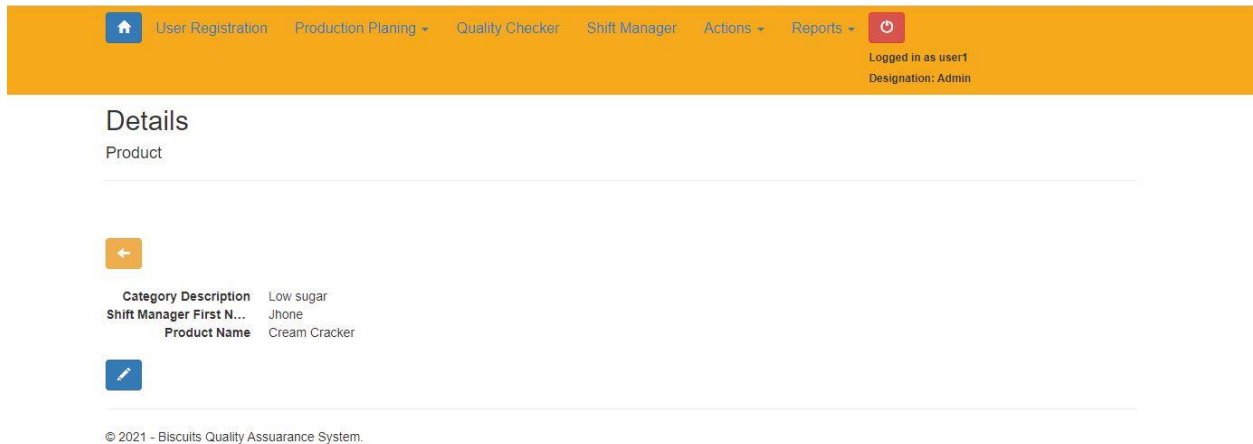


Figure C.20: Edit Product Page

View Product Screen (Figure C.21)

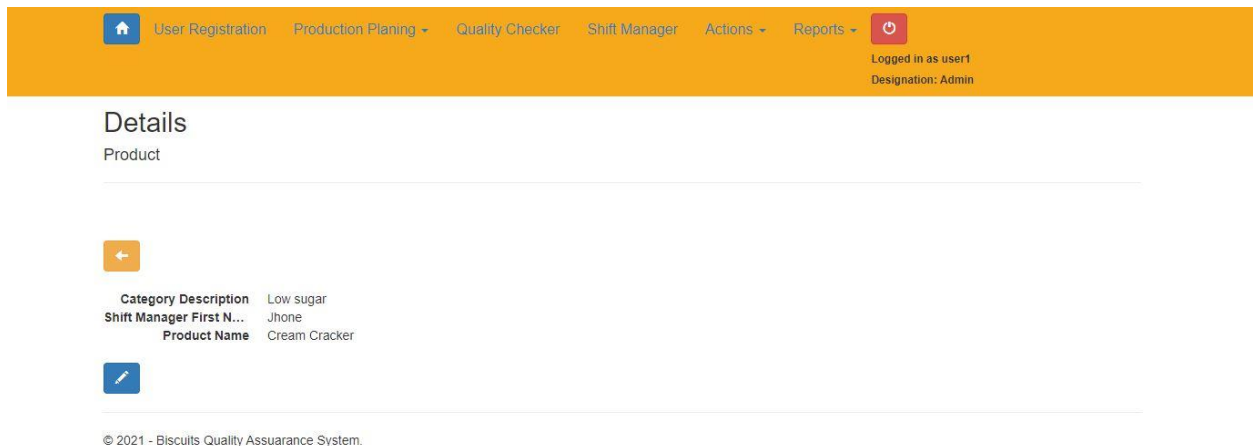


Figure C.21: View Details of Product Page

Quality Assurance Automation System for a biscuit manufacturing company

Delete Product Screen (Figure C.22)

User Registration

Production Planing

Quality Checker

Shift Manager

Actions

Reports

Logged in as user1
Designation: Admin

Are you sure you want to delete this?
Product

Category Description

Low sugar

Shift Manager First N...

Jhone

Product Name

Cream Cracker

Delete

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Figure CError! No text of specified style in document..22: Delete Product Page

Product Plan - Home Screen (Figure C.23)

User Registration

Production Planing

Quality Checker

Shift Manager

Actions

Reports

Logged in as user1
Designation: Admin

Product Home

Product Name	Category Name	Shift Manager ID	+ New Product
Cream Cracker	Biscuits	SH001	
Wafas	Biscuits	SH002	
Maari	Biscuits	SH001	
Chocolate biscuit	Biscuits	SH002	

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Figure CError! No text of specified style in document..23: Product Plan - Home Screen

Quality Assurance Automation System for a biscuit manufacturing company

Add Product Plan Screen (Figure C.24)

Home User Registration Production Planning Quality Checker Shift Manager Actions Reports Logged in as user1 Designation: Admin

Create Product Plan

←

Product Plan ID

Product Code Cream Cracker

Product Date

Product Expected Qty

Product Qty

Create

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Figure C.24: Add Product Plan Screen

Edit Product Plan Screen (Figure C.25)

Home User Registration Production Planning Quality Checker Shift Manager Actions Reports Logged in as user1 Designation: Admin

Details Product

←

Category Description	Low sugar
Shift Manager First Name	Jhone
Product Name	Cream Cracker

Edit

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Figure C.25: Edit Details of Product Plan Screen

Quality Assurance Automation System for a biscuit manufacturing company

View Product Plan Screen (Figure C.26)



User Registration

Production Planning ▾

Quality Checker

Shift Manager

Actions ▾

Reports ▾



Logged in as user1
Designation: Admin

Details

Product



Category Description

Low sugar

Shift Manager First N...

Jhone

Product Name

Cream Cracker



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Figure CError! No text of specified style in document..26: View Details of Product Plan Screen

Delete Product Plan Screen (Figure C.27)



User Registration

Production Planning ▾

Quality Checker

Shift Manager

Actions ▾

Reports ▾



Logged in as user1
Designation: Admin

Are you sure you want to delete this?

Product



Category Description

Low sugar

Shift Manager First N...

Jhone

Product Name

Cream Cracker

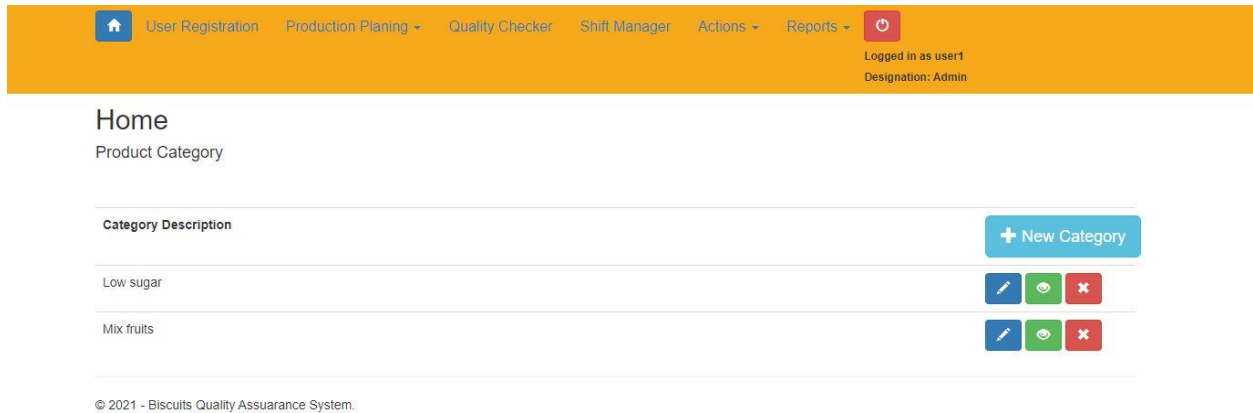
Delete

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Figure CError! No text of specified style in document..27: Delete Product Plan Screen

Quality Assurance Automation System for a biscuit manufacturing company

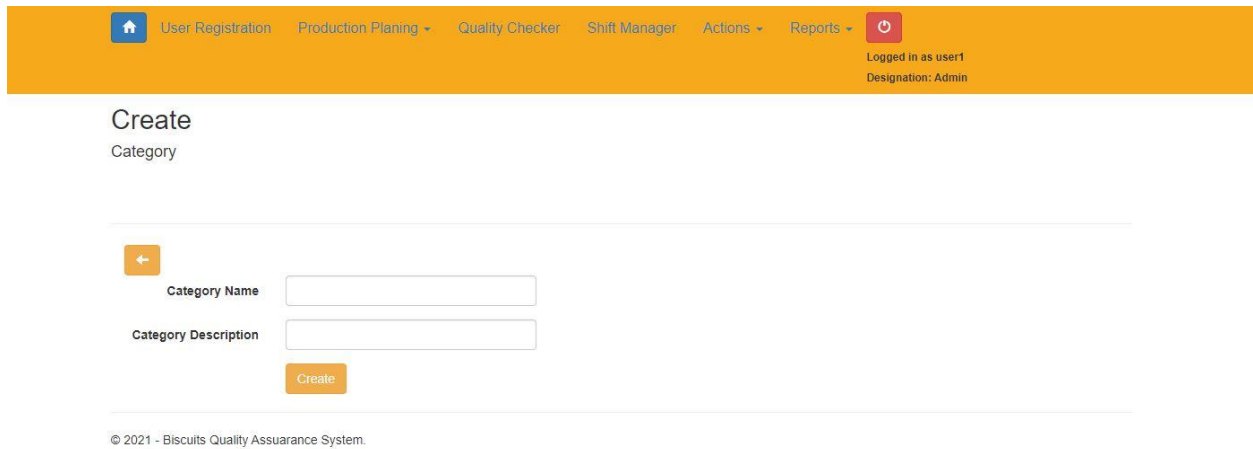
Product Category - Home Screen (Figure C.28)



The screenshot shows the 'Home' screen for the 'Product Category' section. At the top is an orange navigation bar with a home icon, 'User Registration', 'Production Planning', 'Quality Checker', 'Shift Manager', 'Actions', 'Reports', and a power icon. Below the navigation bar, the page title 'Home' is followed by 'Product Category'. The main content area features a table with the header 'Category Description'. The table contains two rows: 'Low sugar' and 'Mix fruits'. To the right of the table is a '+ New Category' button. Below the table, there are three icons: a blue pencil, a green eye, and a red 'X'. At the bottom left, there is a copyright notice: '© 2021 - Biscuits Quality Assurance System.'

Figure C.28: Product Category - Home Screen

Add Product Category Screen (Figure C.29)

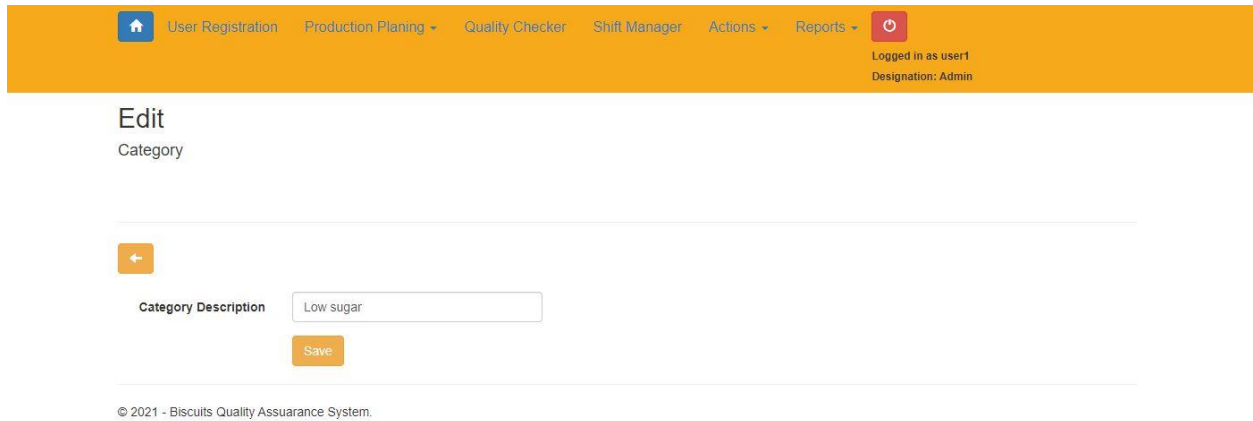


The screenshot shows the 'Create' screen for the 'Product Category' section. At the top is an orange navigation bar with a home icon, 'User Registration', 'Production Planning', 'Quality Checker', 'Shift Manager', 'Actions', 'Reports', and a power icon. Below the navigation bar, the page title 'Create' is followed by 'Category'. The main content area features a form with two input fields: 'Category Name' and 'Category Description'. Below the input fields is a 'Create' button. At the bottom left, there is a copyright notice: '© 2021 - Biscuits Quality Assurance System.'

Figure C.29: Add Product Category Screen

Quality Assurance Automation System for a biscuit manufacturing company

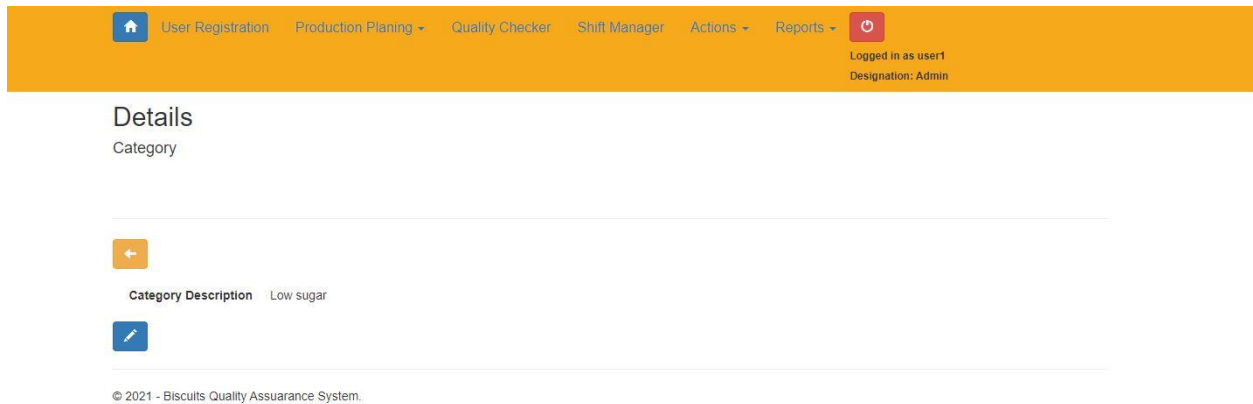
Edit Product Category Screen (Figure C.30)



The screenshot shows the 'Edit Product Category' screen. At the top is an orange navigation bar with a home icon, 'User Registration', 'Production Planing', 'Quality Checker', 'Shift Manager', 'Actions', 'Reports', and a power icon. On the right of the bar, it says 'Logged in as user1' and 'Designation: Admin'. Below the bar, the title 'Edit' is followed by 'Category'. A back arrow icon is on the left. The main form has a label 'Category Description' and a text input field containing 'Low sugar'. Below the input is an orange 'Save' button. At the bottom left, there is a copyright notice: '© 2021 - Biscuits Quality Assurance System.'

Figure C.30: Edit Product Category Screen

View Product Category Screen (Figure C.31)



The screenshot shows the 'View Product Category' screen. It has the same orange navigation bar as Figure C.30. Below the bar, the title 'Details' is followed by 'Category'. A back arrow icon is on the left. The main form displays 'Category Description' followed by 'Low sugar'. Below this, there is a blue edit icon (pencil). At the bottom left, there is a copyright notice: '© 2021 - Biscuits Quality Assurance System.'

Figure C.31: View Product Category Screen

Quality Assurance Automation System for a biscuit manufacturing company

Delete Product Category Screen (Figure C.32)



User Registration

Production Planing 

Quality Checker

Shift Manager

Actions 

Reports 



Logged in as user1
Designation: Admin

Are you sure you want to delete this?

Category



Category DescriptionLow sugar

Delete

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Figure C.32: Delete Product Category Screen

Quality Parameter - Home Screen (Figure C.33)



User Registration

Production Planing 

Quality Checker

Shift Manager

Actions 

Reports 



Logged in as user1
Designation: Admin

Quality Parameter Home

Product Name	Weight (g)	Water Level 1 (ml)	Water Level 2 (ml)	Taste	Moisture	
Cream Cracker	110	5	5	Average	Expected	  
Cream Cracker	200	70	5	Good	Not meet	  
Chocolate biscuit	5	1	2	Good	2%	  

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Figure C.33: Quality Parameter - Home Screen

Quality Assurance Automation System for a biscuit manufacturing company

Add Quality Parameter Screen (Figure C.34)

User Registration

Production Planing ▾

Quality Checker

Shift Manager

Actions ▾

Reports ▾

Logged in as user1
Designation: Admin

Create

Quality Parameter

Quality Parameter Code

Weight (g)

Water Level 1 (ml)

Water Level 2 (ml)

Taste

Moisture

Product Code

Cream Cracker ▾

Create

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Figure C.34: Add Quality Parameter Screen

Edit Quality Parameter Screen (Figure C.35)

User Registration

Production Planing ▾

Quality Checker

Shift Manager

Actions ▾

Reports ▾

Logged in as user1
Designation: Admin

Edit

Quality Parameter

Weight (g)

110

Water Level 1 (ml)

5

Water Level 2 (ml)

5

Taste

Average

Moisture

Expected

Product Code

Cream Cracker ▾

Save

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Figure C.35: Edit Quality Parameter Screen

Quality Assurance Automation System for a biscuit manufacturing company

View Quality Parameter Screen (Figure C.36)

[User Registration](#)

[Production Planning](#)

[Quality Checker](#)

[Shift Manager](#)

[Actions](#)

[Reports](#)

[Logout](#)

Logged in as user1
Designation: Admin

Details

Quality Parameter



Product Name	Cream Cracker
Weight (g)	110
Water Level 1 (ml)	5
Water Level 2 (ml)	5
Taste	Average
Moisture	Expected



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Figure C.36: View Quality Parameter Screen

Delete Quality Parameter Screen (Figure C.37)

[User Registration](#)

[Production Planning](#)

[Quality Checker](#)

[Shift Manager](#)

[Actions](#)

[Reports](#)

[Logout](#)

Logged in as user1
Designation: Admin

Are you sure you want to delete this?

Quality_Parameter



Product Name	Cream Cracker
Weight (g)	110
Water Level 1 (ml)	5
Water Level 2 (ml)	5
Taste	Average
Moisture	Expected



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Figure C.37: Delete Quality Parameter Screen

Quality Assurance Automation System for a biscuit manufacturing company

Decision – Home Screen (Figure C.38)

User Registration

Production Planning

Quality Checker

Shift Manager

Actions

Reports

Logged in as user1
Designation: Admin

Decisions Home

Decision Description	Decision Date	Shift Manager ID	Complaint ID	Decision Status	+ New Decision
Increase the heat	6/19/2021 11:15:59 PM	SH004	COM002	Completed	
Seems like added water is greater than the expected	6/1/2021 12:00:00 AM	SH001	COM001	Open	
Size is not in expected level	6/1/2021 12:00:00 AM	SH001	COM001	Open	
Increase the heat	6/13/2021 2:06:00 AM	SH001	COM001	Open	
Increase the heat new2	6/19/2021 11:24:38 PM	SH004	COM006	Completed	
Seems like added water is greater than the expected	6/19/2021 11:34:22 PM	SH004	COM002	Completed	
Increase the heat	6/21/2021 2:22:25 AM	SH004	COM003	Inprogress	

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Figure C.38: Decision – Home Screen

Add Decision Screen (Figure C.39)

User Registration

Production Planning

Quality Checker

Shift Manager

Actions

Reports

Logged in as user1
Designation: Admin

Create Decision

Decision ID

Decision Description

Decision Date

Shift Manager ID

Jhone

Complaint ID

Water level issue_Update

Decision Status

Open

Create

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Figure C.39: Add Decision Screen

Quality Assurance Automation System for a biscuit manufacturing company

Edit Decision Screen (Figure C.40)

The screenshot shows the 'Edit Decision' screen. At the top is an orange navigation bar with a home icon and links to 'User Registration', 'Production Planning', 'Quality Checker', 'Shift Manager', 'Actions', and 'Reports'. On the right of the bar, it says 'Logged in as user1' and 'Designation: Admin'. Below the navigation bar, the page title 'Edit' is followed by 'Decision'. A back button (orange square with a white arrow) is on the left. The form contains five fields: 'Decision Description' (text input with 'Increase the heat'), 'Decision Date' (text input with '06/19/2021 11:15 PM'), 'Shift Manager ID' (dropdown menu with 'Sam'), 'Complaint ID' (dropdown menu with 'Moisture Issueupdate'), and 'Decision Status' (dropdown menu with 'Completed'). A 'Save' button (orange) is at the bottom right of the form. At the bottom of the page, there is a copyright notice: '© 2021 - Biscuits Quality Assurance System.'

Figure C.40: Edit Decision Screen

View Decision Screen (Figure C.41)

The screenshot shows the 'View Decision' screen. It has the same orange navigation bar as the previous screen. Below the navigation bar, the page title 'Details' is followed by 'Decision'. A back button (orange square with a white arrow) is on the left. The form displays the decision details in a table-like structure: 'Decision Description' (Increase the heat), 'Decision Date' (6/19/2021 11:15:59 PM), 'Shift Manager ID' (SH004), 'Complaint ID' (COM002), and 'Decision Status' (Completed). A blue edit button (square with a white pencil icon) is at the bottom left of the form. At the bottom of the page, there is a copyright notice: '© 2021 - Biscuits Quality Assurance System.'

Figure C.41: View Decision Screen

Quality Assurance Automation System for a biscuit manufacturing company

Delete Decision Screen (Figure C.42)

[Home](#) [User Registration](#) [Production Planning](#) [Quality Checker](#) [Shift Manager](#) [Actions](#) [Reports](#) [Logout](#)

Logged in as user1
Designation: Admin

Are you sure you want to delete this?

Decision

Decision Description Increase the heat
Decision Date 6/19/2021 11:15:59 PM
Shift Manager ID SH004
Complaint ID COM002
Decision Status Completed

Delete

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Figure C.42: Delete Decision Screen

Complaints – Home Screen (Figure C.43)

[Home](#) [User Registration](#) [Production Planning](#) [Quality Checker](#) [Shift Manager](#) [Actions](#) [Reports](#) [Logout](#)

Logged in as user1
Designation: Admin

Home

Complaints

Product Name	Complaint Description	Quality Checker First Name	Shift Manager First Name	Complaint Date	Complaint Status	+ New Complaint
Cream Cracker	Walter level issue_Update	Sampath	Sam	6/1/2021 12:00:00 AM	Inprogress	Edit View Delete
Cream Cracker	Moisture Issueupdate	Sampath	Sam	6/13/2021 2:04:00 AM	Completed	Edit View Delete
Cream Cracker	Walter level issue2	Sampath	Sam	6/15/2021 1:34:00 PM	Completed	Edit View Delete
Cream Cracker	Test	Sampath	Sam	6/19/2021 4:20:00 PM	Open	Edit View Delete
Wafas	Walter level issue new	Sampath	Jhone	6/19/2021 11:20:00 PM	Open	Edit View Delete
Wafas	Walter level issue new2	Sampath	Sam	6/19/2021 11:23:00 PM	Completed	Edit View Delete
Cream Cracker	Walter level issue - Email test	Sampath	Sam	6/20/2021 12:05:00 AM	Open	Edit View Delete
Cream Cracker	Walter level issue - Email test2	Sampath	Sam	6/20/2021 12:05:00 AM	Open	Edit View Delete
Cream Cracker	Walter level issue-Email test	Sampath	Jhone	6/20/2021 12:28:00 AM	Open	Edit View Delete
Cream Cracker	Walter level issue- Custom mail	Sampath	Jhone	6/20/2021 12:35:00 AM	Open	Edit View Delete

Figure C.43: Complaints – Home Screen

Quality Assurance Automation System for a biscuit manufacturing company

Add Complaint Screen (Figure C.44)

Home User Registration Production Planning Quality Checker Shift Manager Actions Reports Logged in as user1 Designation: Admin

Create Complaint

Complaint ID

Complaint Description

Complaint Date

Quality Checker ID

Shift Manager ID

Complaint Status

Product Code

Create

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Figure C.44: Add Complaint Screen

Edit Complaint Screen (Figure C.45)

Home User Registration Production Planning Quality Checker Shift Manager Actions Reports Logged in as user1 Designation: Admin

Edit Complaint

Product Code

Complaint Description

Complaint Date

Quality Checker ID

Shift Manager ID

Complaint Status

Save

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Figure C.45: Edit Complaint Screen

Quality Assurance Automation System for a biscuit manufacturing company

View Complaint Screen (Figure C.46)

 User Registration

 Production Planning

 Quality Checker

 Shift Manager

 Actions

 Reports



Logged in as user1
Designation: Admin

Details

Complaint



Product Name

Cream Cracker

Complaint Description

Walter level issue_Update

Quality Checker First ...

Sampath

Shift Manager First N...

Sam

Complaint Date

6/1/2021 12:00:00 AM

Complaint Status

Inprogress



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Figure CError! No text of specified style in document..46: View Complaint Screen

Delete Complaint Screen (Figure C.47)

 User Registration

 Production Planning

 Quality Checker

 Shift Manager

 Actions

 Reports



Logged in as user1
Designation: Admin

Are you sure you want to delete this?

Complaint



Product Name

Cream Cracker

Complaint Description

Walter level issue_Update

Quality Checker First ...

Sampath

Shift Manager First N...

Sam

Complaint Date

6/1/2021 12:00:00 AM

Delete

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Figure CError! No text of specified style in document..47: Delete Complaint Screen

Quality Assurance Automation System for a biscuit manufacturing company

User Registration - Home Screen (Figure C.48)

 User Registration

Production Planing ▾

Quality Checker

Shift Manager

Actions ▾

Reports ▾

 Logged in as user1
Designation: Admin

User Home

User Role Type	User Name	First Name	Last Name	Email	Contact Number	Password	Created Date	
Admin	user1			contactchandimal@gmail.com		24c9e15e52afc47c225b757e7bee1f9d	6/16/2021 12:17:00 AM	  
Production Manager	user2			contactchandimal@gmail.com		7e58d63b60197ceb55a1c487989a3720		  
Shift Manager	user3			contactchandimal@gmail.com		92877af70a45fd6a2ed7fe81e1236b78		  
Quality Checker	user4			contactchandimal@gmail.com		3f02ebe3d7929b091e3d8ccfde2f3bc6		  
Admin	DemoAdmin			contactchandimal@gmail.com		8e165fdeeb688949b82f24dd4e1436f1		  
Quality Checker	qc			contactchandimal@gmail.com		9300c96aaec324987ea5ca6e13a02eda	6/22/2021 2:08:00 AM	  
Quality Checker	userqc			contactchandimal@gmail.com		a0b2ac1595c65b7aff81e6abbe1d794f	6/22/2021 2:43:00 AM	  

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Figure CError! No text of specified style in document..48: User Registration - Home Screen

Add User Screen (Figure C.49)

 User Registration

Production Planing ▾

Quality Checker

Shift Manager

Actions ▾

Reports ▾

 Logged in as user1
Designation: Admin

Create User



Employee ID

User Name

First Name

Last Name

Email

Contact Number

User Role ID

Password

Created Date

Admin ▾

Create

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Figure CError! No text of specified style in document..49: Add User Screen

Quality Assurance Automation System for a biscuit manufacturing company

Edit User Screen (Figure C.50)

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Figure C.50: Edit User Screen

View User Screen (Figure C.51)

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Figure C.51: View User Screen

Quality Assurance Automation System for a biscuit manufacturing company

Delete User Screen (Figure C.52)

The screenshot shows the 'Delete User' screen of the Quality Assurance Automation System. The top navigation bar is orange and contains links for User Registration, Production Planning, Quality Checker, Shift Manager, Actions, and Reports. A user profile indicator shows 'Logged in as user1' with 'Designation: Admin'. The main content area has a heading 'Are you sure you want to delete this?' followed by 'User'. Below this is a table of user details: User Role Type (Admin), User Name (user1), First Name, Last Name, Email (contactchandimal@gmail.com), Contact Number, Password (24c9e15e52afc47c225b757e7bee1f9d), and Created Date (6/16/2021 12:17:00 AM). A red 'Delete' button is at the bottom left. The footer shows '© 2021 - Biscuits Quality Assurance System.'

User Role Type	Admin
User Name	user1
First Name	
Last Name	
Email	contactchandimal@gmail.com
Contact Number	
Password	24c9e15e52afc47c225b757e7bee1f9d
Created Date	6/16/2021 12:17:00 AM

[Delete](#)

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Figure C.52: Delete User Screen

Systematic Email for the "Shift Manager" (Figure C.53)

The screenshot shows an email interface with a subject line 'New complaint added by Sampath for the product Cream Cracker'. The email body contains three messages from 'projectucscqualitybiscuit@gmail.com' to 'Hi Sam'. The first message mentions a 'Walter level issue_Update2'. The second message mentions a 'Moisture Issue2'. The third message mentions a 'Walter level issue2'. The email is dated 'Fri, 3 Sept, 01:12 (11 days ago)'. At the bottom, there are 'Reply' and 'Forward' buttons.

New complaint added by Sampath for the product Cream Cracker

projectucscqualitybiscuit@gmail.com
Hi Sam, There is new issue found on Cream Cracker. Issue is describe bellow, 'Walter level issue_Update2'. Please put your attention on this. Thanks & Regards 'Sam

4

projectucscqualitybiscuit@gmail.com
Hi Sam, There is new issue found on 'Cream Cracker'. Issue is describe bellow, 'Moisture Issue2'. Please put your attention on this. Thanks & Regards, Sampath

projectucscqualitybiscuit@gmail.com
to me
Hi Sam,
There is new issue found on 'Cream Cracker'. Issue is describe bellow, 'Walter level issue2'. Please put your attention on this.
Thanks & Regards,
Sampath
(Quality Checker)

[Reply](#) [Forward](#)

Figure C.53: Systematic Email for the "Shift Manager"