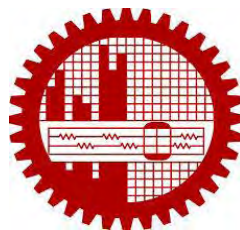# ONLINE CERTIFICATION OF FOOD PRODUCTS

by

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POST GRADUATE DIPLOMA IN INFORMATION AND COMMUNICATION
TECHNOLOGY

Institute of Information and Communication Technology (IICT)

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY (BUET)

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This project titled ─ONLINE CERTIFICATION OF FOOD PRODUCTS" submitted by Mohammad Nazmul Hasan, Roll No: 0413311024, Session: April/2013, has been accepted as satisfactory in partial fulfillment of the requirements for the degree of Post Graduate Diploma in Information and Communication Technology on 19 July, 2017.

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Candidate's Declaration

It is hereby declared that this report or any part of it has not been submitted elsewhere for the award of any degree or diploma.

_____

Mohammad Nazmul Hasan
ID: 0413311024

Dedicated

To

My Parents and Family Members

TABLE OF CONTENT

CHAPTER-III: SYSTEM DESIGN

CHAPTER-IV: IMPLEMENTATION AND FINDINGS

CHAPTER-V: CONCLUSION

LIST OF FIGURES

ABBREVIATION & KEY TERMS

URL	Uniform Resource Locator
HTTP	Hypertext Transfer Protocol
WWW	World Wide Web
HTML	Hyper Text Markup Language
PHP	Hypertext Preprocessor
CSS	Cascading Style Sheets
UIR	User Interface Re-engineering
DR	Database Re-engineering
DAI	Database Administrative Interface
EBF	Existing Bug Fixing
DBMS	Database Management System
DFD	Data Flow Diagram
ERD	Entity Relationship Diagram
DD	Database Diagram
PC	Personal Computer
TCP/IP	Transmission Control Protocol/ Internet Protocol
GDP	Gross domestic product

Acknowledgement

At first I would like to convey my gratitude to Almighty Allah for giving me the opportunity to accomplish this project. I would like to thank my supervisor Dr. Md. Rubaiyat Hossain Mondal, Associate Professor, Institute of Information and Communication Technology (IICT), Bangladesh University of Engineering and Technology (BUET), Dhaka, Bangladesh. He has assigned me an interesting and useful area, which has an extensive range of relevance in real world. He has provided all sorts of support regarding the project work. Without his proper guidance, advice, continual encouragement and active involvement in this process of this work, it would have not been feasible.

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Abstract

The increasing demands for quality food products have created a new dimension around the globe. Obtaining quality certification is a crucial concern to product manufacturers for marketing their food products in the local as well as in the international market. Currently in Bangladesh, there is scope of achieving quality certificates through a semi-automated system. The current process of obtaining quality certificates is time consuming and so manufacturers face difficulty in obtaining the certificates. Since Bangladesh is trying to export more food products, the need is increasing for quality certificates in due time. An automated system where the product manufacturers apply online and the authorities update the survey results online can facilitate the certificate obtaining and the corresponding renewal processes. This project develops a web based online system for management of food certificates. The key features of the developed software are the user application for a new quality certification and also renewal of previous certificates. Moreover, the developed system has aspects such as data monitoring by the applicants and the authority, and generating and updating survey forms by the inspection team. Once the evaluation process ends, the successful applicants can download the certificates. Besides, the software has an admin user role which can control and monitor the overall system, set access permission and generate required reports. The overall software was developed using the popular Waterfall process model. The system was implemented using *WampServer 3.0.6* as a Windows web development environment, *PHP-5.6.25* as a scripting language for server-side web development, *MySQL-5.7.14* as open source relational database server and *Macromedia Dreamweaver 8.0* as HTML editor tool for user interface design. In addition, *Crystal Report* was used for generating printable reports. Unit testing and system testing were performed before the software was finalized. The developed software successfully met the initial requirements. As future work, this developed system can be extended to include full online fees payment.

1.1 Introduction

The characteristics of food that is acceptable to consumers is known as food quality. This characteristic includes external factors such as appearance (size, shape, color, gloss, and consistency), texture, and flavor and internal factors (chemical, physical, microbial). As food consumers are susceptible to any form of contamination that may occur during the manufacturing process, food quality is an important food manufacturing requirement. Many consumers also rely on manufacturing and processing standards, particularly to know what ingredients are present, due to dietary, nutritional requirements (kosher, halal, vegetarian), or medical conditions (e.g., diabetes, or allergies) [1]-[3]. Besides ingredient quality, there is also an important requirement named sanitation. The food processing environment should be as clean as possible in order to produce the safest possible food for the consumers. Food quality also deals with product traceability, (e.g., of ingredient, and packaging suppliers). It also deals with labeling issues to certify there is precise ingredient and nutritional material [1]-[7], [10].

Quality certification for food products is a vital disquiet to product manufacturers for marketing their food products in the local and as well as in the international market. Now-a-days in Bangladesh, there is scope of achieving quality certificates through semi-automated system. Besides the quality certification, the halal certificate for food products is also an important requirement for the Muslim community. Since Bangladesh is trying to export more food products, the need is increasing for quality and halal certificates in due time. Currently, the there is no online system for obtaining halal certificate in Bangladesh. The existing manual or semi-automated systems are time consuming and so manufacturers face difficulty in obtaining the certificates. A fully automated system where 'the product manufacturers apply online and the authorities update the assessment results online' can facilitate the certificate obtaining and the corresponding renewal processes remarkably.

1.2 Objectives with specific aims and possible outcome

The objective of this project is to develop a web based online system for quality certifications for food products. To fulfill the objective, the following possessions are carried out:

- registration processes for quality certification
- data monitoring by the authority
- generating survey forms and updating survey results by the inspection team
- monitoring the status of each and every single step within the processes by the applicant and the authority
- providing online certification.

The possible outcome after the successful completion of this effort is an online system for product manufacturers to get quality certificate.

1.3 Organization of the Project Report

The rest of the report is organized as follows:

Chapter 1 describes the overview and objectives of the project. Chapter 2 describes about the system study and requirement analysis. The system design and development is presented in Chapter 3. In Chapter 4, a description is provided for the implementation of the online system. Chapter 5 describes project strength, limitations and challenges of the project, conclusion and recommendations for future works of the system.

This project was developed following a number of stages including feasibility study, planning, requirement gathering and analysis, process flow, implementation tools and technologies. These stages are described in the following.

2.1 Feasibility Study

An analysis of accounting factors like economic, technological, legal and scheduling to complete a successful project is known as feasibility study. Before investing a considerable amount of time and money into a project, project managers use feasibility studies to determine potential positive and negative outcomes [11].

In another sense, an evaluation and analysis of a proposed project to fix if it (a) is technically feasible, (b) is feasible within the estimated cost, and (c) will be profitable. Feasibility studies are almost always conducted in such area where large sums are at stake. This is also called feasibility analysis [12].

Achieving quality certification is an important concern to food manufacturers for marketing their food products in the local and in the international market. Alongside the quality certification, the halal certificate for food products is also a significant obligation for the Muslim community. Although there is a possibility of obtaining quality and halal certificates through semi-automated and manual systems, respectively in Bangladesh. The existing methods are time consuming and so food manufacturers face difficulty in achieving the certificates. Now-a-days Bangladesh is trying to export more food products so the need is escalating for quality and halal certificates day by day. An automated system where the product manufacturers apply online and the authorities update the assessment results online can assist the certificate achieving and the subsequent renewal processes.

2.2 Planning

In this project, appropriate and well-defined planning was done where the term planning means the process of making plans for something. Planning is a vital aspect in the System Development Life Cycle (SDLC).

If the strategy is well-conceived then it pushes the decision making down to the lowest possible level, closest to where the problems are happened, while at the same time provides the oversight necessary to build a comprehensible system.

The system has six fundamentals to it:

- A Database of Applicant data;

- Information Management System for Food Quality Certificate;

- Online assessment system;

- Protect Fraudulent activity;

- Food quality Certificate issuing process would be transparent and Faster;

- Reduce Cost and Time.

2.3 Scope

Determining and documenting a list of specific project goals, deliverables, features, functions, tasks, deadlines, and ultimately costs are encompassed in project scope. It is a significant part of project planning. In other words, it is what needs to be achieved and the work that must be done to deliver a project [13].

Managing project scope is primarily concerned with defining and controlling what is and is not included in the project."

The scopes of this project are as follows:

1. Information, Requirement and Registration Process

2. Registration/Sign-up by Applicant/Company User

3. Online application via assigned form with required documents attachment

4. SMS notification

5. Verification, Inspection and update assessment results in online by Audit/Inspection Team

6. Online Certification

7. Overall control and permission by Admin

2.4 Methodology

Methodology of a project portrait the way how the project is being completed. An organized methodology is the guidelines for successful completion of study. The following steps were followed to develop the proposed online system:

1. First of all, requirement analysis was done regarding the quality certificates of food products. Next, the 'software requirements specifications (SRS)' was prepared.

2. The data flow diagram (DFD) and entity relationship diagram (ERD) were prepared. After completing the database design, user interfaces/forms were designed for different tasks such as online registration form, application status view for the customers, and list of applications, survey forms for the authority.

3. Next, the web based software was developed using Hypertext Preprocessor (PHP) as the dynamic scripting language. In the front end of the software, HyperText Markup Language (HTML), jQuery and Cascading Style Sheets (CSS) were used. MySQL was used as the database. In addition, Crystal Reports was used for generating printable reports.

4. After the development of the software, thorough testing was done with practical use case scenarios.

2.5 Requirements Analysis

This section discusses the requirement analysis in the context of this project. The process of determining user expectations for a new or modified product is called requirements analysis or also called requirements engineering. Requirements must be quantifiable, relevant and detailed. This kind of requirement is often called functional specifications in software engineering. Requirements analysis is a significant part of project management [9].

The success or failure of a systems or software project critically depends on requirements analysis. The requirements should be documented, actionable, measurable, testable, traceable, related to identified business needs or opportunities, and defined to a level of detail sufficient for an efficient system design [14].

Requirement analysis is a well-defined stage in the Software Development Life Cycle model because it is the process of understanding the customer needs and expectations from a proposed system or application.

Requirements are description of system properties/attributes or details of how a system should behave.

During the requirement analysis phase the developer must:- [15]

- Attempt to identify problems in the current system
- Avoid blindly taking statements about the clients wants e.g. a wish list
- Attempt to determine the real needs of the client
- Recognize the client is not always conscious of all the needs
- Overcome any lack of computer literacy on the part of the client i.e. bridge the technical divide between developer and client
- Correctly interpret client's request even if not stated in the best way possible

2.6 Steps in Requirements Analysis Process

The steps in Requirements Analysis Process for the framework of the proposed project are illustrated here.

i. Fix System boundaries: The preliminary step of identifying the new application assimilates with the business processes, how it fits into the larger picture and what its scope and limitations will be [16].

ii. Identifying the customer: Now-a-days there has been a focus on identifying who the customers of an application are. Referred to broadly as the _stakeholders', these indicate the group or groups of people who will be directly or indirectly impacted by the new application. The requirements analyst knows where he has to look for answers. It is important for the requirements elicitation process to focus on the wish-list of this defined group to arrive at a valid requirements list [16].

iii. Requirements elicitation: In this process, information is congregated from the multiple stakeholders identified. From each of these groups, the requirements analyst draws out what their requirements from the application are and what they expect the application to accomplish.

(a) Problems faced in Requirements Elicitation:

- Ambiguous understanding of process
- Inconsistency within a single process by multiple users
- Insufficient input from stakeholders
- Conflicting stakeholder interests
- Changes in requirements after project has begun

(b) Tools used in Requirements Elicitation

To handle the complex and multilayered process of requirements elicitation, software requirements analysis process has thrown up modern tools that are better equipped. Some of the current requirements elicitation tools in use are: [16]

- Prototype
- Use cases
- Data Flow Diagram (DFD)
- Transition Process Diagrams
- User interfaces

iv. Requirements analysis process: A structure analysis of these can be done after modeling the requirements, once all stakeholder requirements have been gathered. Requirements animation, automated reasoning, knowledge-based critiquing, consistency checking, analogical and case-based reasoning are some of the software requirements analysis techniques [16].

v. Requirements Specification: Requirements Specifications may be documented separately as

User Requirements- inscribed in clear, specific language with plain text and use cases, for the benefit of the customer and end-user.

System Requirements- articulated as a programming or mathematical model, addressing the application development and testing team.

When requirements are modeled and analyzed, these should be documented in clear, unambiguous terms. A written requirements document is perilous so that its movement is possible among all stakeholders including user-groups, clients, the development and testing teams [16].

vi. Requirements Management: Requirements Management is a comprehensive process which includes all features of software requirements analysis and additionally ensures verification, validation and traceability of requirements. Effective requirements management practices ensure that all system requirements are stated explicitly, that oversights and errors are corrected and that sprouting specifications can be combined later in the project lifecycle [9] [16].

2.7 Requirements Engineering Tasks

The appropriate mechanism for understanding what the customer wants, analyzing need, assessing feasibility, negotiating a reasonable solution, specifying the solution unambiguously, validating the specification and managing the requirements as they are transformed into an operational system are provided by requirements engineering for the proposed system. The requirements engineering process is proficient through the execution of seven different functions:

- Inception
- Elicitation (problems of scope, problems of understanding, problems of volatility)
- Elaboration
- Negotiation
- Specification
- Validation and
- Management (traceability tables)

2.8 Negotiating and Validating Requirements

The concept of negotiating and validating requirements for the proposed system is explained in this section. The customer and the developer come into a process of negotiation in real life, where the customer may be asked to balance performance, functionality and other product or system characteristics against time and cost to market. The goal of this negotiation is to develop a project plan that meets the needs of the customer and to reflect the real-world constraints (e.g. time, people, and budget) that have been placed on the software team.

As each element of the analysis model is created, it is examined for consistency, omissions, and ambiguity. The requirements represented by the model are prioritized by the customer and grouped within requirements packages that will be implemented as software increments and delivered to the customer. Some questions should be asked and answered to ensure that the requirements model is an accurate reflection of the customer's needs and that it provides a solid foundation for design.

2.9 Software Requirements and Platform Selection

The perception of software requirements and platform selection for the proposed system are explicated in this section. Depending on different factors and options a programming language is chosen. Similarly, Platform selection is based on some special characteristics. The language and the platform that is easy to implement and contains some special features which benefits the developer should be chosen. It also depends on the expertise of the developer on a language and platform. The main goal is to satisfy the clients by providing maximum service through the software.

2.10 Sources of Data

The sources of Data in the context of the proposed system are demonstrated here. Data constitute the foundation of analysis and interpretation. Data can be obtained from three important sources, namely: (i) Primary Source (ii) Secondary Source (3) Internal Source.

(i) Primary Data- Primary data are measurements observed and recorded as part of an original study. It may become necessary to collect original data to conduct first hand investigation. There are two basic methods of obtaining primary data, namely:

(a) Questioning and (b) Observation

(ii) Secondary Source- When an investigator uses the data which has already been collected by others, such data are called Secondary data. Secondary data can be obtained from journals, reports, government publications, publications of research organizations, trade and professional bodies etc.

(iii) Internal Source- The measurements that are produced by the routine business record keeping like accounting, finance, production, personnel, quality control, sales, R&D etc is named internal data [17].

2.11 Methods of Data Collection

There are different methods for collecting data. These are used to investigate a system. These are field works to investigate the system and gather all sorts of information and requirements. The following methods were applied for collecting information for this project:

- Observation
- Questionnaires
- Document study
- Interviews

Other methods such as studying existing documentation were also used. Details about the common techniques are given below: [17]

2.11.1 Observation: For the proposed system video cameras were not used but video cameras can be used to monitor what actually happens on the system environment for other systems. The presence of cameras in the workplace may represent a privacy issue so careful consideration of all factors and the risks involved should be taken before embarking on this path. Legal issues may also be involved. This process is not suited with requirements analysis process [18].

2.11.2 Questionnaires: It is a useful tool for gathering information. In case of large departments/organizations it is difficult to conduct numerous interviews. Unlike the interview process that is interactive in nature, there is no way to pose new questions (follow-ups) based on the answers given to previous questions. This means a skilful and methodical interviewer will obtain better information than that obtained using a well-developed and well-worded questionnaire [18].

2.11.3 Documents study: Another way to obtain information about a client's operations is to examine the formats that are currently used. Other documents such as job descriptions, internal reports, annual journals, operating procedures etc are very helpful [18].

2.11.4 Interview: Interview is the way to understand people. It can be formal or informal. The goal of taking interview is to gather information required for the development of the system. At the end of the interview process the interviewer prepares a written report outlining the results of the interview. Telephone interview was arranged for collecting some information [18].

2.12 Requirement Gathered for the System

2.12.1 Hardware Requirement

Hosting Server: It is required to have a mid-range server with Windows or Linux Operating System.

Workstation: A general configured personal computer (PC) which is able to use internet browsing.

2.12.2 Communication Interfaces

The default communication protocol for data transmission between server and the client is Transmission Control Protocol/ Internet Protocol (TCP/IP). At the upper level hypertext transfer protocol (HTTP) was used for communication between the web server and client.

Memory Constrain: There is not a specific memory constraint for this software.

2.12.3 Software System Attributes

The attributes of this software are reliability, security, maintainability and portability.

a) Reliability: Reliability engineering highlights dependability in the lifecycle management of a product. The ability of a system and the factor to function under stated conditions for a specific period of time is described by Dependability, or reliability. Reliability engineering is determined as a sub-discipline within systems engineering. In theoretically reliability is defined as the probability of success (Reliability=1-Probability of Failure), as the frequency of failures, or in terms of availability, as a probability derived from reliability and maintainability. Maintainability and maintenance are often defined as a portion of "reliability engineering" in Reliability Programs. Reliability plays a key role in the cost-effectiveness of systems. The software must operate 100% of the time.

b) Security: The authorization mechanism of the system will block the unwanted attempts to the server and also let the system decide which privileges the user. The system has different types of users so there are different levels of authorization.

There will be also a firewall installed on the server so the incoming transactions can be filtered. Data integrity for critical variables will also be checked.

c) Maintainability: The requirements, modules that are explained in this document are enough to satisfy the project goal. So, the maintainability shall be easily done by the admin of the system.

d) Portability: This Software is an online service. So, anyone can use the service. Only the server of the system must have the required software including MySQL, Apache2. The interface is designed with the help of PHP as it provides easy abstract window toolkit and used widely. PHP is an extremely rich programming language and it contains the basic components of developing user's interface. It is an integrated development environment in which we can develop, run, test and debug our application. The programmer can easily use the buildup tool kits for any application software. It has evolved into a major development environment that covers every aspect of programming, from education applications to database and from financial applications to Internet components. In future, the platform independent Language Java can be used.

2.12.4 Architecture of web Application:

The following architecture was followed for the proposed project.

(1) The Client Side- A client, i.e. the computer, laptop, mobile etc. which requests the resources, through the internet with a user interface (typically a web browser) for presentation purposes.

(2) The Admin Side- Admin is also a client, i.e. the computer, laptop, mobile etc. which requests the resources, through the internet with a user interface (typically a web browser) for creating, updating and deleting information.

(3) The Web Server- Almost all of the works of web application take place on the server. A specific application, called a web server, is responsible for authentication, authorization and secure communication channel with the browser. A relational-database server stores whatever information the application requires.

(4) The Application Server/Middleware- The application server is also called middleware, whose assignment it is to provide the requested resources, but by calling on another server. PHP belongs to a class of languages known as middleware.

These languages work closely with the Web server to interpret the requests made from the World Wide Web (WWW), process these requests, interact with other programs on the server to fulfill the requests, and then pass the web server exactly what to serve to the client's browser.

2.12.5 Functional Requirements: Functional requirements are clustered into the following categories:

a) Network specific requirements

SL	Title	Description
01.	Server	System requires a streaming server

b) File and database management requirements

SL	Title	Description
01.	System allows for creation of profiles	User can view their demographic data and edit their personal information. Admin can modify customer database and the privilege to user access.
02.	User Authentication	User has the unique user ID and Password to authenticate their Connection.
03.	System file	System contains many file for storing information.
04.	Image file	Files can store image (e.g. .jpeg, .gif, etc.) content on the user side and admin can view the image file.
05.	Save data	Stored information is clustered to categories
06.	Data available	Receive content from fixed/wireless public networks.

c) Query and retrieval requirements

SL	Title	Description
01.	User identification	System can select user (Stake Holder, administrator)
02.	View user info	User can view his/her personal info and status.

SL	Title	Description
03.	Submit Application	User can apply for getting Certificate in his own account.
04.	Enable systems	Systems are enabling for browsing and navigate.

d) User Interface requirements

SL	Title	Description
01.	Platform allows	Platform allows users for the admin and the users.
02.	Runs on	Use Interface runs on pc, mobile devices
03.	Provide data	User can provide Food Certificate data. Admin can edit any data.
04.	Update data	admin can update their provide data.

e) Security requirements

SL	Title	Description
01.	Authentication mechanism	System requires authentication mechanisms for user identification.
02.	User category	Users are classified in three categories (Bonded, Non-Bonded and Temporary).
03.	Access information	Users can access to specific content based on their username and password.
04.	Encryption	System uses data encryption

2.12.6 Other Non-Functional Requirement Analysis

This section presents the nonfunctional requirements, which were considered during the development of the Online Certification system. This summarization is given below:

SL	Title	Description
01.	Performance	This requirement has to do with QoS characteristics, such as high-speed internet availability for data intensive transmissions. It also concerns to the time required for

SL	Title	Description
		performing the operations allowed by the system.
02.	Scalability/ Expandability	The system should be able to scale and expand the dispatch center to be able to handle more traffic. The system's performance attributes should be maintained independent of the number of nodes or documents. A dramatic increase in the number of nodes or documents will have minimal effect on performance and availability.
03.	Availability	Ensures that authorized users have always access to data and associated assets 24/7 with 100% reliability.
04.	Robustness, Fault Detection and Recovery	It should be ensured that content and content delivery services are available at any time even if some hardware or software components fail to function
05.	Maintainability	If a service has been upgraded, then the old version of the service must be available for some time in order for the IT personnel to upgrade the software to use the new version of the service by the IT personnel.
06.	Usability	Easy to use

2.13 Input and Output Finding of the System

The possible inputs are applicant/ company/ product producer/ manufacturer information with required attach documents, the assessment results updated by Audit/Inspection Team and so on.

On the other hand, the possible outputs are weekly, monthly, yearly reports, SMS notification, Online Certificate etc.

2.14 Process Flow and Analysis

(1) an applicant/company/product producer/manufacturer will register in the site to get user ID & Password for access;

(2) will get a confirmation SMS (free SMS);

(3) login into the system;

(4) apply for food product registration with details information;

(5) in the registration form, there are Text type data, selective data and some document adding by browsing like NID, Photo, Trade license, Tax, e-TIN etc.;

(6) submit and get a feedback SMS (free SMS);

(7) audit/inspection team/board of authority will view or collect registration information from site and go for physical inspection/assessment or sample collection from the applicant;

(8) if product has chemical test report then at the very beginning he/she will upload the test report during apply, means at the beginning chemical/lab test report is not mandatory;

(9) after audit/inspection when inspection committee/team/board of authority update the status of the product in the system the applicant will get a positive/negative reply via SMS (free SMS);

(10) if it is positive reply then applicant will login into the system and download his/her quality food certificate. The certificate will be like e-TIN certificate with QR code;

(11) initial validity of the certificate will be 2 years. There will be renewal system after each year. Renewal system is very simple in the renewal system he/she just search his registration data by his/her random tracking number/serial number and will upload update documents and apply for renewal;

(12) after completion of two consecutive year he/she will get an original certificate from the authority;

(13) a simple payment system to take registration fee during registration;

(14) Admin will view or use the applicant data and will change status. On the other hand, super admin will set permission, monitor system and other control issues;

(15) There will be some reports for user, authority and admin as well.

2.15 Implementation Tools and Technologies

The fundamental requirement of the project is a web application built in Apache2, MySQL and PHP. The web based software will be developed using Hypertext Preprocessor (PHP) as the dynamic scripting language. In the front end of the software, HyperText Markup Language (HTML), jQuery and Cascading Style Sheets (CSS) will be used. MySQL will be used as the database. In addition, Crystal Reports will be used for generating printable reports.

2.16 Chapter Summery

This chapter has described the feasibility study, planning, scope, methodology of the project. Next requirement analysis, sources of data, methods of data collection, process flow and analysis, possible input and outcomes are explained. This chapter has also focused on the platform of software and the implementation tools and technologies which are used for developing this system.

3.1 Scope and Features of the Proposed System

The proposed system named Food Products Certification is completely a web based automated certification system for food products manufacturer. The overall software was developed using the popular *Waterfall Process Model* where software requirement analysis, design, implementation, verification and maintenance are done sequentially. It is possible to get certificate from this system by applying online with proper requirements and fees. It has the following noteworthy features:

(a) Guidelines regarding application process, requirements and fees;

(b) User Registration;

(c) Online Application;

(d) Attachment of required documents;

(e) Provide Payment Information;

(f) Notification and Feedback;

(g) Assessment by Audit/Inspection team;

(h) Get Certification;

(i) Renewal;

(j) Control and Supervision by Administration;

(k) Information for Visitors.

3.2 Major Section of the System Activities

There are basically four major sections of system activities regarding system user. The details are illustrated below:

User/Applicant	- Follow guidelines regarding application process, requirements and fees;
	- Registration
	- Online Application
	- Required documents attachment
	- Payment
	- Update Payment Information
	- Get Notification and feedback

Audit/Inspection User	- Verify attached documents and filled information
	- Physical survey/assessment
	- Update assessment result
	- Add comments (if required)
Visitors	- Search information on demand
	- Get wanted information
Admin User	- Create audit/inspection user
	- Assign permission
	- Generate reports
	- Control, monitoring and supervision

3.3 System Architecture

The overall system architecture is shown below:
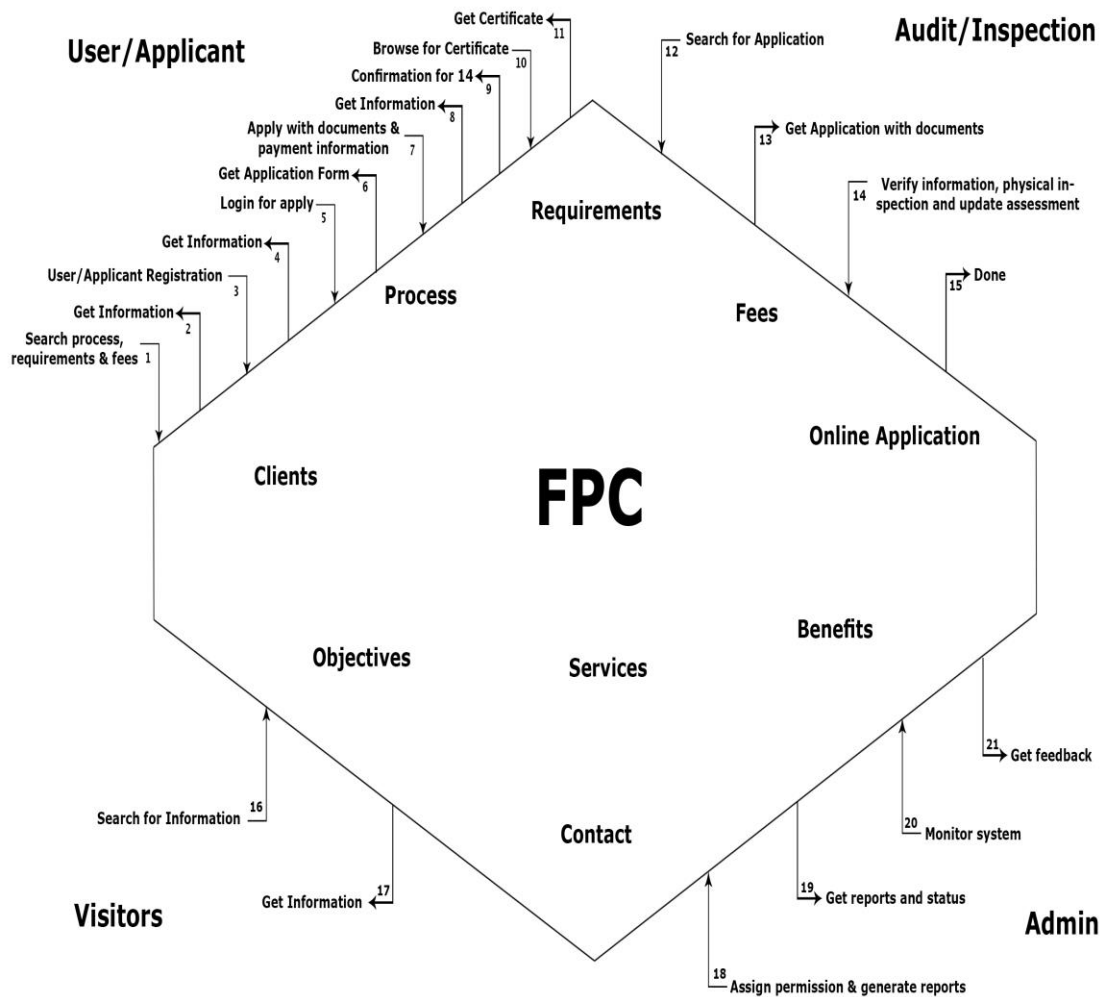
Fig-3.1 System Architecture

The step by step work follow is demonstrated underneath:

User/Applicant	
To System	From System
1. Search process, requirements & fees	2. Get Information
3. User/Applicant Registration	4. Get Confirmation
5. Login for apply	6. Get Application Form
7. Apply with documents & payment information	8. Get Confirmation
	9. Confirmation for 14 (out)
10. Browse for Certificate	11. Get Certificate
Audit/Inspection User	
To System	From System
12. Search for Application	13. Get Application with documents
14. Verify information, physical inspection and update assessment	15. Done
Visitors	
To System	From System
16. Search for Information	17. Get Information
Admin User	
To System	From System
18. Create Audit/Inspection User, assign permission & generate reports	19. Get reports and status
20. Control, Monitor and Supervision of the system	21. Get feedback

3.4 Use Case Diagram

The Use Case diagram of the proposed Food Products Certification System is as follows:
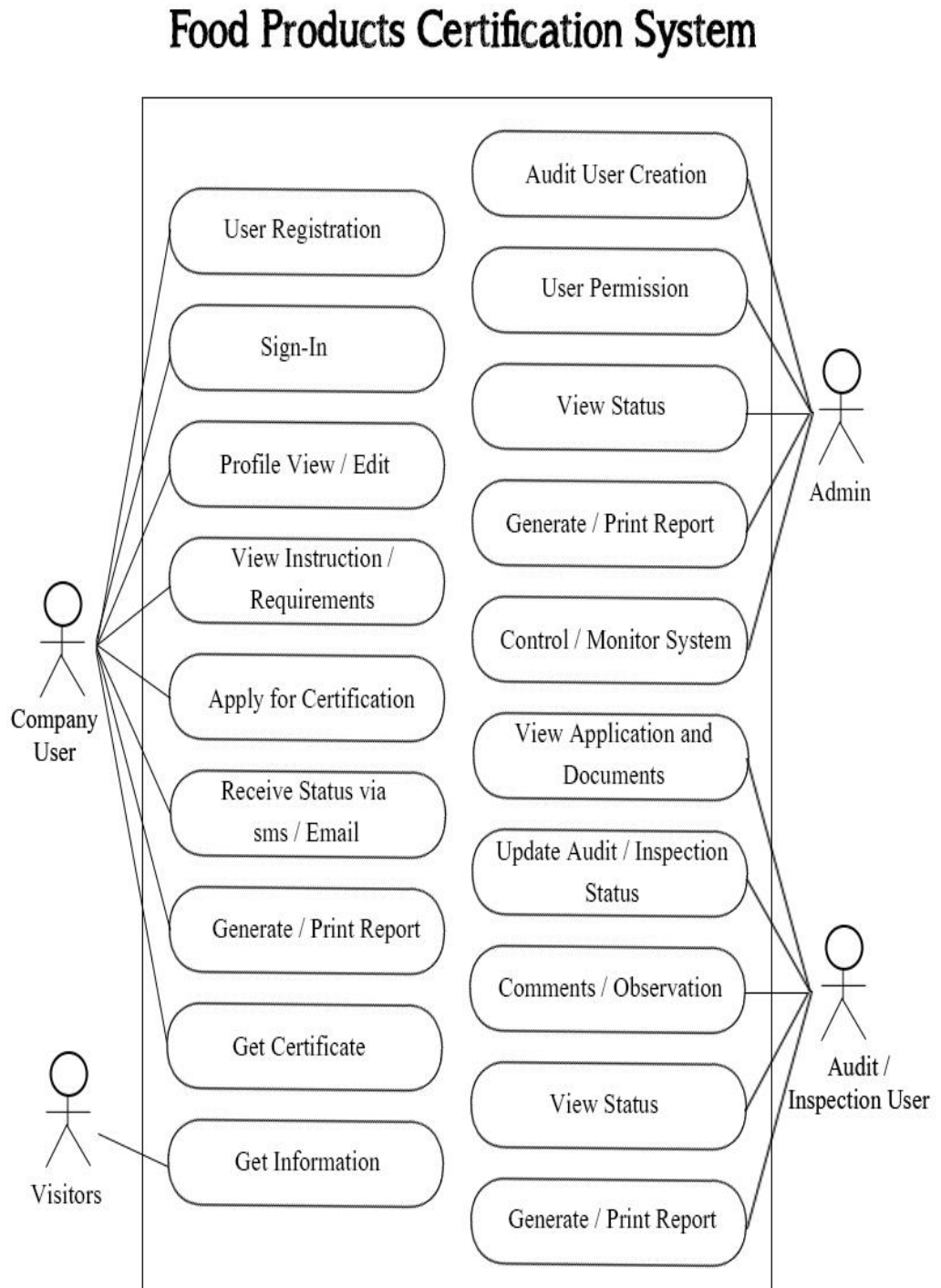
Fig-3.2 Use Case Diagram

3.5 Flow Chart

The flow chart of the online certification software is as follows:
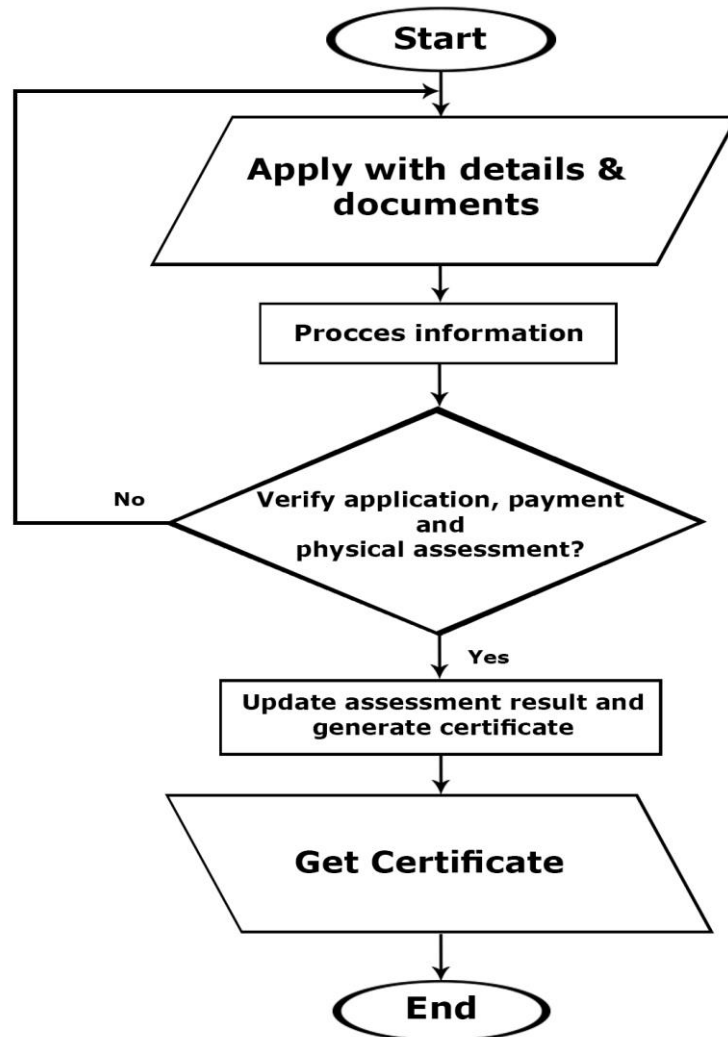
Fig-3.3 Flow Chart

(1) an applicant/company/product producer/manufacturer will register in the site to get user ID & Password for access;

(2) will get a confirmation SMS (free SMS);

(3) login into the system;

(4) apply for food product registration with details information;

(5) in the registration form there are Text type data, selective data and some document adding by browsing like NID, Photo, Trade license, Tax, e-TIN etc;

(6) adding payment information including Bank Name, Branch Name, Amount, Date and Scroll number;

(7) submit and get a feedback SMS (free SMS);

(8) audit/inspection team/board of authority will view or collect registration information from site, verify information and go for physical inspection/assessment or sample collection from the applicant;

(9) if product has chemical test report then at the very beginning he/she will upload the test report during apply, means at the beginning chemical/lab test report is not mandatory;

(10) after audit/inspection when inspection committee/team/board of authority update the status of the product in the system the applicant will get a positive/negative reply via SMS (free SMS);

(11) if it is positive reply then applicant will login into the system and download his/her quality food certificate. The certificate will be like e-TIN certificate with QR code;

(12) initial validity of the certificate will be 2 years. There will be renewal system after each year. Renewal system is very simple in the renewal system he/she just search his registration data by his/her random tracking number/serial number and will upload update documents and apply for renewal;

(13) after completion of two consecutive year he/she will get an original certificate from the authority;

(14) Admin will view or use the applicant data and will change status. On the other hand, super admin will set permission, monitor system and other control issues;

(15) There will be some reports for user, authority and admin as well.

3.6 Data Flow Diagram (DFD)

A DFD is a picture of the movement of data between external entities and the processes and data stores within an overall system. The elements required for the system and their changes are represented by DFD. It is also called Bubble Chart.

- DFD is a way of expressing system requirements in a graphical form
- The DFD clarifies system requirements and identifies major transformations that will become programs in system design.

It is the starting point in system design that decomposes the requirements specifications down to the lowest level detail. In the following, the DFDs of the overall system are demonstrated. [19] [20] [21]

DFD for User/Applicant:
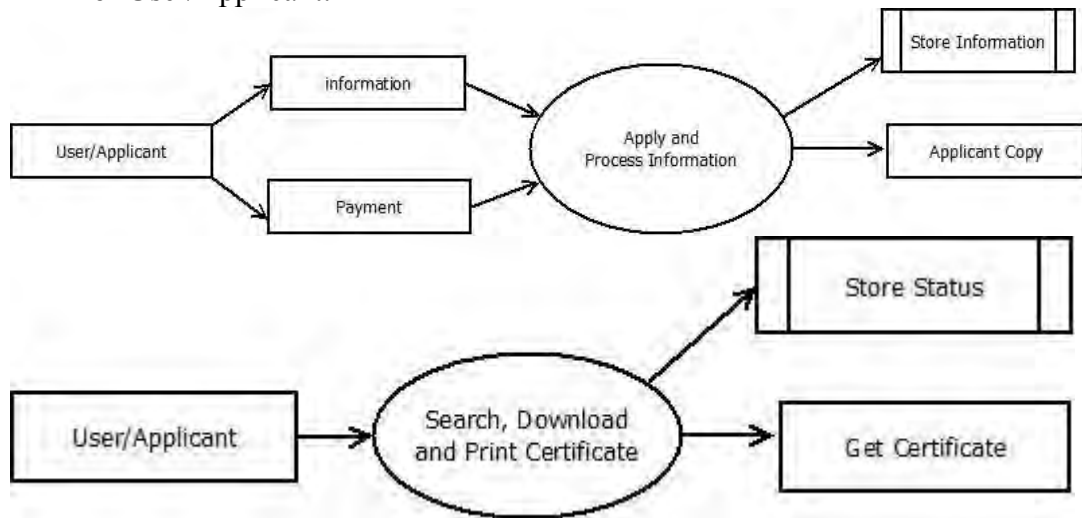
DFD for Audit/Inspection:
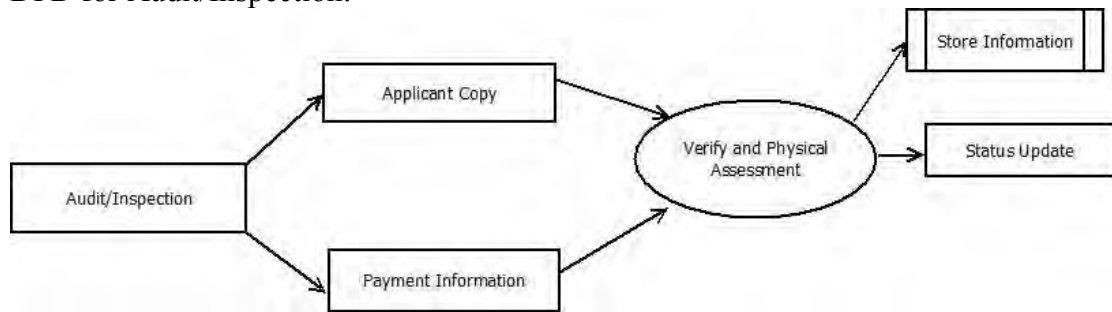
DFD for Visitors:

DFD for Admin:

Fig-3.4 Data Flow Diagram (DFD)

3.7 Front end and Back End Design

3.7.1 What is System Design

In the context of proposed system, system design known as the logical design of the software. Software design is a process through which requirements are translated into a ―blueprint" for developing software. Initially the blueprint depicts a holistic view of software. That is, the design which is represented at a high level of abstraction - the levels that can be directly traced to the specific system objective, detailed data, functional and behavioral requirements.

3.7.2 Basic Design of Software

The Automation Application administrator can manipulate data with the help of this software. It assists administrator to keep record of the information with more comfortably, safely and securely. There are two interfaces of the Stake Holder Relationship Management System which are described below:

Administrator Interface: The software is connected with company server database, thus no more connection with other systems is needed. No system interface is needed during the development of this project.

User Interface: The software must be designed as a web based that has a main user interface. Format of main screen must be standard and flexible. The system must be user friendly. Pages must be connected to each other in a consistent way. Operations to be done with the system being repeatable.

3.7.3 Front End and Back End Design of the Proposed System

The web based software will be developed using PHP as the dynamic scripting language. In the front end of the software, HTML, jQuery and CSS will be used. MySQL will be used as the database in the back end. In addition, Crystal Reports will be used for generating printable reports.

3.8 Database

Database systems are designed to manage large bodies of information. Defining structures for storage of information and proving mechanisms for the manipulation of information are included in management of data. In addition, the safety of the information stored must ensure by the database system, despite system crashes attempts to unauthorized access. The system must avoid possible anomalies result, if data are to be shared among several users.

A database management system (DBMS) is a collection of interrelated data and a set of programs to access those data. The collection of data usually refers to the database, containing information relevant to an enterprise. The primary goal of a database is to provide a way to store and retrieve database information that is both convenient and efficient. [8]

3.8.1 Types of Database Application
There are two types of application:

1. Desktop Based
   - Standalone, - Network Support
2. Web Based

3.8.2 Database System versus File system
The typical file system is supported by a conventional operating system. The system stores permanent record in various files and it needs different application programs to extract records from it and add records to the application file. Organization usually stored information/data in such system, before database management system came along.

Keeping data/information in file processing system has number of major disadvantages:

➢ Data redundancy and inconsistency
➢ Difficult in data access
➢ Data isolation
➢ Integrity problem
➢ Atomicity problem
➢ Concurrent access anomalies
➢ Security problem

3.8.3 Procedures of Database
There are various procedures for database Design. Some of the database procedures are shown below:

Create Database Tables	Coding
Normalization	Debugging and Testing
Relationship	Database level Modification
Implement with Oracle/MySQL	Finalization
	Implementation

3.9 Information Modeling

Whenever understanding of a real-world phenomenon or interaction is desired, the first step is to build a simple model representing the phenomenon and perform study and evaluation of the model rather than actual interaction. In building model, the ambiguity and complexity in the real world is avoided totally or compensated with valid approximation. In fact a systematic study of any phenomenon whether economic, industrial or scientific is done through modeling. Information modeling pertains to the development of model in information generation, storage, destruction, evaluation, manipulation, synthesis and utilizations. These models help in systematization of information generation, flow, interpretation synthesis of more information.

3.9.1 Concept of Information Modeling

The first step of information modeling is to precisely choose that part of reality, which is of interest. This is known as Entity. Entity defines another parameter. Entities are atomic that they are invisible. The parameters of entity are known as attributes. Attributes are known as quantum of information, which describes the entity entirely.

The second step in information modeling is relationship among entities. It is the most important in making sense of the entity and inter-entity relationship. The relationship is the information, which links two entities. The relationship can be of four categories:

One-to-One (1:1) –One instance of the first entity can correspond to only one instance of the second entity. It is known as binary relationship.
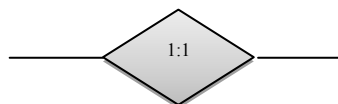
Fig-3.5: One-to-One Relation

One-to-Many(1:M) – One instance of the first entity can correspond to more than one of the second entity.
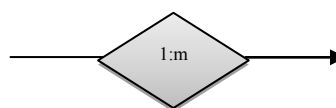
Fig-3.6: One-to-Many Relation

<u>Many-to-One (M:1)</u> – More than one instance of the first entity can corresponds to the same one instance of the second entity
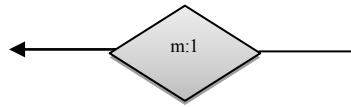
Fig-3.7: Many-to-One Relation

<u>Many-to-Many (M:M)</u> – More than one instance of the first entity can correspond to more than one instance of the second entity.
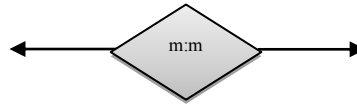
Fig-3.8: Many-to-Many Relation

3.9.2 Procedures for Information Modeling

The steps for Information Modeling and rules of data normalization are described below:

❖ The universe of discourse or the part of real world should be selected properly with minimum redundancy but completely in terms of entities.

❖ Entities are to be classified according to their attributes contents and merged, which has One-to-One (1:1) Relationship into composite entities.

❖ Their relationship among entities should be defined and named.

❖ Normalization should be done to reduce redundancy and increase integrity. [8]

3.10 Data Modeling

In terms of the proposed project, a data model is a model describing the data in an organization. It provides frame work for abstracting the essential qualities or characteristics of data. Data modeling is the process of abstracting and documentation using a data model.

Data modeling creates hierarchies of abstraction along two dimensions: aggregation and generalization. Aggregation identifies data item as arts of higher-level, more aggregate descriptor. Generalization creates categories into which a data item may be classified.

There are two major classes of data models – logical data models and physical data models. These two classes reflect the fact that efficient physical storage and retrieval of data must be designed around the physical characteristics of storage media and devices, but user of data should be able to describe, think about and use data without being concerned of its physical storage.

3.10.1 Types of data Modeling

The data modeling consists of three interrelated pieces of information, the data object, the attributes that describes the data object and the relationship that connects data objects to one another. A data object is a representation of almost any composite information that must be understood by software. Composite information means something that has a number of different properties or attributes.

Six different types of data models are given below:

- Entity-Relationship Model (E-R Model)
- Relational Model
- Object-Oriented Data Model
- Object-Relational Data Model
- Hierarchical Data Model
- Network Data Model

3.10.2 Entity–relationship model

An entity–relationship model is a systematic way of describing and defining a business process. In this business process, the components (entities) are connected with each other by relationships that express the dependencies and requirements between them, such as: a building may be divided into zero or more apartments, but an apartment can only be located in one building. Entities may have several properties (attributes) which characterizes them. To represent these entities, attributes, and relationships graphically are called entity–relationship diagrams.

An ER model is typically implemented as a database. In the case of a relational database, which stores data in tables, every row of each table represents one instance of an entity. Some data fields in these tables point to indexes in other tables; such pointers represent the relationships.

Entity–relationship modeling

An entity may be defined as a thing capable of an independent existence that can be uniquely identified. An entity is an abstraction from the complexities of a domain. Generally, we speak of some aspects of the real world that can be distinguished from other aspects of the real world when we speak of an entity.

An entity is a thing that exists either physically or logically. An entity may be a physical object such as a house or a car (they exist physically), an event such as a house sale or a car service, or a concept such as a customer transaction or an order (they exist logically—as a concept). The following chain we should really distinguish between an entity and an entity-type, although the entity is the one most commonly used term. An entity-type is a category. An entity, strictly speaking, is an instance of a given entity-type. There are usually many instances of an entity-type. Most people tend to use the term entity as a synonym for this term because the term entity-type is somewhat awkward.

Entities can be thought of as nouns. Examples: a computer, an employee, a song, a mathematical theorem.

A relationship captures how entities are related to one another. By linking two or more nouns, relationships can be thought of as verbs. Examples: an owner's relationship between a company and a computer, a supervisors relationship between an employee and a department, a performs relationship between an artist and a song, a proved relationship between a mathematician and a theorem.

The model's linguistic aspect described above is utilized in the declarative database query language ERROL, which mimics natural-language, constructs. ERROL's semantics and implementation are based on reshaped relational algebra (RRA), a relational algebra that is adapted to the entity–relationship model and captures its linguistic aspect.

Entities and relationships can both have attributes. the proved relationship may have a date attribute.

The entity's primary key is a minimal set of uniquely identifying attributes which every entity (unless it is a weak entity) must have.

Entity–relationship diagrams don't show single entities or single instances of relations. Rather, they show entity sets (all entities of the same entity type) and relationship sets (all relationships of the same relationship type). Example: a particular song is an entity. The collection of all songs in a database is an entity set. The eaten relationship between a child and her lunch is a single relationship. The relationship set is a set of all such child-lunch in a database. In other words, a relationship set corresponds to a relation in mathematics, while a relationship corresponds to a member of the relation. [8]

3.11 Entity Relationship Diagram (ERD)

The ERD for the proposed system is drawn in the following.
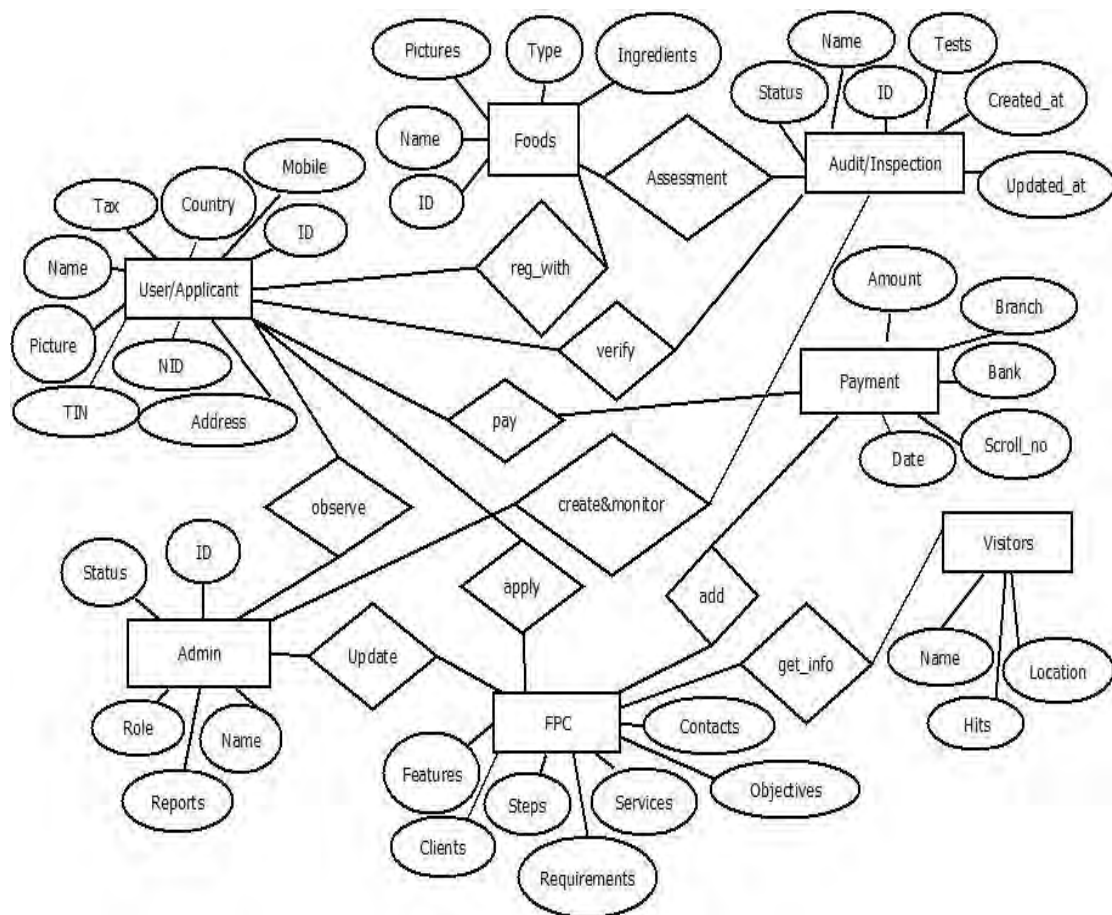
Fig-3.9 Entity Relationship Diagram (ERD)

3.12 Database Development

Relational database management system was used to manage the database. The database was developed in MySQL. The total data have been normalized and then tables are obtained.

3.12.1 Description of the Database Development

For simplicity, five tables have been designed namely auditlogs, compsnies, foods, migrations and users. Brief description of the tables is given below:

Auditlogs Table: This table contains fifteen columns (id, food_id, flavor_and_fragrance, allergens, chemical_and_nutritional_analysis, GMOs_detection, microbiological_testing, residues_and_contaminants_testing, sensory_analysis, analytical_chemistry_tests, foodborne_virus_detection, ingredients_and_additives, status, created_at, updated_at).

Sl	Field	Type	Sl	Field	Type
1	Id	int(10)	2	food_id	int(11)
3	flavor_and_fragrance	tinyint(1)	4	Allergens	tinyint(1)
5	chemical_and_nutritional_analysis	tinyint(1)	6	GMOs_detection	tinyint(1)
7	microbiological_testing	tinyint(1)	8	residues_and_contaminants_testing	tinyint(1)
9	sensory_analysis	tinyint(1)	10	analytical_chemistry_tests	tinyint(1)
11	foodborne_virus_detection	tinyint(1)	12	ingredients_and_additives	tinyint(1)
13	Status	varchar(254)			
14	created_at	timestamp	15	updated_at	timestamp

Companies Table: It has fifteen columns (id, user_id, name, tinid, address, mobile, picture, nid, etinid, taxid, tradelicenseid, certificate, agreement, created_at, updated_at).

Sl	Field	Type	Sl	Field	Type
1	Id	int(10)	2	user_id	int(11)
3	Name	varchar(191)	4	Tinid	varchar(250)
5	Address	varchar(250)	6	Mobile	varchar(250)
7	Picture	varchar(250)	8	Nid	varchar(250)
9	Etinid	varchar(250)	10	Taxid	varchar(250)
11	Tradelicenseid	varchar(250)	12	Certificate	varchar(250)
13	Agreement	varchar(250)			
14	created_at	timestamp	15	updated_at	timestamp

Migrations Table: It has three columns (id, migration, batch).

Sl	Field	Type	Sl	Field	Type
1	Id	int(10)	2	Migration	varchar(191)
3	Batch	int(11)			

Foods Table: Foods table has twenty one columns (id, user_id, name, food_type, valid, valid_at, reject, tinid, address, mobile, picture, nid, nid_picture, etinid, taxid, tradelicenseid, certificate, agreement, created_at, updated_at, company_name).

Sl	Field	Type	Sl	Field	Type
1	Id	int(10)	2	user_id	int(11)
3	Name	varchar(191)	4	food_type	varchar(191)
5	Valid	tinyint(1)	6	valid_at	timestamp
7	Reject	tinyint(1)			
8	Tinid	varchar(250)	9	Address	varchar(250)
10	Mobile	varchar(250)	11	Picture	varchar(250)
12	Nid	varchar(250)	13	nid_picture	varchar(250)
14	Etinid	varchar(250)	15	Taxid	varchar(250)
16	Tradelicenseid	varchar(250)	17	Certificate	varchar(250)
18	Agreement	varchar(250)	19	company_name	varchar(191)
20	created_at	timestamp	21	updated_at	timestamp

Users Table: It has seventeen columns (id, name, email, mobile, country, password, role, avatar, question, answer, captcha, is_confirmed, token, confirmed_at, remember_token, created_at, updated_at).

Sl	Field	Type	Sl	Field	Type
1	Id	int(10)	2	Name	varchar(250)
3	Email	varchar(250)	4	Mobile	varchar(250)
5	country	varchar(250)	6	Password	varchar(254)
7	Role	varchar(250)	8	Avatar	varchar(250)
9	Question	text	10	Answer	text
11	Captcha	varchar(191)			
12	is_confirmed	tinyint(1)	13	confirmed_at	timestamp
14	Token	varchar(254)	15	remember_token	varchar(100)
16	created_at	timestamp	17	updated_at	timestamp

3.13 Software Tools

3.13.1 Programming Language and Software Platform

Programming language is very much important because it helps to Design interface and runs the application smoothly. In addition, a programming language affords a organized mechanism for defining fragments of data, and the operations or alterations on that data automatically when required. The following software interfaces were used in the proposed system.

3.13.2 Software Interfaces:

Name & Version	Source	Purpose	Definition of the Interface
Browser: Firefox, Chrome and Microsoft Internet Explorer(IE) any version	Mozilla, Google and Microsoft Corporation	The web browser specified here is required in order to execute the user side of the software.	Firefox is one of the world's most popular browsers. It includes a variety of features that are designed to give you a fast and secure browsing experience. The Microsoft Internet Explorer provides easier, faster, safer, flexible and reliable browsing experience with enhanced web privacy features for all users. A freeware web browser developed by Google is Google Chrome. It used the WebKit layout engine until version 27 and, with the exception of its iOS releases, from version 28 and beyond uses the WebKit fork Blink.
Web Server: Wamp Server-3.0.6	Created by Romain Bourdon	The web server specified here is required as the provider of the client software at the server site.	WampServer is a Windows web development environment. It allows us to create web applications with Apache2, PHP and a MySQL database. Alongside, PhpMyAdmin allows us to manage easily our databases. A software stack denotes by WampServer for the Microsoft Windows operating system, created by Romain Bourdon and consisting of the Apache web server, OpenSSL for SSL support, MySQL database and PHP programming language.
Web Development: PHP-5.6.25	PHP Group.	PHP is used for server-side web development PHP generally runs on a web server which work with MySQL database and Apache server.	PHP is a mostly-used general-purpose scripting language that has improved object-oriented capabilities especially suited for web development and can be embedded into HTML

Name & Version	Source	Purpose	Definition of the Interface
Database: MySQL-5.7.14	MySQL.	Required as relational database server.	MySQL is the world's most popular and powerful open source relational database software, with over 100 million copies of its software downloaded or distributed throughout its history. With flexibility, superior speed, reliability, and ease of use, MySQL has become the preferred choice of corporate IT managers because it eliminates the major problems associated with downtime, maintenance, administration and support.
User Interface Design: Macromedia Dreamweaver 8.0	Macromedia Inc.	The web development tool specified here is required for designing and coding of the software.	Macromedia Dreamweaver is professional HTML editor tool, enabling users to efficiently design, coding, develop and maintain standards websites and applications.

3.14 Testing

Testing is defined as a process of exercising a program with the precise intent of finding errors prior to delivery to the end user. It explains the performance of the system. It is also an important part of any data entry system. Testing is performed to find the errors or any kind of invalid input. So, it also involves evaluating the result. To evaluate the new system is working according to the user requirements and any kinds of improvements are necessary or not, Testing is carried out.

3.14.3 Unit Tests

Unit testing is the most 'micro' scale of testing; to test particular code or functions segments, naturally done by the programmer and not by testers, as it needs comprehensive knowledge of the internal program design and code.

Each program is separately tested in unit testing. It focuses on the modules to locate errors. If any error found, the module is revised and possible cause of error is defined and corrected. The thing that is considered to do the unit testing are narrated below-

- The forms are tested to ensure that information flows into and out properly.
- Data are examined to ensure that data stored temporarily maintains its integrity during all steps in an algorithm's execution.
- Boundary conditions are tested to ensure that the forms operate properly at boundaries established to limit or restrict processing.
- Finally, all error handling paths are tested.
- Testing was done with wrong password; mandatory fields are filled up
- Or not and also invalid inputs.

3.14.4 Acceptance testing

Acceptance testing means the final certification that the system is ready to be used in production setting. It is not done yet because this software is only for one part of the total business process. After completing and integrating all the modules, the entire software will be installed in all the machines and then the users will test to find out the lacking of the computerized system. In testing part tester must input data as an end user. Also, the software must give some kind of warnings or error messages to warn or instruct the end users.

3.14.5 Integration Testing

These tests are usually carried out to check whether a number of modules are working together appropriately. There are a number of forms attached to the Resource Allocation Process. It contains several forms together and each form is working parallelly with one another. In other processes, the scenario is the same case like before. [22] [23] [24] [25]

3.14.6 Test Case

A test case for the testing of proposed software project is represented below:

Project Name: *Online Certification of Food Products*						
Sample Test Case						
Test Case ID: *test_7*			Test Designed By: *Mr. X.*			
Test Priority: *Medium*			Test Design Date: *17.05.2017*			
Module Name: *System Login Screen*			Test Executed By: *Mr. Y*			
Test Title: *Verify Login with valid User_ID and Password*			Test Execution Date: *17.05.2017*			
Description: *Test the Certification System Login Page*						
Pre-conditions: *User has valid User_ID and Password*						
Dependencies: *N/A*						
Step	Test Step	Test Data	Excepted Result	Actual Result	Status (Pass/Fail)	Notes
1	Navigate to Login Page	User_ID: company1@gmail.com	User should be able to login	User is navigated to	Pass	
2	Provide valid User Name	Password: 111111		dashboard with successful		
3	Provide Valid Password			login		
4	Click on Login Button					
Post-Conditions: User is validated with database and successfully login to account. The account session details are logged in database.						

3.15 Validation and Verification

The validation and verification of the proposed software project are taken into consideration.

3.15.1 Validation

The process of evaluating software during or at the end of the development process to determine whether it satisfies specified requirements.

In other words, while verification is ensuring that the product has been built according to the design specifications and requirements, validation endures that the product actually meets the user's needs and that the specifications were accurate in the first place. Validation certifies that ―you built the right thing".

3.15.2 Verification

It is the process of evaluating software to fix whether the components of a development phase satisfy the conditions executed at the start of that phase. Verification ensures that ―you build it right".

3.16 Chapter Summery

This chapter described the whole process of the system. The design, development and testing of the system is explained in details. Here, step by step analysis and designing technique of this system is elaborated. This chapter has also focused on the software testing process and the relationship between the table and draw ER diagram with data flow diagram of this software.

4.1 Implementation

In the context of the proposed project, visions and plans become reality in the phase named Project implementation (or project execution). The logical conclusion is done after evaluating, deciding, visioning, planning, applying for funds and finding the financial resources of a project [26].

In other sense, Implementation is a process whereby ̶project inputs are converted to project outputs". May be looked at as:

- Putting in action the activities of the project.
- Putting into exercise what was anticipated in the project document (i.e. transforming the project proposal into the actual project.)
- Management of the project or executing the project intentions.

Project Implementation phase involves:

Project activation: This means making arrangements to have the project started. It involves coordination and allocation of resources to make project operational.

 Project operation: This is practical management of a project. Project inputs are altered into outputs to achieve immediate objectives here.

Approaches to project implementation:

Top-down approach: In the Top-down approach, implementation principally done by agencies from outside the community with limited participation by the beneficiaries.

Bottom-up approach: Beneficiaries implement the project. Here outside agencies can provide financial resources and technical assistance if needed.

Collaborative participatory approach: Both top-down and bottom-up approaches to project implementation are applied in the process. [27]

4.2 Input and Output

Input:

User_ID, Password, Re-type Password, Security Question, Security Answer, Country, Mobile Number, Email, Captcha Verification;

Full Name of the Applicant/Company, Product Type, Ingredients, NID Number, e-TIN Number, Contact Address, Contact Number;

Payment Information including Bank Name, Branch Name, Amount, Date, Scroll Number;

Attachment of Picture, NID copy, Trade License copy, e-TIN copy, Latest Income Tax copy, Office/Factory Rental or Ownership Agreement copy, Incorporation Certificate copy (if any).

Output:

SMS reply/feedback, Email reply/feedback, Application Status, Weekly/ Monthly/ Yearly Reports, Food Quality Certificate.

4.3 Reports and Findings

- Number of Visitors in the site (Weekly/ Monthly/ Yearly) (Hit Count)
- Number and Details of Applicant (Weekly/ Monthly/ Yearly)
- Payment Status (applicant wise/total) (Weekly/ Monthly/ Yearly)
- List of in process applications (Weekly/ Monthly)
- List of completed applications (Weekly/ Monthly/ Yearly)
- List of positive and negative response (Weekly/ Monthly/ Yearly)
- List of Quality Certificate Owner (Weekly/ Monthly/ Yearly)
- List of Clients (those who achieve quality certificate)
- Number and details of Audit/Inspection users

4.4 Description of the developed software

In the following, the developed software is briefly described:

(a) Front Page: The main page of the software has a list of menus including Home, About Us, Services, Process, Contact, Apply, etc.
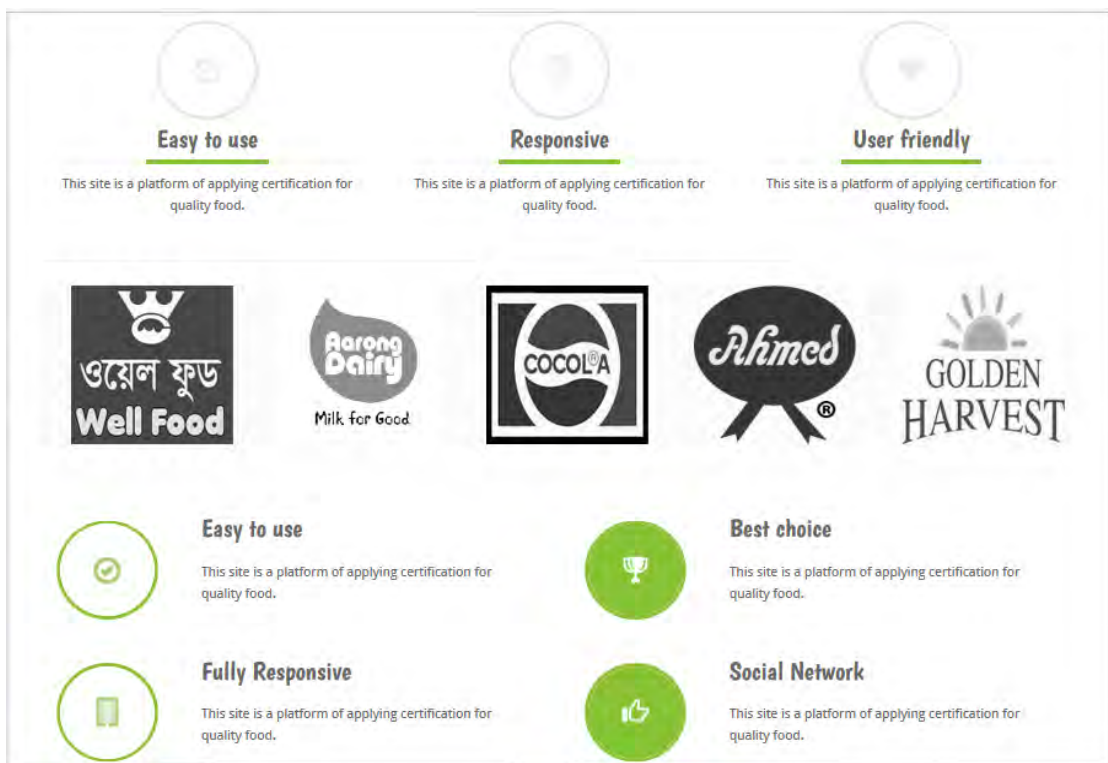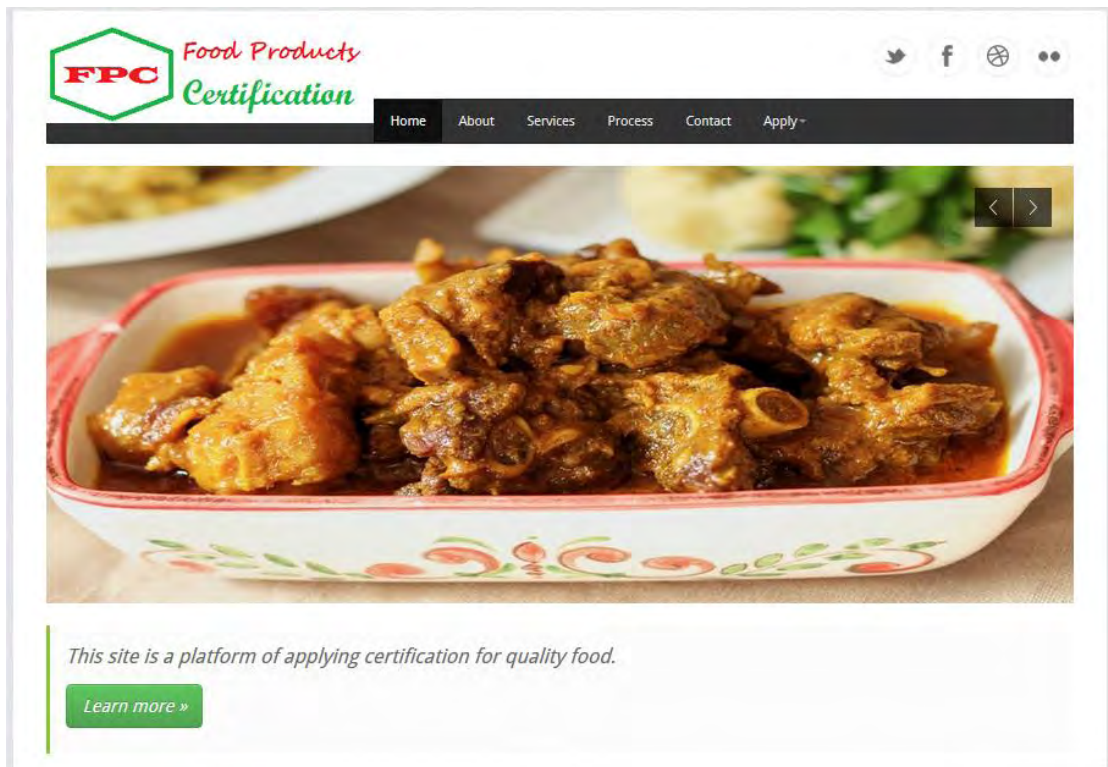
(b) Login Page: The users need to login into the system using username and password as shown below:
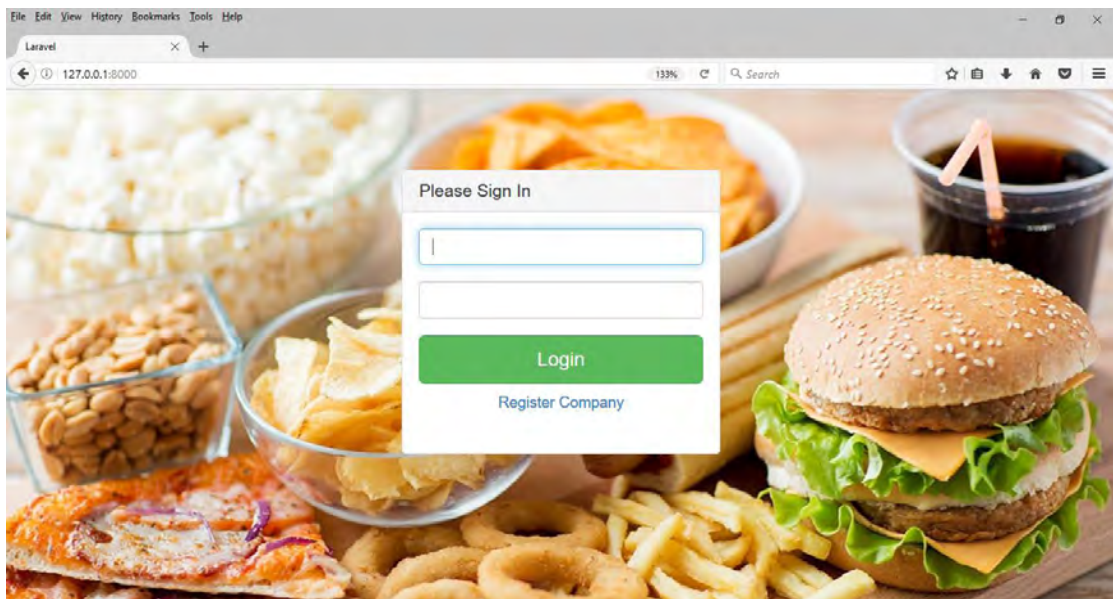
(c) Company/Firm User Page: The company/firm user applies for certification of particular food. The interface is shown below:
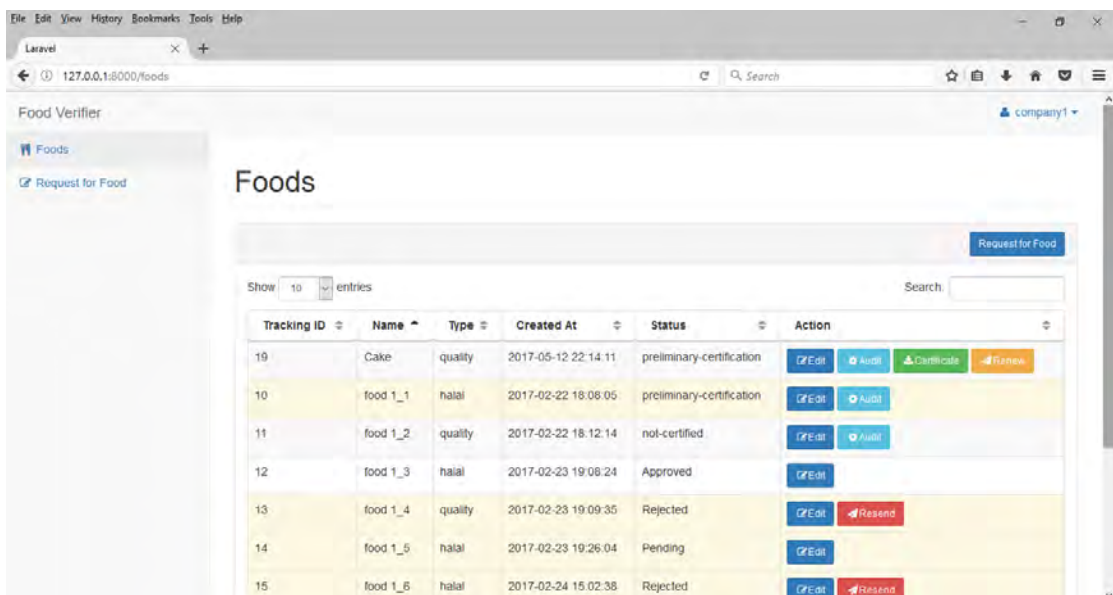
(d) Audit User Page: The audit/inspection user audits the application and updates the survey result by the following interface:
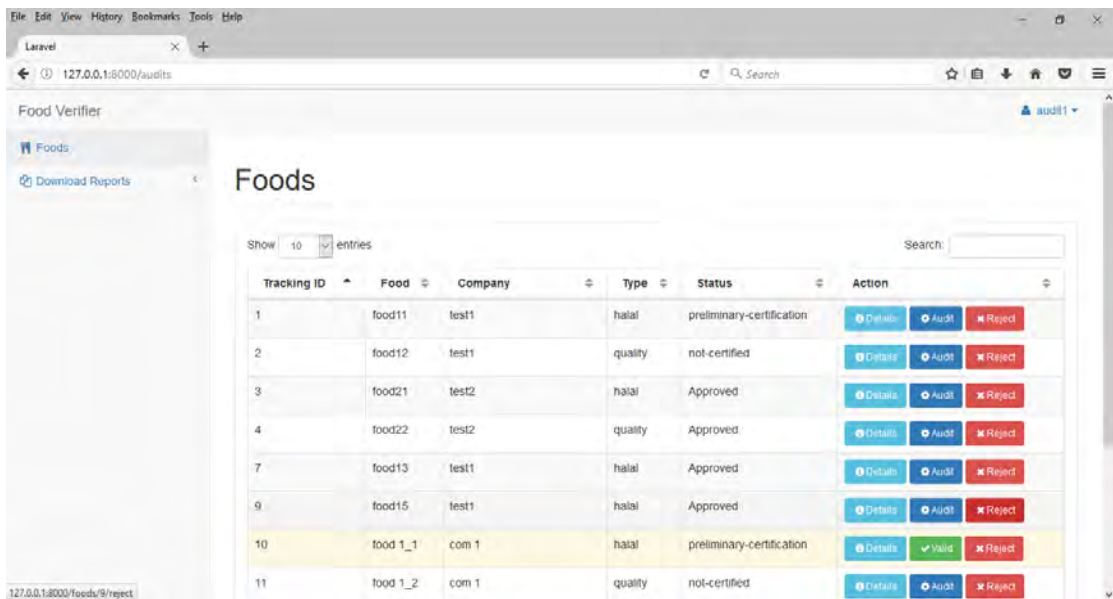
(e) Admin User Page: The admin user controls and monitors the overall system, sets access permission and generates required reports.
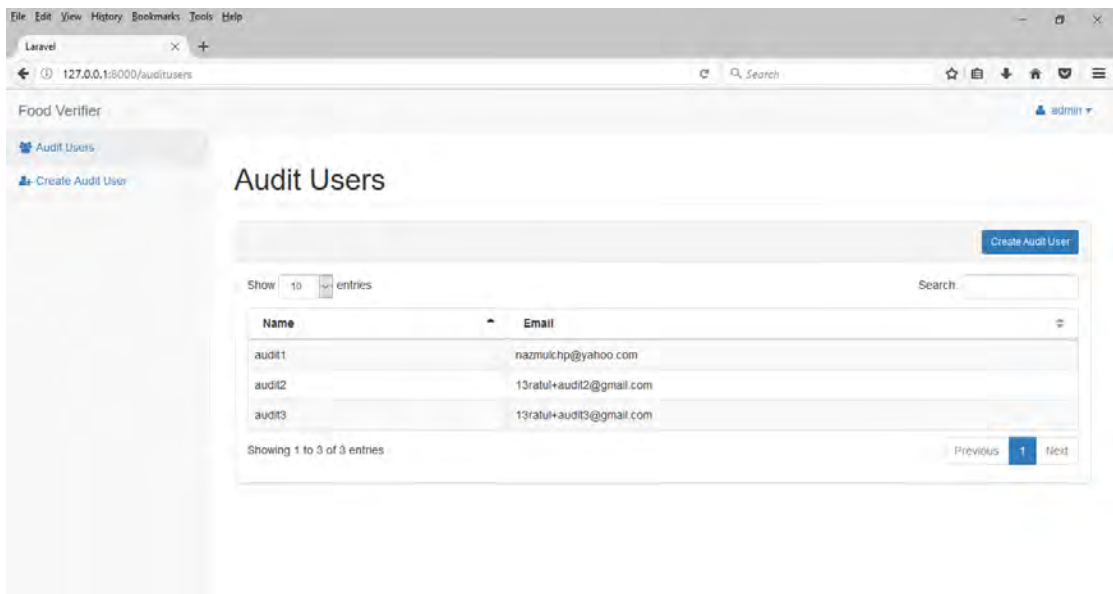
(f) Generated Certificate

Finally, after completion of all the processes the certificate is generated which is downloadable by the corresponding applicants/users.

4.5 Chapter Summary

This chapter has explained implementation of the project at the very beginning. Then it has described probable input and output of the proposed system. Finally, most possible reports and findings from the system have been elaborated.

5.1 Project Summary

The overall project summary in brief is described as follows:

5.1.1 Strengths of the Project

The proposed automated system provides a number of benefits over the existing manual systems. Some of these are given below:

- Online food quality certification system for foods manufacturer/producer
- Objectives, requirements, fees, process, services are displayed
- SMS and Email reply, notification and feedback
- Electronic Certificate
- Status view and possible required reports
- User friendly and location independent system
- It is easy to take decision and make new future plans
- This system reduces the paper work and the physical labor
- It is easy to store and retrieve any information when necessary
- In summary, the system will reduce the functional complexity.

5.1.2 Limitations

Each and every system around the world has some limitations. The proposed system has some limitations too. Some of the limitations are as follows:

- Quality Certification system for only manufactured foods
- A part (physical assessment and testing of foods) of the overall process is manual
- Payment system is not fully electronic/online
- Integration with Food Testing System or Food Testing Lab
- Time constraints to complete the whole process
- Renewal system of Certification
- Analysis and accomplishment of user needs and demands

5.1.3 Challenges

The major challenges to implement the proposed system are as follows:

- Ownership and Authorization
- Replication and Showcasing
- Adaptability
- Security and Support
- Monitoring, Supervision, Control and Upgradation
- Logistics and Funding
- Awareness, Training, etc.

5.2 Conclusion

For marketing food products in the local and as well as in the international market, quality certification for food products is a crucial concern to product manufacturers. Now-a-days the need is increasing for quality certificates as Bangladesh is trying to export more food products. A web based system for quality food products certification is a current demand for the food product manufacturers. A fully automated system where ‗the product manufacturers apply online and the authorities update the assessment results online' can facilitate the certificate obtaining and the corresponding renewal processes remarkably.

The web based software has been developed using Hypertext Preprocessor (PHP) as the dynamic scripting language. In the front end of the software, HyperText Markup Language (HTML), jQuery and Cascading Style Sheets (CSS) have been used. MySQL has been used as the database. In addition, Crystal Reports have been used for generating printable reports. This system acts as an easy communication between food product manufacturers and food quality certification authority. During the overall process, SMS and Email reply, notification and feedback status create applicant gratification. The developed system is a user-friendly system in many aspects.

The online system reduces the paper works and physical labor. It is easy to retrieve information when necessary. It also helps to generate online certificate and different types of reports when required in an efficient manner.

The system provides information and guidelines for the applicants. The system is able to store huge information in a short time and it is possible to retrieve any information easily when necessary.

5.3 Recommendation

There are some important observations regarding the developed web based system for food products quality certification. The recommendations are stated below:

(i) Power and data backup for smooth performance.

(ii) Maintenance, supports and security issues

(iii) Java programming language can be used instead of PHP programming due to its platform independency.

(iv) In this software, there is no way to reset password at the user end. So, Password recovery can be added for better performance.

(v) This software is only tested for some medium scale scenarios. If anyone wants to implement it in a large-scale, Oracle can be used instead of MySQL for better performance.

5.4 Future Work

Possible future work related to the developed system are outlined below:

- Mobile Apps
- Call Centre and query tickets
- Comprehensive Integration with Food Testing System or Food Testing Lab
- Fully electronic/online payment system
- Easy Certificate Renewal System
- System upgradation based on user needs and demand analysis
- Technological Development
- Field scrutiny and Piloting
- Implementation in broad scale

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Appendix: Code Segment of the Developed Software

Home Page:

```
/*Start hiding from IE Mac \*/

<!DOCTYPE html>

<html lang="en">

<head>

            <!-- start: Meta -->

            <meta charset="utf-8">

            <title>Quality Food, Safe Food.</title>

            <meta name="description" content="Quality Food"/>

            <meta name="keywords" content="Quality, Food" />

            <meta name="author" content="Nazmul from BUET"/>

            <!-- end: Meta -->

            <!-- start: Mobile Specific -->

<meta name="viewport" content="width=device-width, initial-scale=1, maximum-scale=1">

            <!-- end: Mobile Specific -->

            <!-- start: Facebook Open Graph -->

            <meta property="og:title" content=""/>

            <meta property="og:description" content=""/>

            <meta property="og:type" content=""/>

            <meta property="og:url" content=""/>

            <meta property="og:image" content=""/>

            <!-- end: Facebook Open Graph -->

    <!-- start: CSS -->

    <link href="css/bootstrap.css" rel="stylesheet">

    <link href="css/bootstrap-responsive.css" rel="stylesheet">

            <link href="css/style.css" rel="stylesheet">

            <link rel="stylesheet" type="text/css"
href="http://fonts.googleapis.com/css?family=Droid+Sans:400,700">

            <link rel="stylesheet" type="text/css"
href="http://fonts.googleapis.com/css?family=Droid+Serif">
```

```html
        <link rel="stylesheet" type="text/css"
href="http://fonts.googleapis.com/css?family=Boogaloo">

        <link rel="stylesheet" type="text/css"
href="http://fonts.googleapis.com/css?family=Economica:700,400italic">

        <!-- end: CSS -->

    <!-- Le HTML5 shim, for IE6-8 support of HTML5 elements -->

    <!--[if lt IE 9]>

     <script src="http://html5shim.googlecode.com/svn/trunk/html5.js"></script>

    <![endif]-->

</head>

<body>

        <!--start: Wrapper -->

        <div id="wrapper">

            <!--start: Container -->

            <div class="container">

                <!--start: Header -->

                <header>

                    <!--start: Row -->

                    <div class="row">

                        <!--start: Logo -->

                        <div class="logo span4">

                    <a class="brand" href="#"><img src="img/logo.png"></a>

                        </div>

                        <!--end: Logo -->

                        <!--start: Social Links -->

                        <div class="span8">

                            <div id="social-links">

                                <ul class="social-small-grid">

                                    <li>

                                    <div class="social-small-item">

                                <div class="social-small-info-wrap">
                                <div class="social-small-info">
```

```
                    <div class="social-small-info-front social-small-twitter">
                                            <a href="http://twitter.com"></a>
        </div>
                <div class="social-small-info-back social-small-twitter-hover">
                        <a href="http://twitter.com"></a>
        </div>
                </div>

                </div>

                        </div>

                                </li>

                                        <li>

                                        <div class="social-small-item">

                                        <div class="social-small-info-wrap">
                        <div class="social-small-info">
        <div class="social-small-info-front social-small-facebook">
                                            <a href="http://facebook.com"></a>
                        </div>

    <div class="social-small-info-back social-small-facebook-hover">
                        <a href="http://facebook.com"></a>
                                        </div>
                </div>

                </div>

                        </div>

                                </li>

                                <li>

                                        <div class="social-small-item">

                        <div class="social-small-info-wrap">

                                                <div class="social-small-info">

                        <div class="social-small-info-front social-small-dribbble">

                                                <a href="http://dribbble.com"></a>
        </div>

        <div class="social-small-info-back social-small-dribbble-hover">
                                <a href="http://dribbble.com"></a>
        </div>
                </div>

                        </div>

                                </div>
```

```
                                        </li>

                                        <li>

                            <div class="social-small-item">

                            <div class="social-small-info-wrap">
            <div class="social-small-info">
            <div class="social-small-info-front social-small-flickr">
                            <a href="http://flickr.com"></a>

        </div>
        <div class="social-small-info-back social-small-flickr-hover">
                            <a href="http://flickr.com"></a>

                                                    </div>

                                                    </div>

                                                        </div>

                                                    </div>

                                        </li>

                                    </ul>

                                </div>

                        </div>

                        <!--end: Social Links -->

                </div>

                <!--end: Row -->

        </header>

        <!--end: Header-->

        <!--start: Navigation-->

        <div class="navbar navbar-inverse">

        <div class="navbar-inner">

        <div class="container">

<a class="btn btn-navbar" data-toggle="collapse" data-target=".nav-collapse">

                    <span class="icon-bar"></span>

                    <span class="icon-bar"></span>

                    <span class="icon-bar"></span>

                    </a>

                    <div class="nav-collapse collapse">
```

```html
<ul class="nav">
<li class="active"><a href="index.html">Home</a></li>
        <li><a href="about.html">About</a></li>
        <li><a href="services.html">Services</a></li>
        <li><a href="services.html">Process</a></li>
        <li><a href="contact.html">Contact</a></li>
        <li class="dropdown">
<a href="#" class="dropdown-toggle" data-toggle="dropdown">Apply<b class="caret"></b></a>
        <ul class="dropdown-menu">
        <li><a href="objectives.html">Objectives</a></li>
        <li><a href="req.html">Fees & Requirements</a></li>
<li><a href="benefit.html">Benefits of Certification</a></li>
                <li class="divider"></li>
                <li class="nav-header">Apply Now</li>
                <li><a href="#">Login</a></li>
                <li><a href="#">Register</a></li>
        </ul>
        </li>
        </ul>
        </div>
        </div>
        </div>
        <!--end: Navigation-->
        </div>
        <!--end: Container-->
        <!--start: Container -->
        <div class="container">
                <!-- start: Flexslider -->
                <div class="slider">
```

```html
<div class="flexslider">
        <ul class="slides">
                <li>
                <img src="img/slider/slider1.jpg" alt="" />
                <div class="slide-caption n hidden-phone">
                        <h3>Quality Food, Safe Food.</h3>
                                <p>
                        Quality Food Certification System.
                                </p>
                        </div>
                </li>
                <li>
                <img src="img/slider/slider2.jpg" alt="" />
                <div class="slide-caption hidden-phone">
                        <h3>Quality Food, Safe Food.</h3>
                                <p>
                        Quality Food Certification System.
                                </p>
                        </div>
                </li>
                <li>
                <img src="img/slider/slider3.jpg" alt="" />
                </li>
                <li>
                <img src="img/slider/slider4.jpg" alt="" />
                </li>
                <li>
                <img src="img/slider/slider5.jpg" alt="" />
                </li>
                <li>
```

```html
                                        <img src="img/slider/slider6.jpg" alt="" />
                                        </li>
                                        <li>
                                        <img src="img/slider/slider7.jpg" alt="" />
                                        </li>
                                        <li>
                                        <img src="img/slider/slider8.jpg" alt="" />
                                        </li>
                                        <li>
                                        <img src="img/slider/slider9.jpg" alt="" />
                                        </li>
                                        <li>
                                        <img src="img/slider/slider10.jpg" alt="" />
                                        </li>
                                </ul>
                        </div>
                </div>
                <!-- end: Flexslider -->
<!-- start: Hero Unit - Main hero unit for a primary marketing message or call to action -->
                <div class="hero-unit">
<p>
                        This site is a platform of applying certification for quality food.
                        </p>
<p><a class="btn btn-success btn-large">Learn more &raquo;</a></p>
</div>
                <!-- end: Hero Unit -->
<!-- start: Row -->
<div class="row">
<div class="span4">
                        <div class="icons-box">
```

```
                                    <i class="ico-ok circle big"></i>

                        <div class="title"><h3>Easy to use</h3></div>

                                    <p>

                This site is a platform of applying certification for quality food.

                                    </p>

                        <div class="clear"></div>

                    </div>

    </div>

    <div class="span4">

            <div class="icons-box">

                                    <i class="ico-ipad circle big"></i>

                        <div class="title"><h3>Responsive</h3></div>

                                    <p>

                This site is a platform of applying certification for quality food.

                                    </p>

                        <div class="clear"></div>

                    </div>

    </div>

    <div class="span4">

            <div class="icons-box">

                                    <i class="ico-heart circle big"></i>

                        <div class="title"><h3>User friendly</h3></div>

                                    <p>

                This site is a platform of applying certification for quality food.

                                    </p>

                        <div class="clear"></div>

                    </div>

    </div>

    </div>

            <!-- end: Row -->
```

```html
<hr>
<!-- start Clients List -->
<div class="clients-carousel">
    <ul class="slides clients">
        <li><img src="img/logos/1.png" alt=""/></li>
        <li><img src="img/logos/2.png" alt=""/></li>
        <li><img src="img/logos/3.png" alt=""/></li>
        <li><img src="img/logos/4.png" alt=""/></li>
        <li><img src="img/logos/5.png" alt=""/></li>
        <li><img src="img/logos/6.png" alt=""/></li>
        <li><img src="img/logos/7.png" alt=""/></li>
        <li><img src="img/logos/8.png" alt=""/></li>
        <li><img src="img/logos/9.png" alt=""/></li>
        <li><img src="img/logos/10.png" alt=""/></li>
    </ul>
</div>
<!-- end Clients List -->
<hr>
<!-- start: Row -->
<div class="row">
    <!-- start: Icon Boxes -->
    <div class="icons-box-vert-container">
        <!-- start: Icon Box Start -->
        <div class="span6">
            <div class="icons-box-vert">
                <i class="ico-ok ico-color circle-color big"></i>
                <div class="icons-box-vert-info">
                    <h3>Easy to use</h3>
<p>This site is a platform of applying certification for quality food.</p>
                </div>
```

```html
                              <div class="clear"></div>
                    </div>
          </div>
          <!-- end: Icon Box-->
          <!-- start: Icon Box Start -->
          <div class="span6">
                    <div class="icons-box-vert">
          <i class="ico-cup  ico-white circle-color-full big-color"></i>
                              <div class="icons-box-vert-info">
                                        <h3>Best choice</h3>
<p>This site is a platform of applying certification for quality food.</p>
                              </div>
                              <div class="clear"></div>
                    </div>
          </div>
          <!-- end: Icon Box -->
          <!-- start: Icon Box Start -->
          <div class="span6">
                    <div class="icons-box-vert">
          <i class="ico-ipad ico-color circle-color big"></i>
                              <div class="icons-box-vert-info">
                                        <h3>Fully Responsive</h3>
<p>This site is a platform of applying certification for quality food.</p>
                              </div>
                              <div class="clear"></div>
                    </div>
          </div>
          <!-- end: Icon Box -->
          <!-- start: Icon Box Start -->
          <div class="span6">
```

```html
                                    <div class="icons-box-vert">
                        <i class="ico-thumbs-up  ico-white circle-color-full big-color"></i>
                                            <div class="icons-box-vert-info">
                                        <h3>Social Network</h3>
            <p>This site is a platform of applying certification for quality food.</p>
                                        </div>
                                        <div class="clear"></div>
                                    </div>
                            </div>
                            <!-- end: Icon Box -->
                    </div>
                    <!-- end: Icon Boxes -->
                    <div class="clear"></div>
            </div>
            <!-- end: Row -->
            <hr>
        </div>
        <!--end: Container-->
        <!--start: Container -->
    <div class="container">
        <!-- start: Footer Menu -->
                <div id="footer-menu" class="hidden-tablet hidden-phone">
                        <!-- start: Container -->
                        <div class="container">
                                <!-- start: Row -->
                                <div class="row">
                                        <!-- start: Footer Menu Logo -->
                                        <div class="span1">
                                                <div id="footer-menu-logo">
        <a href="#"><img src="img/logo-footer-menu.png" alt="logo" /></a>
```

```
                </div>

                </div>

                <!-- end: Footer Menu Logo -->

                <!-- start: Footer Menu Links-->

                <div class="span10">

                        <div id="footer-menu-links">

                                <ul id="footer-nav">

                <li><a href="index.html">Start</a></li>

                <li><a href="about.html">About</a></li>

        <li><a href="services.html">Services</a></li>

        <li><a href="process.html">Process</a></li>

        <li><a href="contact.html">Contact</a></li>

                                </ul>

                        </div>

                </div>

                <!-- end: Footer Menu Links-->

                <!-- start: Footer Menu Back To Top -->

                <div class="span1">

                        <div id="footer-menu-back-to-top">

                        <a href="#"></a>

                        </div>

                </div>

                <!-- end: Footer Menu Back To Top -->

        </div>

        <!-- end: Row -->

    </div>

    <!-- end: Container  -->

</div>

<!-- end: Footer Menu -->

<!-- start: Footer -->
```

```
<div id="footer">

        <!-- start: Container -->

        <div class="container">

                <!-- start: Row -->

                <div class="row">

                        <!-- start: About -->

                        <div class="span3">

                                <h3>About Us</h3>

        <p> This site is a platform of applying certification for quality food. </p>

                                </div>

                        <!-- end: About -->

                        <!-- start: Photo Stream -->

                        <div class="span3">

                                <h3>Photo Stream</h3>

                        <div class="flickr-widget">

<script type="text/javascript"
src="http://www.flickr.com/badge_code_v2.gne?count=9&display=latest&size=s&layout=x&sour
ce=user&user=29609591@N08"></script>

                        <div class="clear"></div>

                                </div>

                        </div>

                        <!-- end: Photo Stream -->

                        <div class="span6">

                                <!-- start: Follow Us -->

                                <h3>Follow Us!</h3>

                                <ul class="social-grid">

                                        <li>

                        <div class="social-item">

                        <div class="social-info-wrap">

                                <div class="social-info">
                        <div class="social-info-front social-twitter">
                <a href="http://twitter.com"></a>
                </div>
```

```html
<div class="social-info-back social-twitter-hover">

<a href="http://twitter.com"></a>

</div>

    </div>

            </div>

                    </div>

                            </li>

                                <li>

                                <div class="social-item">
                            <div class="social-info-wrap">

                            <div class="social-info">
            <div class="social-info-front social-facebook">
            <a href="http://facebook.com"></a>
                            </div>

                <div class="social-info-back social-facebook-hover">

                <a href="http://facebook.com"></a>
    </div>
            </div>

                    </div>

                    </div>

                            </li>

                            <li>

                                    <div class="social-item">

                                    <div class="social-info-wrap">
                            <div class="social-info">
            <div class="social-info-front social-dribbble">

<a href="http://dribbble.com"></a>
            </div>

<div class="social-info-back social-dribbble-hover">

<a href="http://dribbble.com"></a>

            </div>

                    </div>

                    </div>

                            </div>
```

```html
                                                      </li>
                                                      <li>
                                                      <div class="social-item">
                                                      <div class="social-info-wrap">
                                        <div class="social-info">
                                <div class="social-info-front social-flickr">
<a href="http://flickr.com"></a>
</div>
<div class="social-info-back social-flickr-hover">
<a href="http://flickr.com"></a>
</div>
    </div>
            </div>
                    </div>
                            </li>
                            </ul>
                    <!-- end: Follow Us -->
                    <!-- start: Newsletter -->
                            <form id="newsletter">
                            <h3>Newsletter</h3>
                            <p>Please leave us your email</p>
                            <label for="newsletter_input">@:</label>
                            <input type="text" id="newsletter_input"/>
            <input type="submit" id="newsletter_submit" value="submit">
                                    </form>
                                    <!-- end: Newsletter -->
                            </div>
                    </div>
                    <!-- end: Row -->
            </div>
            <!-- end: Container  -->
```

```
                              </div>

                         <!-- end: Footer -->

                    </div>

                    <!-- end: Container  -->

              </div>

              <!-- end: Wrapper  -->

              <!-- start: Copyright -->

              <div id="copyright">

                    <!-- start: Container -->

                    <div class="container">

                              <p>

Quallity Food &copy; 2017, Designed by FPC Authority <img src="img/poland.png"
alt="Poland" style="margin-top:-4px">

                              </p>

                    </div>

                    <!-- end: Container  -->

              </div>

              <!-- end: Copyright -->

<!-- start: Java Script -->

<!-- Placed at the end of the document so the pages load faster -->

<script src="js/jquery-1.8.2.js"></script>

<script src="js/bootstrap.js"></script>

<script src="js/flexslider.js"></script>

<script src="js/carousel.js"></script>

<script def src="js/custom.js"></script>

<!-- end: Java Script -->

</body>

</html>

/*Stop hiding from IE Mac */
```

User:

```php
<?php
namespace App;
use Illuminate\Notifications\Notifiable;
use Illuminate\Foundation\Auth\User as Authenticatable;
class User extends Authenticatable
{
    use Notifiable;
    /**
     * The attributes that are mass assignable.
     *
     * @var array
     */
    protected $fillable = [
        'name', 'email', 'password', 'mobile', 'country', 'role', 'avatar', 'question', 'answer', 'captcha', 'token', 'is_confirmed', 'confirmed_at'
    ];
    /**
     * The attributes that should be hidden for arrays.
     *
     * @var array
     */
    protected $hidden = [
        'password', 'remember_token',
    ];
    public function foods()
    {
        return $this->hasMany('App\Food');
    }
    public function auditUser() {
```

```php
        return $this->hasOne("App\AuditUser");

    }

}
```

Foods:

```php
<?php

namespace App;

use Illuminate\Database\Eloquent\Model;

class Food extends Model

{

    protected $fillable = ['user_id', 'name', 'company_name', 'food_type', 'valid', 'valid_at', 'reject',

                'tinid', 'address', 'mobile', 'picture', 'nid',

                'nid_picture', 'etinid', 'tradelicenseid', 'certificate', 'aggreement'

                ];

    public function user()

    {

                return $this->belongsTo('App\User');

    }

    public function auditlog()

    {

                return $this->hasOne('App\Auditlog');

    }

}
```

Audit User:

```php
<?php

namespace App;

use Illuminate\Database\Eloquent\Model;

class AuditUser extends Model
```

```php
{
    public $timestamps = false;

    protected $fillable = [

        'user_id',

        'designation',

        'organization_name',

        'nid'

    ];

    public function user() {

        return $this->belongsTo('App\User'); // this matches the Eloquent model

    }

}
```

Audit Log:

```php
<?php

namespace App;

use Illuminate\Database\Eloquent\Model;

class Auditlog extends Model

{

    protected $fillable = ['food_id', 'status', 'Flavor_and_Fragrance', 'Allergens',

            'Chemical_and_nutritional_analysis', 'GMOs_Detection',
'Microbiological_Testing',

            'Residues_and_Contaminants_Testing', 'Sensory_Analysis',
'Analytical_Chemistry_Tests', 'Foodborne_Virus_Detection', 'Ingredients_and_Additives'];

    public function food()

    {

            return $this->belongsTo('App\Food');

    }

}
```