Chapter 1

PREAMBLE

1.1 Introduction

In this era of rapidly growing demand-supply chain, there is a need to establish automated systems in industries to reduce human intervention, thereby controlling malpractices, increasing system efficiency and improving country's economy.

One such industry that contributes largely towards the country's development and has scope of automation in its current systems is Dairy Industry. In villages, hundreds of farmers collect milk from their animal farms on a daily basis. These farmers sell the milk to the Milk Cooperative Society in their areas and earn a price based on the quality and quantity of the milk.

The purpose of the project is to automate the milk data collection and to eliminate the human intervention. Normally a lot of error occurs while determining the quality of milk and updating the passbook entries. Due to this the farmers are often cheated by the officers with the amount paid to them.

1.2 Existing System

Let us consider this existing process in detail:

- Every farmer is given a passbook which contains the following details:

  a) A unique identification number
  b) Name of the farmer
  c) Contact details of the farmer
  d) Signature of the farmer
  e) Name of the officer from the society

f) Signature of the officer
g) Weight of the milk
h) Quality of the milk
i) Amount paid for the milk
j) Date of the transaction

- A farmer goes to the milk co-operative society to sell the milk from his farm.
- A series of milk analysis procedures is carried out to check the quality and quantity of milk given by the farmer as below:
    a) The officer weighs the milk with the help of an electronic weighing scale.
    b) A sample of this milk is taken and a lactometer is used to find out the fat content and density of the milk which helps in determination of the quality of milk.
    c) All these details are stored in a database and can be retrieved by the officers whenever needed.
- Based on the above analysis, a fixed price is given to the farmer and the entry is updated in the passbook.

1.3 Limitation of the Existing system

Some of the major problems faced in the current process are:

- Due to human intervention, errors may be encountered in measurements and calculations.
- Farmers may be cheated by the officers with regard to the amount to be paid to them.
- Wrong samples may be taken to determine the quality of milk. Due to the above problems, the farmers do not get paid the actual amount and hence, incur financial losses.

1.4 Problem Statement

In this era of rapidly growing demand-supply chain, there is a need to establish automated systems in industries to reduce human intervention, thereby controlling malpractices, increasing system efficiency and improving country’s economy. One such industry that contributes largely towards the country’s development and has scope of automation in its current system is Diary Industry.

In villages, hundreds of farmers collect milk from their animal farms on a daily basis. These farmers sell the milk to the Milk Co-operative Society in their areas and earn a price based on the quality and quantity of the milk.

Some of the major problems faced in the current process are:

1. Due to human intervention, errors may be encountered in measurements and calculations.

2. Farmers may be cheated by the officers with regard to the amount to be paid to them.

3. Wrong samples may be taken to determine the quality of milk. Due to the above problems, the farmers do not get paid the actual amount and hence, incur financial losses.

To overcome the above mentioned problems, we propose automation of the entire process of milk collection using which the errors encountered can be eliminated successfully

1.5 Objective of the project

The main objective of the project is to eliminate the human intervention in the milk collection system and to ensure farmers are paid a fair price for their product.

1.6 Proposed System

1. Every Officer in the Co-operative society shall be given a RFID card, as a unique identification number for the officer.
2. Before the transactions for the day begin, he shall flash his RFID card before a RFID reader.
3. Thus, details like the Name of the officer and location shall be retrieved from the Officers' Database.
4. Every farmer who visits the Co-operative Society shall also be given a RFID card, as a unique identification number for the farmer.
5. As soon as he walks into the office to sell the milk, he shall flash his card before the RFID reader.

6. Thus, all his details like his ID, name, location and other contact details get retrieved from the Farmers' Database.
7. The date and the time shall be retrieved from the system and stored on both the Farmers' and Officers' Database.
8. A handy, movable web camera shall be used to capture the image of the lactometer and weighing scale readings, after the lactometer is immersed in the milk sample.
9. This captured image shall be processed and the readings shall be recorded into Farmers' database.
10. The cost of the milk shall be then calculated with the help of the software and the appropriate money is paid or is recorded to be paid, for later payment.
11. After the above step, with the help of a GSM modem, SMS shall be sent to the Farmer's mobile number which was previously retrieved from the Farmers' database.
12. This SMS will have all the details about the milk sold by the farmer, the date and the time of the transaction.
13. The same SMS will be sent to the server that has details of the day-to-day transactions.
14. This SMS acts as a confirmation receipt to the farmer instead of the passbook. This SMS can be in regional languages and can be customized based on locations.

1.7 Advantages of Proposed System

1. No human intervention errors.
2. More reliable and faster.
3. More accurate and no scope for alteration of information by unauthorized sources.
4. Easy to handle.
5. As we store the location information and other details, the higher authorities can retrieve the details from the central server anytime, anywhere, through a webpage which can be further implemented in this project.

1.8 Phase Description

Phase	Task	Description
Phase 1	Analysis	Analyzing the existing systems and the drawbacks
Phase 2	Literature survey	Collect raw data and elaborate on literature surveys.
Phase 3	System analysis	Analyses the requirements of the project and lists the specific requirements needed.
Phase 4	Design	Object designing and Functional description
Phase 5	Implementation	Implement the code based on the object specification
Phase 6	Testing	Test the project according to Test Specification
Phase 7	Documentation	Prepare the document for this project with conclusion and future enhancement.

Table 1.6: Phase Description

1.9 Organization of the project report

The project report is organized as follows:

Chapter 2: **Literature Review -** Gives a brief overview of the survey papers and the research sources that have been studied to establish a thorough understanding of the project under consideration.

Chapter 3 **Theoretical Background -** Establishes groundwork for the proposed project by giving a detailed analysis of the project topic, existing research relevant to the project, arguments in favor and against the existing solutions and finally explores the motivation behind the proposed solution.

Chapter 4 **System Requirement Specification** - Discusses in details about the different kinds of requirements needed to successfully complete the project.

Chapter 5 **System Analysis** - gives details about several analysis that are performed to facilitate taking decision of whether the project is feasible enough or not.

Chapter 6 **System Design -** Gives the design description of the project, conceptual and detailed design well supported with design diagrams.

Chapter 7 **Implementation** - Discusses the implementation details of the project and reasons the use of the programming language and development environment.

Chapter 8 **Testing -** Briefs the testing methods used for testing the different modules in the project.

Chapter 9 **Results and Performance Analysis -** Gives the snapshots and graphs of the proposed protocols.

Chapter 10 **Conclusion and Future Scope -** Gives the concluding remarks of the project, throwing light on its future aspects.

References Lists the websites and references referred during the project work.

Chapter 2

LITERATURE SURVEY

In order to get required knowledge about various concepts related to the present analysis existing literature were studied. Some of the important conclusions were made through those are listed below.

1. Radio frequency identification (RFID) on the IEEE Emerging Technology portal, 2006 – 2012”- **Bichlien Hoang,Ashley Caudill, www.ieee.org -** in this paper Radio frequency identification (RFID) has been used in a number of practical applications, such as improving supply chain management, tracking household pets, accessing office buildings, and speeding up toll collection on roadways. RFID technology can be used to track products in a manner similar to using bar codes for product identification

2**. INTEGRATING GPS, GSM AND CELLULAR PHONE FOR LOCATION TRACKING AND MONITORING”- B. P. S. Sahoo , Satyajit Rath , Computer Networking & e-Management Division, CSIR-IMMT, Bhubaneswar-** This paper proposes a prototype model for location tracking using Geographical Positioning System(GPS) and Global System for Mobile Communication (GSM) technology. The system displays the object moving path on the monitor and the same information can also be communicated to the user cell phone, on demand of the user by asking the specific information via SMS. This system is very useful for car theft situations, for adolescent drivers being watched and monitored by parents. The result shows that the object is being tracked with a minimal tracking error.

3. “ **DIGITAL IMAGE PROCESSING”-THIRD EDITION, Richard E Woods, Rafael C Gonzalez-**The principal objectives of the book is to provide an introduction to basic concepts and methodologies for digital image processing, and to develop a foundation that can be used as the basis for further study and research in this field. All mainstream areas of image processing are covered, including image fundamentals, image enhancement in the spatial and frequency domains, restoration, color image processing, wavelets, image compression, morphology, segmentation, and image description

2.1 CASE STUDY AT MILK COLLECTION CENTRE

Fig 2.1.1: Chennasandra milk society

- We visited Chennasandra milk society on Sunday(19/1/14) morning at around 6:30 a.m.
- The milk society opens twice a day (6:30 am and 5:30 p.m)

Fig 2.1.2: Milk sample for testing

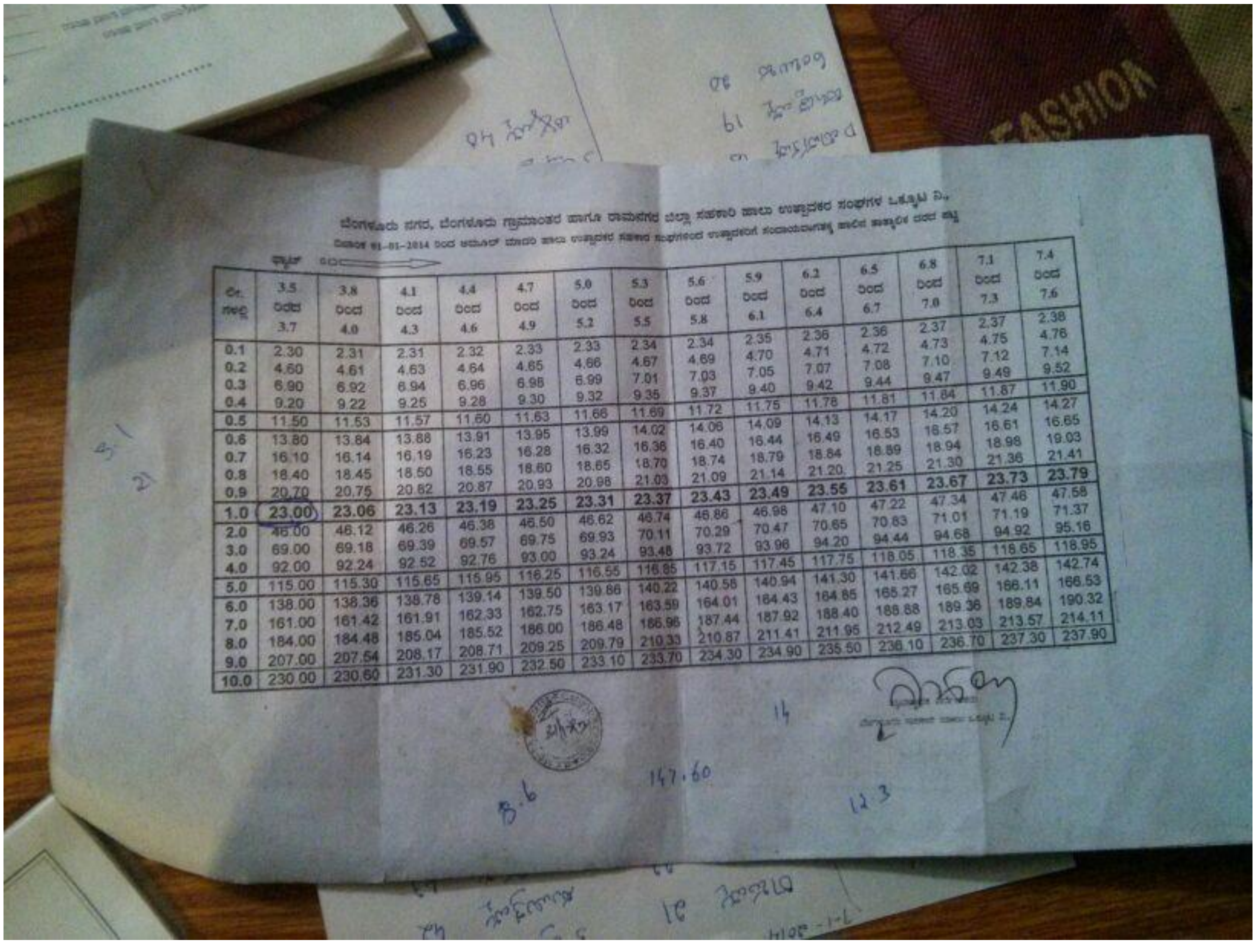
- The farmers pour the milk in the white cylindrical container so as to check the milk density and the temperature.

Table 2.1.3:Check lactometer reading

- The supervisor checks the temperature in order to determine if water is mixed into the milk. The ideal temperature for good quality milk is about 27 degrees Celsius. If the temperature is below 27 degrees Celsius then the milk is rejected.
- The supervisor then inserts the lactometer in order to determine the density of the milk. The ideal lactometer reading is 30 to 35.

Fig 2.1.4:Check the weight of the milk

- Finally the farmer pours the milk into a huge container where the weight is determined.
- The supervisor then enters the weight of the milk and the amount to the farmer based on the fat content.



[illegible]	3.5 ರಿಂದ 3.7	3.8 ರಿಂದ 4.0	4.1 ರಿಂದ 4.3	4.4 ರಿಂದ 4.6	4.7 ರಿಂದ 4.9	5.0 ರಿಂದ 5.2	5.3 ರಿಂದ 5.5	5.6 ರಿಂದ 5.8	5.9 ರಿಂದ 6.1	6.2 ರಿಂದ 6.4	6.5 ರಿಂದ 6.7	6.8 ರಿಂದ 7.0	7.1 ರಿಂದ 7.3	7.4 ರಿಂದ 7.6
0.1	2.30	2.31	2.31	2.32	2.33	2.33	2.34	2.34	2.35	2.36	2.36	2.37	2.37	2.38
0.2	4.60	4.61	4.63	4.64	4.65	4.66	4.67	4.69	4.70	4.71	4.72	4.73	4.75	4.76
0.3	6.90	6.92	6.94	6.96	6.98	6.99	7.01	7.03	7.05	7.07	7.08	7.10	7.12	7.14
0.4	9.20	9.22	9.25	9.28	9.30	9.32	9.35	9.37	9.40	9.42	9.44	9.47	9.49	9.52
0.5	11.50	11.53	11.57	11.60	11.63	11.66	11.69	11.72	11.75	11.78	11.81	11.84	11.87	11.90
0.6	13.80	13.84	13.88	13.91	13.95	13.99	14.02	14.06	14.09	14.13	14.17	14.20	14.24	14.27
0.7	16.10	16.14	16.19	16.23	16.28	16.32	16.36	16.40	16.44	16.49	16.53	16.57	16.61	16.65
0.8	18.40	18.45	18.50	18.55	18.60	18.65	18.70	18.74	18.79	18.84	18.89	18.94	18.98	19.03
0.9	20.70	20.75	20.82	20.87	20.93	20.98	21.03	21.09	21.14	21.20	21.25	21.30	21.36	21.41
1.0	**23.00**	**23.06**	**23.13**	**23.19**	**23.25**	**23.31**	**23.37**	**23.43**	**23.49**	**23.55**	**23.61**	**23.67**	**23.73**	**23.79**
2.0	46.00	46.12	46.26	46.38	46.50	46.62	46.74	46.86	46.98	47.10	47.22	47.34	47.46	47.58
3.0	69.00	69.18	69.39	69.57	69.75	69.93	70.11	70.29	70.47	70.65	70.83	71.01	71.19	71.37
4.0	92.00	92.24	92.52	92.76	93.00	93.24	93.48	93.72	93.96	94.20	94.44	94.68	94.92	95.16
5.0	115.00	115.30	115.65	115.95	116.25	116.55	116.85	117.15	117.45	117.75	118.05	118.35	118.65	118.95
6.0	138.00	138.36	138.78	139.14	139.50	139.86	140.22	140.58	140.94	141.30	141.66	142.02	142.38	142.74
7.0	161.00	161.42	161.91	162.33	162.75	163.17	163.59	164.01	164.43	164.85	165.27	165.69	166.11	166.53
8.0	184.00	184.48	185.04	185.52	186.00	186.48	186.96	187.44	187.92	188.40	188.88	189.36	189.84	190.32
9.0	207.00	207.54	208.17	208.71	209.25	209.79	210.33	210.87	211.41	211.95	212.49	213.03	213.57	214.11
10.0	230.00	230.60	231.30	231.90	232.50	233.10	233.70	234.30	234.90	235.50	236.10	236.70	237.30	237.90

14

147.60

3.6

12.3

Fig 2.1.5: Check the fat content and the corresponding cost

- The above picture depicts the amount to be paid to the farmer based on the fat content.

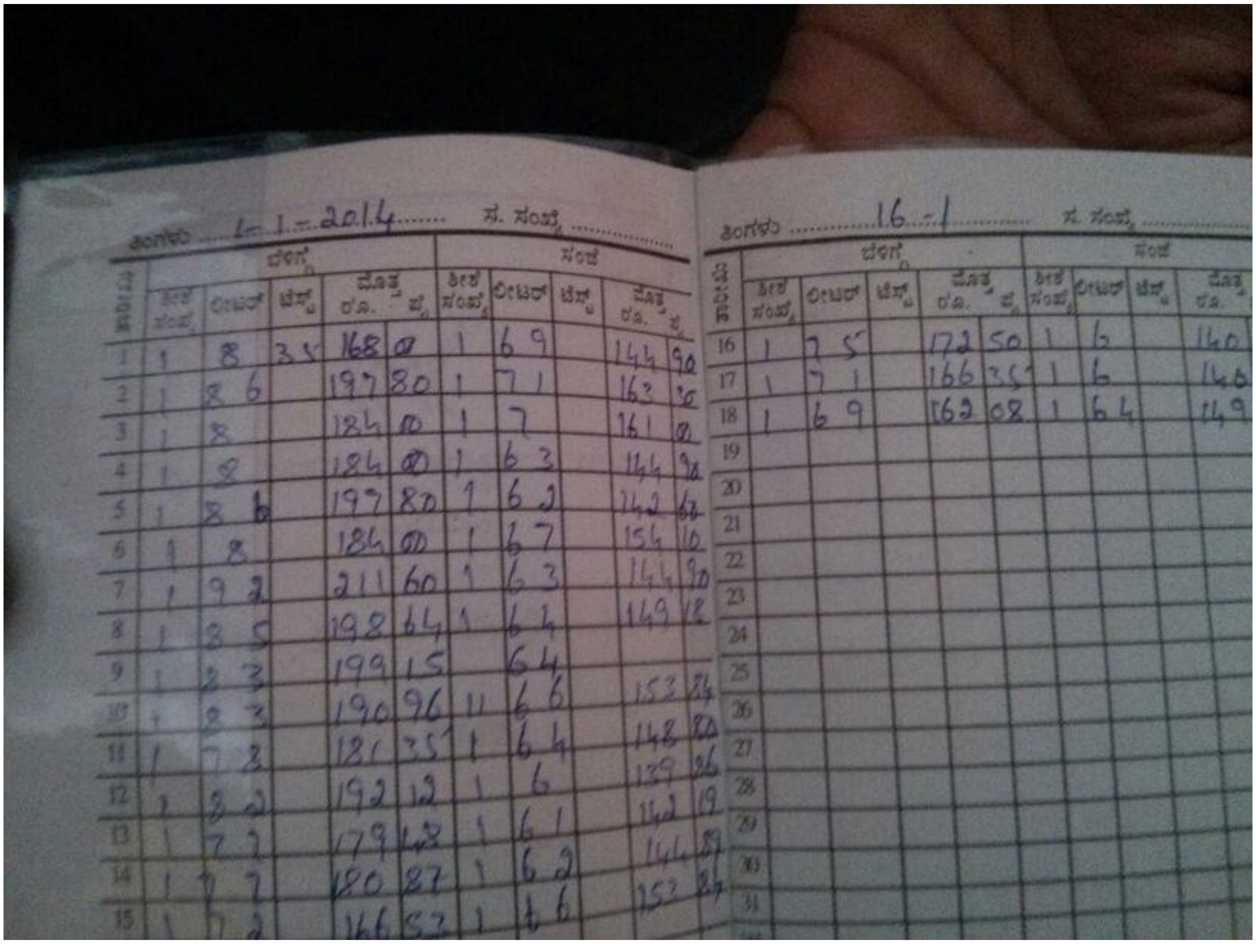


Fig 2.1.6: Make entry in the passbook

- Lastly the supervisor enters the details in the farmer's passbook and the farmers are paid on monthly basis.
- At the end, the containers are sealed and sent to the respective milk factory.

Chapter 3

THEORETICAL BACKGROUND

3.1 GSM Modem Background:

GSM (Global System for Mobile communications: originally from GROUPE Special Mobile) is the most popular standard for mobile phones in the world. Its promoter, the GSM Association, estimates that 80% of the global mobile market uses the standard. GSM is used by over 3 billion people across more than 212 countries and territories. Its ubiquity makes international roaming very common between mobile phone operators enabling subscribers to use their phones in many parts of the world. GSM differs from its predecessors in that both signaling and speech channels are digital, and thus is considered a second generation (2G) mobile phone system. This has also meant that data communication was easy to build into the system.

3.1.1 Services provided by GSM:

From the beginning, the planners of GSM wanted ISDN compatibility in terms of the services offered and the control signalling used. However, radio transmission limitations, in terms of bandwidth and cost, do not allow the standard ISDN B-channel bit rate of 64 kbps to be practically achieved.

A variety of data services is offered. GSM users can send and receive data, at rates up to 9600 bps, to users on POTS (Plain Old Telephone Service), ISDN, Packet Switched Public Data Networks, and Circuit Switched Public Data Networks using a variety of access methods and protocols, such as X.25 or X.32. Since GSM is a digital network, a modem is not required between the user and GSM network, although an audio modem is required inside the GSM network to interwork with POTS.

Other data services include Group 3 facsimile, as described in ITU-T recommendation T.30, which is supported by use of an appropriate fax adaptor. A unique feature of GSM, not found in older analog systems, is the Short Message Service (SMS).

SMS is a bidirectional service for short alphanumeric (up to 160 bytes) messages. Messages are transported in a store-and-forward fashion. For point-to-point SMS, a message can be sent to another subscriber to the service, and an acknowledgement of receipt is provided to the sender. SMS can also be used in a cell-broadcast mode, for sending messages such as traffic updates or news updates. Messages can also be stored in the SIM card for later retrieval.

2.1.2 Architecture of the GSM network:

A GSM network is composed of several functional entities, whose functions and interfaces are specified. Figure 2.1 shows the layout of a generic GSM network. The GSM network can be divided into three broad parts. The Mobile Station is carried by the subscriber. The Base Station Subsystem controls the radio link with the Mobile Station. The Network Subsystem, the main part of which is the Mobile services Switching Center (MSC), performs the switching of calls between the mobile users, and between mobile and fixed network users. The MSC also handles the mobility management operations. Not shown is the Operations and Maintenance Center, which oversees the proper operation and setup of the network. The Mobile Station and the Base Station Subsystem communicate across the Um interface, also known as the air interface or radio link. The Base Station Subsystem communicates with the Mobile services Switching Center across the A interface.

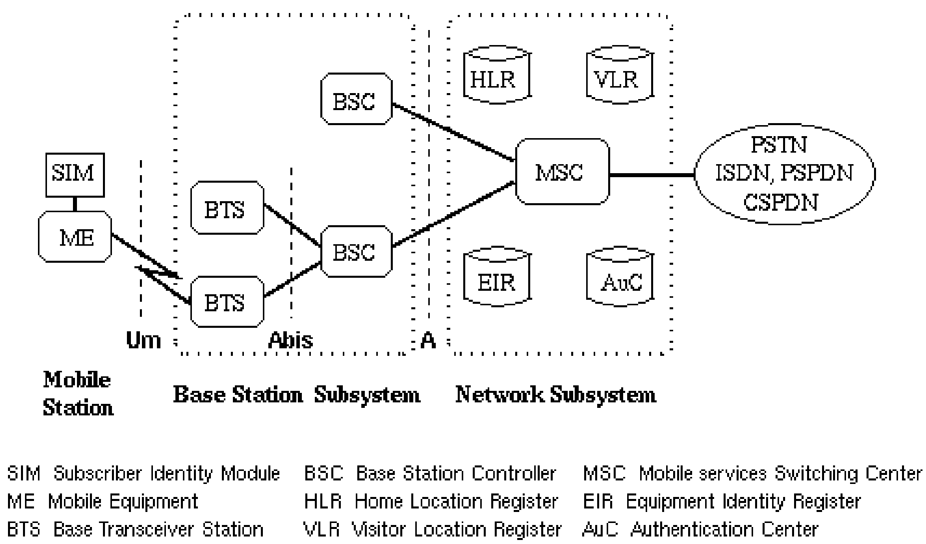


Fig 2.1 Layout of generic GSM

2.2 RADIO FREQUENCY IDENTIFICATION BACKGROUND:

Radio frequency is a wireless non-contact use of radio frequency electromagnetic fields to transfer data, for the purposes of automatically identifying and tracking tags attached to objects. The tags mainly contain the electronically stored information.

The RFID device serves the same purpose as a bar code or a magnetic strip on the back of an ATM card. It provides a unique identifier for that object. And, just as a bar code or magnetic strip must be scanned to get the information, the RFID device must be scanned to retrieve the identifying information.

The RFID system mainly consists of components like:

- Tag
- Reader
- Reader antenna
- Host and software system
- Controller
- Communication infrastructure.

RFID Tags are mainly classified into three categories:

- **Passive tags**: Tags which do not require an onboard power supply such as a battery. They use the power emitted from the reader to energize itself and transmit the stored data to itself. It is smaller and also cheaper compared to an active or semi-active tag.
- **Active tags**: Has an on board power source to transmit the data to the reader. It can also broadcast the data to its surroundings even in the absence of a reader.
- **Semi Active(Semi Passive) tags**: This tag also has an on board power source such as a battery and uses the reader's emitted power to transmit the data. It is also known as battery assisted tag.

2.2.1 Working of RFID:

A Radio device such as a tag is attached to the object that needs to be identified. When this tag object is presented in front of a RFID reader, the tag transmits the data to a reader via the reader antenna. The reader reads the required data and forwards it over suitable communication channels. This application can then use the unique data to identify the object presented to the reader.

RFID was first used to monitor wildlife and research centres. RFID tags were used to keep a track on the movement of animals. They can be attached to anything like wallets or purses, vehicles, assets etc. They can also be used as a navigation system for the visually impaired people.

Some common problems with RFID are reader collision and tag collision. Reader collision occurs when the signals from two or more readers overlap. Tag collision occurs when many tags are present in a small area. Systems must be carefully set up to avoid these problems.

3.2.2 General Architecture of RFID:

RFID solutions consist of a base set of functional components: tags, sensor network, and intelligence systems. Each of these three components provides specific functions that integrate to form a combined RFID-enabled system.

The most fundamental component in the RFID system is the tag. Although the majority of individuals use this to determine whether an RFID system is being employed, it is often one of the most difficult pieces of equipment to identify physically. Passive RFID tags provide the simple function of uniquely identifying an object—whether it is a tool, vehicle, person, or object.

Each RFID tag has a unique code that is read by the readers and sent to a back-end application, where it is associated with the asset or person. The back-end business logic then determines the next steps to perform. Due to the versatility of this unit, RFID tags come in various shapes, sizes, and form-factors to ensure proper mounting and security for the object it is monitoring. In addition to the basic operation of identifying objects, semi-passive and active tags are becoming significantly more intelligent.

Several versions have the ability to include data from additional sensors and monitoring devices, such as thermometers, altimeters, motion sensors, and tamper sensors.

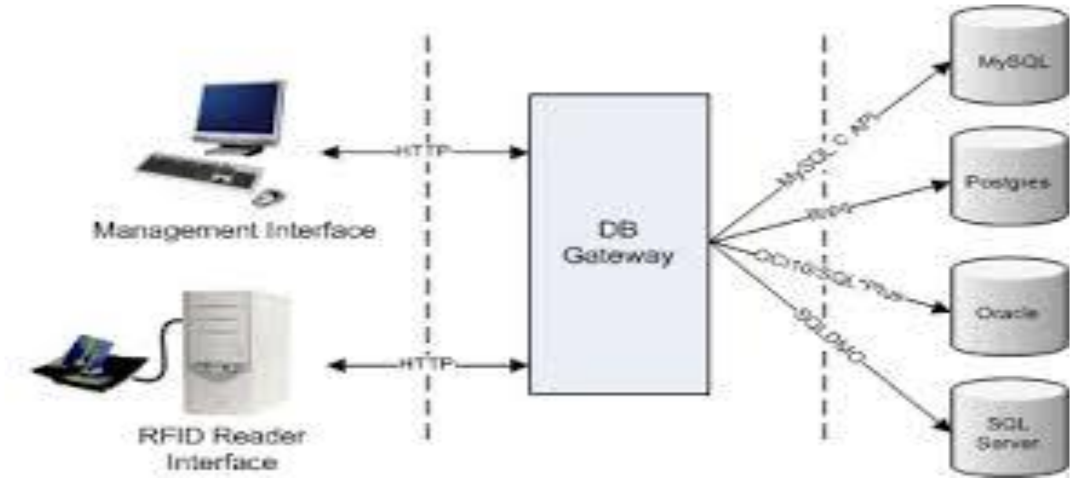


Fig 3.2 Interaction between RFID and DB

Information read from the tag is sent via the RFID system's reader network. This network provides the translation between the wireless transmissions of the RFID tags and the requests made via back-end systems and servers. The architecture of the reader network varies significantly, depending on the RFID system being used. The distance between the tag and the reader depends on the type of tag and amount of energy used.

This can vary from a few centimetres for access control or payment applications to hundreds of meters or even up to a mile for some active tags if read in unobstructed areas. The readers are typically connected to their middleware and back-end application servers via Ethernet.

In some instances where there is no access, cellular modems can be used for backhaul. The network used in an RFID solution can be an open public network such as the Internet, or a more complex proprietary network, some of which have features to improve accuracy.

The final component within an RFID system is the intelligence system. Intelligent systems answer the question of "what does this information mean to me?" An example of this is GPS location data. If you look deeply into GPS and location information, generally you are given a very specific coordinate identifying a latitude and longitude on a map.

By informing an individual that you will be located at these numeric coordinates, you provide that person with very precise information.

However, most people cannot directly understand a location given in map coordinates. In order to interpret this in human terms, we need to place the location on a map or describe a street address or some other conventional description. These are the functions that the intelligence systems perform: mapping complex data from potentially several data sources into a usable format such as mapping interfaces, proactive alerts, inventory updates, and much more. Intelligence systems have great capability, but they are bound by the information that is provided to them. Customers today integrate location systems with maintenance programs, supply chain applications, and field force automation solutions to properly tie together and maximize the full potential of the solution.

3.3 IMAGE PROCESSING:

Image processing is any form of signal processing for which the input is an image, such as a photograph or video frame; the output of image processing may be either an image or a set of characteristics or parameters related to the image. Most image-processing techniques involve treating the image as a two-dimensional signal and applying standard signal-processing techniques to it.

Image processing usually refers to digital image processing, but optical and analog image processing also are possible. This article is about general techniques that apply to all of them. The acquisition of images (producing the input image in the first place) is referred to as imaging.

An image may be considered to contain sub-images sometimes referred to as regions-of-interest, ROIs, or simply regions. This concept reflects the fact that images frequently contain collections of objects each of which can be the basis for a region. In a sophisticated image processing system it should be possible to apply specific image processing operations to selected regions.

Thus one part of an image (region) might be processed to suppress motion blur while another part might be processed to improve color rendition. Sequence of image processing:

In modern sciences and technologies, images also gain much broader scopes due to the ever growing importance of scientific visualization (of often large-scale complex scientific/experimental data). Examples include microarray data in genetic research, or real-time multi-asset portfolio trading in finance.

Before going to processing an image, it is converted into a digital form. Digitization includes sampling of image and quantization of sampled values. After converting the image into bit information, processing is performed. This processing technique may be Image enhancement, Image restoration, and Image compression.

3.3.1 Image enhancement:

It refers to accentuation, or sharpening, of image features such as boundaries, or contrast to make a graphic display more useful for display & analysis. This process does not increase the inherent information content in data. It includes gray level & contrast manipulation, noise reduction, edge crispening and sharpening, filtering, interpolation and magnification, pseudo colouring, and so on.

3.3.2 Image restoration:

It is concerned with filtering the observed image to minimize the effect of degradations. Effectiveness of image restoration depends on the extent and accuracy of the knowledge of degradation process as well as on filter design. Image restoration differs from image enhancement in that the latter is concerned with more extraction or accentuation of image features.

3.3.3 Image compression:

It is concerned with minimizing the number of bits required to represent an image. Application of compression are in broadcast TV, remote sensing via satellite, military communication via aircraft, radar, teleconferencing, facsimile transmission, for educational & business documents, medical images that arise in computer tomography, magnetic resonance imaging and digital radiology, motion, pictures, satellite images, weather maps, geological surveys and so on.

- Text compression – CCITT GROUP3 & GROUP4
- Still image compression – JPEG
- Video image compression – MPEG

Summary

This chapter mainly concentrates on the basic theoretical background related to the topic of focus. It describes the survey work done with respect to the project, which includes overview on image processing. This chapter also discusses the different techniques used in image processing. It includes details about near field communication and GSM modem. This survey work also finds out some of the major flaws associated with all these related topics, so that a suitable solution can be proposed in order to overcome these drawbacks.

Chapter 4

SYSTEM REQUIREMENT SPECIFICATION

Software requirement Specification is a fundamental document, which forms the foundation of the software development process. It not only lists the requirements of a system but also has a description of its major feature. An SRS is basically an organization's understanding (in writing) of a customer or potential client's system requirements and dependencies at a particular point in time (usually) prior to any actual design or development work. It's a two-way insurance policy that assures that both the client and the organization understand the other's requirements from that perspective at a given point in time.

The SRS also functions as a blueprint for completing a project with as little cost growth as possible. The SRS is often referred to as the "parent" document because all subsequent project management documents, such as design specifications, statements of work, software architecture specifications, testing and validation plans, and documentation plans, are related to it. It is important to note that an SRS contains functional and nonfunctional requirements only; it doesn't offer design suggestions, possible solutions to technology or business issues, or any other information other than what the development team understands the customer's system requirements to be.

4.1 Functional Requirement

Functional Requirement defines a function of a software system and how the system must behave when presented with specific inputs or conditions. These may include calculations, data manipulation and processing and other specific functionality. In this system following are the functional requirements:-

- **USER REGISTRATION MODULE:** When RFID card is swiped, unique number is displayed on to the screen .This number is an unique identity which provides the complete details of each farmer. The information stored in the module can be edited, updated and saved.
- **PROCESS MODULE:** The temperature of the milk is taken initially. The ideal temperature of milk is about 27centigrades. If the temperature is below 27centigrades the milk is rejected. The image of the lactometer dipped in the milk container is taken. After the image is taken the image is processed. At the end the weight of the milk is determined.
- **GSM MODULE:** It enables you to control many of the functions of the system from anywhere in the world provided your GSM mobile handset has a network connection. It sends out information about events to your mobile phone. The system uses the SMS messaging protocol to communicate.
- **DATABASE MODULE:** The database module allows the users to build, display and search a bank of record entries about any topic. The format and structure of these entries can be almost unlimited, including images, files, URLs, numbers and text amongst other things.

4.2 Non-Functional Requirement

Non functional requirements are the requirements which are not directly concerned with the specific function delivered by the system. They specify the criteria that can be used to judge the operation of a system rather than specific behaviors. They may relate to emergent system properties such as reliability, response time and store occupancy. Non functional requirements arise through the user needs, because of budget constraints, organizational policies, the need for interoperability with other software and hardware systems or because of external factors such as:-

- Product Requirements
- Organizational Requirements

- User Requirements
- Basic Operational Requirements

4.2.1 Product Requirements

Portability: The program must work on different platforms efficiently. The pre requirement for portability is the generalized abstraction between the application logic and system interfaces. When software with the same functionality is produced for several computing platforms, portability is the key issue for development cost reduction

Correctness: It followed a well-defined set of procedures and rules to compute and also rigorous testing is performed to confirm the correctness of the data.

Ease of Use: The front end is designed in such a way that it provides an interface which allows the user to interact in an easy manner.

Modularity: The complete product is broken up into many modules and well-defined interfaces are developed to explore the benefit of flexibility of the product.

Robustness: This software is being developed in such a way that the overall performance is optimized and the user can expect the results within a limited time with utmost relevancy and correctness.

Non functional requirements are also called the qualities of a system. These qualities can be divided into execution quality & evolution quality. Execution qualities are security & usability of the system which are observed during run time, whereas evolution quality involves testability, maintainability, extensibility or scalability.

4.2.2 Organizational Requirements

Process Standards: Standards are used to develop the application which is the standard used by the most of the standard software developers all over the world.

Design Methods: Design is one of the important stages in the software engineering process. This stage is the first step in moving from problem to the solution domain. In other words, starting with what is needed design takes us to work how to satisfy the needs.

4.2.3 User Requirements

- There must be a user interface to configure the network.
- There must be a interface to confirm if all the processes have functioned properly.
- The system should be user friendly, so that the client application is available at the system tray and user has to just click to select any options.

4.2.4 Basic Operational Requirements

The customers are those that perform the eight primary functions of systems engineering, with special emphasis on the operator as the key customer. Operational requirements will define the basic need and, at a minimum, will be related to these following points:-

- **Mission profile or scenario:** It describes about the procedures used to accomplish mission objective. It also finds out the effectiveness or efficiency of the system.
- **Performance and related parameters:** It points out the critical system parameters to accomplish the mission
- **Utilization environments:** It gives a brief outline of system usage. Finds out appropriate environments for effective system operation.
- **Operational life cycle:** It defines the system lifetime.

4.3 Hardware Requirements

- Processors : Pentium IV
- Processor Speed : 3.00 GHZ
- RAM : 2 GB
- Storage : 20 GB
- Monitor : 15 inches

- Keyboard : Standard 102 keys
- Mouse : Standard 3 buttons

4.4 Software Requirements

- Operating system : Windows XP Professional/ Windows Vista/Windows 7
- Coding Language : C++ / Power basic/ SQL
- Visual Interface : User interface on pc monitor
- Tools : Visual studio /power basic

Summary

This chapter gives details of the functional requirements, non-functional requirements, resource requirements, hardware requirements, software requirements etc. Again the non-functional requirements in turn contain product requirements, organizational requirements, user requirements, basic operational requirements etc.

Chapter 5

SYSTEM ANALYSIS

Overview

Analysis is the process of finding the best solution to the problem. System analysis is the process by which we learn about the existing problems, define objects and requirements and evaluates the solutions. It is the way of thinking about the organization and the problem it involves, a set of technologies that helps in solving these problems. Feasibility study plays an important role in system analysis which gives the target for design and development.

5.1 Feasibility Study

All systems are feasible when provided with unlimited resource and infinite time. But unfortunately this condition does not prevail in practical world. So it is both necessary and prudent to evaluate the feasibility of the system at the earliest possible time. Months or years of effort, thousands of rupees and untold professional embarrassment can be averted if an ill-conceived system is recognized early in the definition phase. Feasibility & risk analysis are related in many ways. If project risk is great, the feasibility of producing quality software is reduced. In this case there are three primary areas of interest:-

5.1.1 Performance Analysis

A performance analysis is generally called for when you want to improve a part of the organization (look for needs) or to fix a problem that someone has brought forth. Both are generally fixed in the same manner.

For the complete functionality of the project work, the project is run with the help of healthy networking environment. Normally, the OS is windows XP. It can also run effectively in Windows 7 and 8 Operating System.

5.1.2 Technical Analysis

System is only beneficial only if it can be turned into information systems that will meet the organization's technical requirement. Simply stated this test of feasibility asks whether the system will work or not when developed & installed, whether there are any major barriers to implementation. Regarding all these issues in technical analysis there are several points to focus on:-

Changes to bring in the system: All changes should be in positive direction, there will be increased level of efficiency and better customer service.

Required skills: Platforms & tools used in this project are widely used. So the skilled manpower is readily available in the industry.

Acceptability: The structure of the system is kept feasible enough so that there should not be any problem from the user's point of view.

5.1.3 Economical Analysis

Economical analysis is performed to evaluate the development cost weighed against the ultimate income or benefits derived from the developed system. For running this system, we need not have any routers which are highly economical. All the functions of routers in the network are implemented through modules. In this system we are not using any physical devices for connection. So the system is economically feasible enough.

Summary

The main aim of this chapter is to find out whether the system is feasible enough or not. For these reasons different kinds of analysis, such as performance analysis, technical analysis, economical analysis etc is performed.

Chapter 6

SYSTEM DESIGN

Overview

Design is a meaningful engineering representation of something that is to be built. It is the most crucial phase in the developments of a system. Software design is a process through which the requirements are translated into a representation of software. Design is a place where design is fostered in software Engineering. Based on the user requirements and the detailed analysis of the existing system, the new system must be designed. This is the phase of system designing. Design is the perfect way to accurately translate a customer's requirement in the finished software product. Design creates a representation or model, provides details about software data structure, architecture, interfaces and components that are necessary to implement a system. The logical system design arrived at as a result of systems analysis is converted into physical system design.

6.1 System development methodology

System development method is a process through which a product will get completed or a product gets rid from any problem. Software development process is described as a number of phases, procedures and steps that gives the complete software. It follows series of steps which is used for product progress. The development method followed in this project is waterfall model.

6.1.1 Model phases

The waterfall model is a sequential software development process, in which progress is seen as flowing steadily downwards (like a waterfall) through the phases of Requirement initiation, Analysis, Design, Implementation, Testing and maintenance.

Requirement Analysis: This phase is concerned about collection of requirement of the system. This process involves generating document and requirement review.

System Design: Keeping the requirements in mind the system specifications are translated in to a software representation. In this phase the designer emphasizes on:-algorithm**,** data structure**,** software architecture etc.

Coding: In this phase programmer starts his coding in order to give a full sketch of product. In other words system specifications are only converted in to machine readable compute code.

Implementation: The implementation phase involves the actual coding or programming of the software. The output of this phase is typically the library, executables, user manuals and additional software documentation

Testing: In this phase all programs (models) are integrated and tested to ensure that the complete system meets the software requirements. The testing is concerned with verification and validation.

Maintenance: The maintenance phase is the longest phase in which the software is updated to fulfill the changing customer need, adapt to accommodate change in the external environment, correct errors and oversights previously undetected in the testing phase, enhance the efficiency of the software.

6.1.2 Reason for choosing Waterfall Model as development method

- Clear project objectives.
- Stable project requirements.
- Progress of system is measurable.
- Strict sign-off requirements.
- Helps you to be perfect.
- Logic of software development is clearly understood.
- Production of a formal specification
- Better resource allocation.

- Improves quality. The emphasis on requirements and design before writing a single line of code ensures minimal wastage of time and effort and reduces the risk of schedule slippage.
- Less human resources required as once one phase is finished those people can start working on to the next phase.

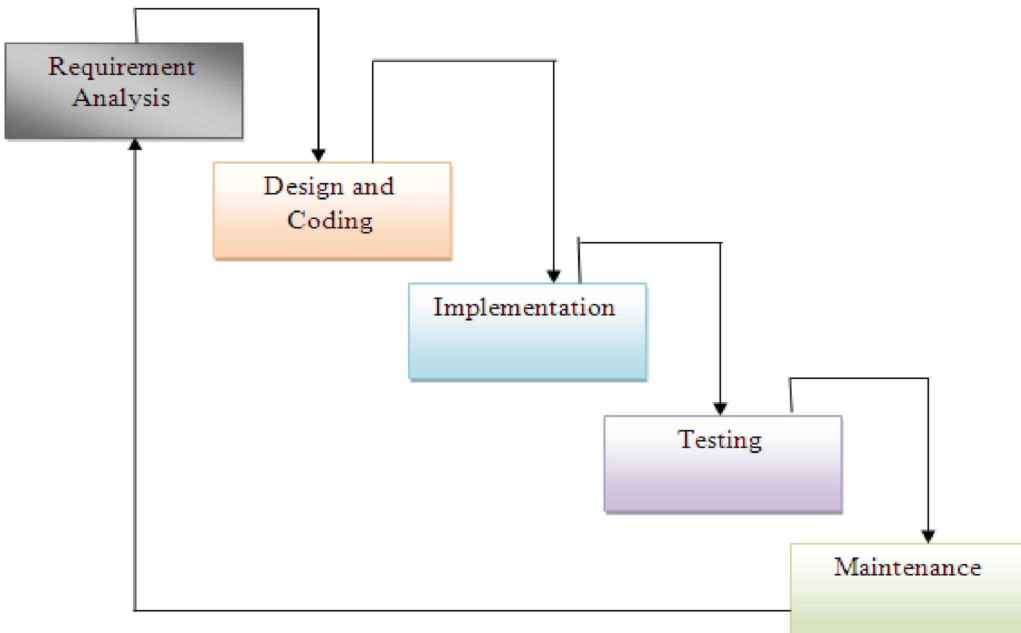
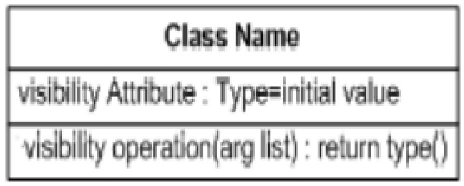
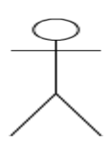
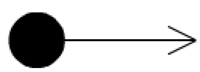
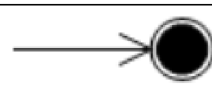
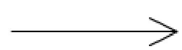
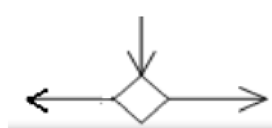


Fig 6.1.2: Waterfall model

6.2 Design Using UML

Designing UML diagram specifies, how the process within the system communicates along with how the objects with in the process collaborate using both static as well as dynamic UML diagrams since in this ever-changing world of Object Oriented application development, it has been getting harder and harder to develop and manage high quality applications in reasonable amount of time. As a result of this challenge and the need for a universal object modeling language every one could use, the Unified Modeling Language (UML) is the Information industries version of blue print. It is a method for describing the systems architecture in detail. Easier to build or maintains system, and to ensure that the system will hold up to the requirement changes.

Sl. No	Symbol Name	Symbol	Description
1	Class		Classes represent a collection of similar entities grouped together.
2	Association		Association represents a static relation between classes.
3	Aggregation		Aggregation is a form of association. It aggregates several classes into a single class.
4	Composition		Composition is a special type of aggregation that denotes a strong ownership between classes.
5	Actor		Actor is the user of the system and other external entity hat react

			with the system.
6	Use Case		A use case is an interaction between system and the external environment.
7	Relation (Uses)		It is used for additional purpose communication.
8	Communication		It is the communication between use cases.
9	State		It represents the state of process. Each state goes through various flows.
10	Initial State		It represents initial state of object.
11	Final State		It represents final state of object.
12	Control Flow		It represents decision making process for object.
13	Decision Box		It represents the decision making process from a constraint.

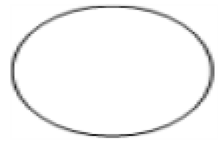
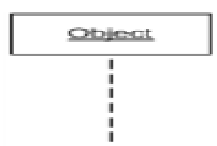
14	Data Process/ State		A circle in a DFD represents a state or process which has been triggered due to some other event or action.
15	External Entity		It represents external entity such as Keyboard, sensors, etc which are used in the system.
16	Transition		It represents any communication that occurs between processes.
17	Object Lifeline		Object lifeline represents the vertical dimension that object communicates.
18	Message		It represents messages exchanged.

Table 6.2: Symbols used in UML

6.2.1 Architectural Design

The overall logical structure of the project is divided into processing modules and a conceptual data structure is defined as Architectural Design

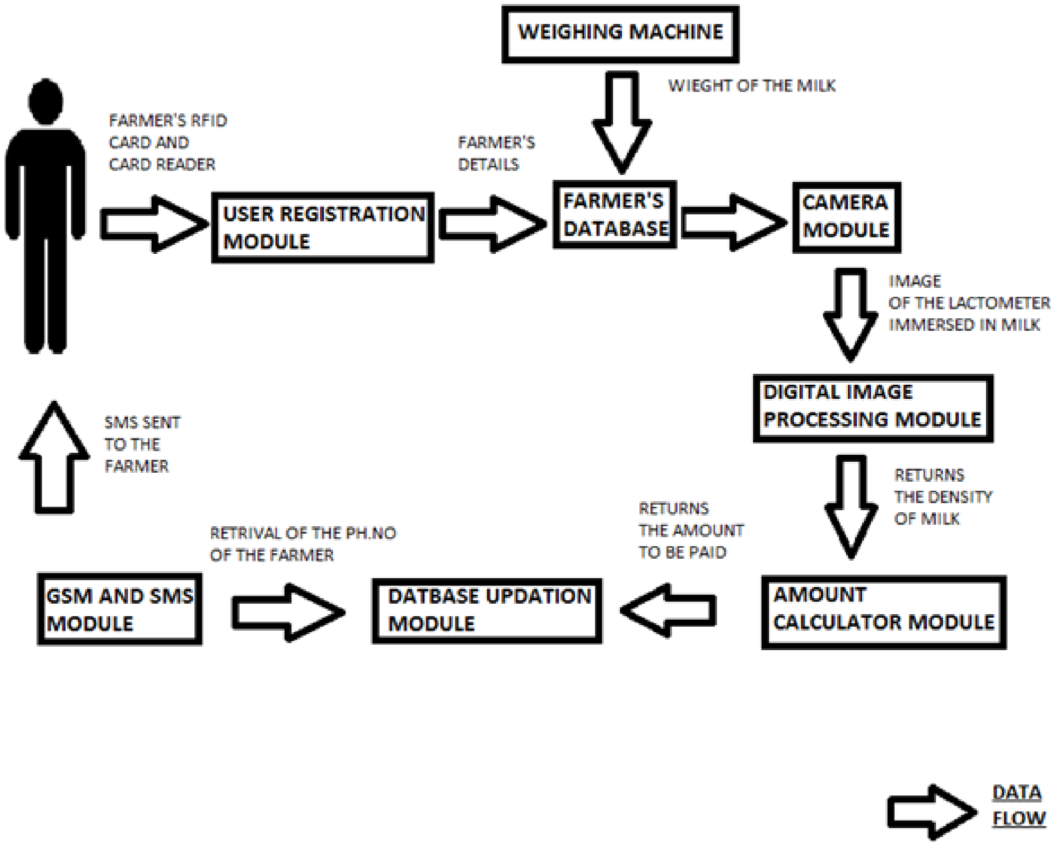


Figure 6.2.1: System Architecture

Figure 6.2.1 shows the Architecture design where the farmer registers himself using the RFID card given to him. Once registered, the milk collection begins, followed by the operations like checking the weight, lactometer reading. This information is stored in the database and the same is communicated to the farmer in the form of a message sent through a GSM modem.

6.2.2 Data Flow Diagram

A data flow diagram (DFD) is graphic representation of the "flow" of data through an information system. A data flow diagram can also be used for the visualization of data processing (structured design). It is common practice for a designer to draw a context-level DFD first which shows the interaction between the system and outside entities.

DFD's show the flow of data from external entities into the system, how the data moves from one process to another, as well as its logical storage. There are only four symbols:

1. Squares representing *external entities*, which are sources and destinations of information entering and leaving the system.

2. Rounded rectangles representing *processes*, in other methodologies, may be called 'Activities', 'Actions', 'Procedures', 'Subsystems' etc. which take data as input, do processing to it, and output it.

3. Arrows representing the *data flows*, which can either, be electronic data or physical items. It is impossible for data to flow from data store to data store except via a process, and external entities are not allowed to access data stores directly.

4. The flat three-sided rectangle is representing data stores should both receive information for storing and provide it for further processing.

Level 0 Data Flow Diagram

The Level 0 DFD shows how the system is divided into sub-systems (processes), each of which deals with one or more of the data flows to or from an external agent, and which together provide all of the functionality of the system as a whole. It also identifies internal data stores that must be present in order for the system to do its job, and shows the flow of data between the various parts of the system.

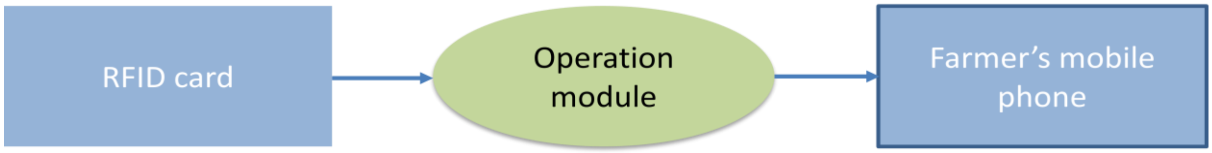


Fig 6.2.2.a Level 0 diagram

Level 1 Data Flow Diagram

The Level 1 DFD shows how the system is divided into sub-systems (processes), each of which deals with one or more of the data flows to or from an external agent, and which together provide all of the functionality of the system as a whole.

It also identifies internal data stores that must be present in order for the system to do its job, and shows the flow of data between the various parts of the system.

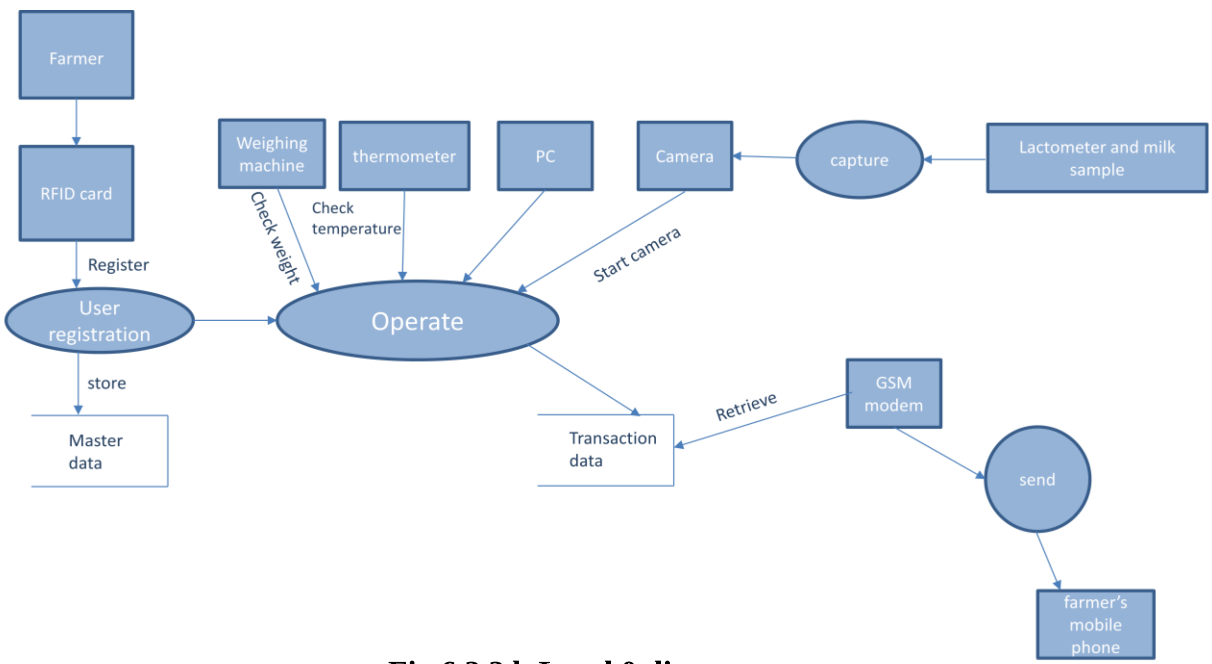


Fig 6.2.2.b Level 0 diagram

Figure 6.2.2 b shows level 1 data flow diagram where the farmer given an unique ID number through a RFID card registers himself after all his information is cross checked with the master data record. Once that is completed, the actual operation module begins. Weighing of the milk, capturing the image of the lactometer reading that is immersed in the milk sample is carried out. This information obtained is stored in the transaction data record. On the completion of this process, the farmer is notified about the entire transaction through a SMS that is sent by a GSM modem.

6.2.3 Module Description

Four modules that are included in the project are given as follows

- **MODULE 1:** User registration module
- **MODULE 2:** Operation module
- **MODULE 3:** Data base module
- **MODULE 4:** GSM and SMS module

MODULE 1: UR (User Registration) module

Every farmer who comes into the milk collection centre is given an unique ID number in the form of a RFID card. Every new farmer is given a new RFID card using which all his personal details are stored in the database module. The form consists of two fields: Mandatory fields and Optional fields.

Mandatory fields are:

- First name
- Date of birth
- Address
- Mobile number
- Aadhaar card number
- Cattle type

Optional fields are:

- Last name
- Landline number
- Email id

If any changes are needed in the details of the farmers that are recorded, then edit operation is carried out.

When the farmer swipes the card near the reader, the reader picks up the number from the card using near field communication technology. This marks the end of registration. After this, the process module is instantiated.

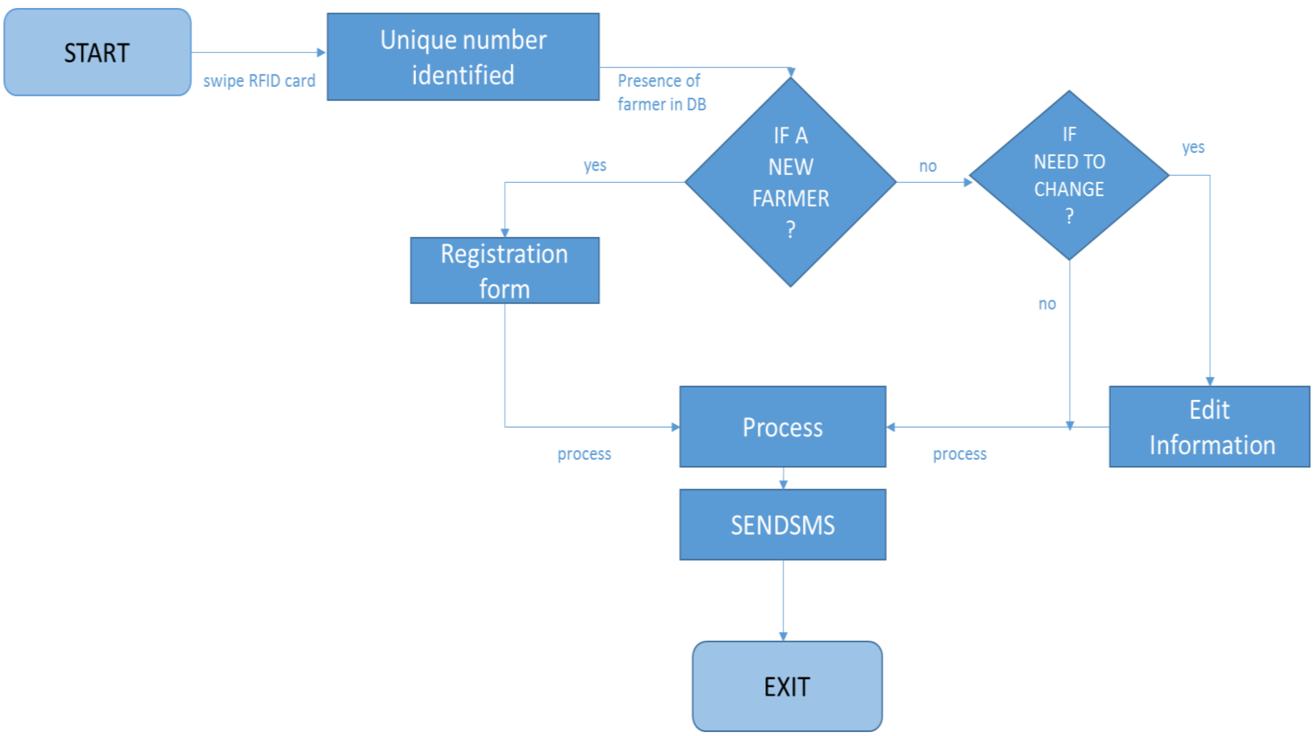


Fig 6.2.3.1 Flow diagram of UR module

MODULE 2: Operation module

After the UR module, the weight of the milk holder corresponds to the pre-delivery weight and the weight of the milk and the holder corresponds to the post delivery weight. The difference between the two gives the actual weight of the milk. The milk sample is taken and with the help of a thermometer, temperature is recorded on to the field provided in the UI form. The same sample is used to obtain the lactometer reading.

The lactometer is immersed in the milk, after the milk is taken upto the rim of the holder. There are certain pre-requisites to be followed like good lighting conditions, perfect angle of the camera and a plain white background. The image is then captured which is saved in a file temporarily. This image is processed in order to obtain the lactometer reading.The temperature, lactometer reading and weight is stored in the database.

MODULE 3: Database (DB) module

In this module, there exists a master data file and a transaction data file. The master data file consists of all the personal details like first name,last name,date of birth,cattle type,Aadhar card number of the farmer that are recorded by the user registration module. This same data can be retrieved as and when required. The transaction data file consists of all the information that is obtained after the operational module such as lactometer reading,weight and temperature. The details recorded in this file are sent to the GSM and SMS module.

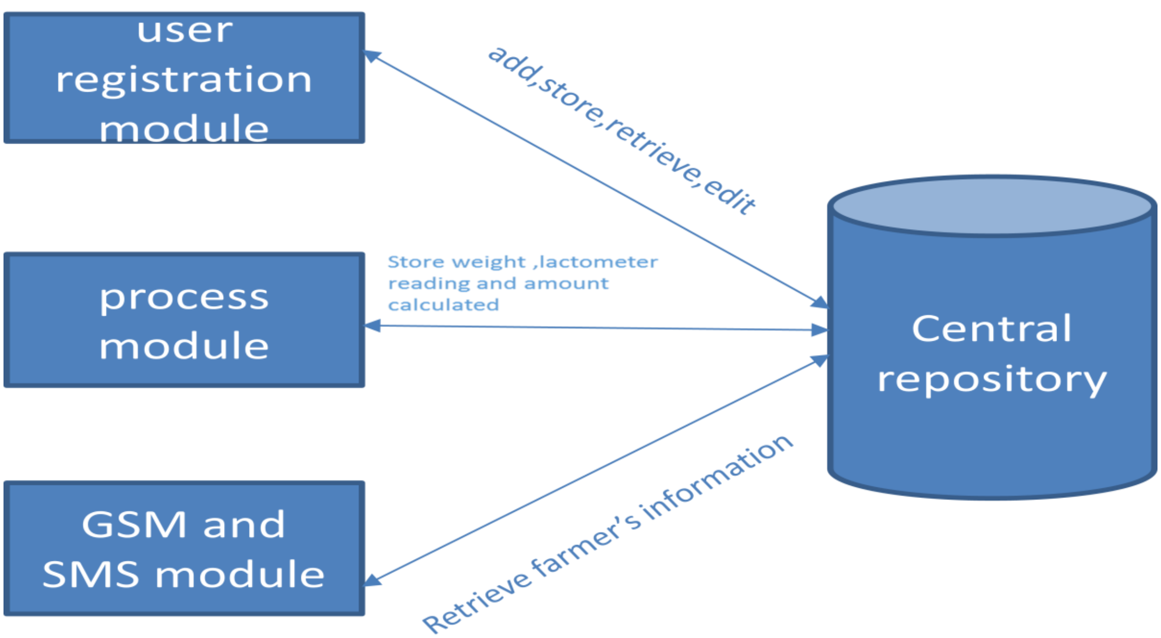


Fig 6.2.3.3 Flow diagram of DB module

MODULE 4: GSM AND SMS MODULE

After the operation module and the completion of the entire process, the information stored in the transaction file in the database is retrieved. The antenna of the GSM modem must be properly placed in order to detect the cellular network. The data from the transaction file is then sent to the farmer's mobile phone.

6.2.4 Class Diagram

UML class diagram shows the static structure of the model. The class diagram is a collection of static modeling elements, such as classes and their relationships', connected as a graph to each other and to their contents.

The class diagram is the main building block of object oriented modeling. It is used both for general conceptual modeling of the systematic of the application, and for detailed modeling translating the models into programming code. Class diagrams can also be used for data modeling. The classes in a class diagram represent both the main objects and or interactions in the application and the objects to be programmed.

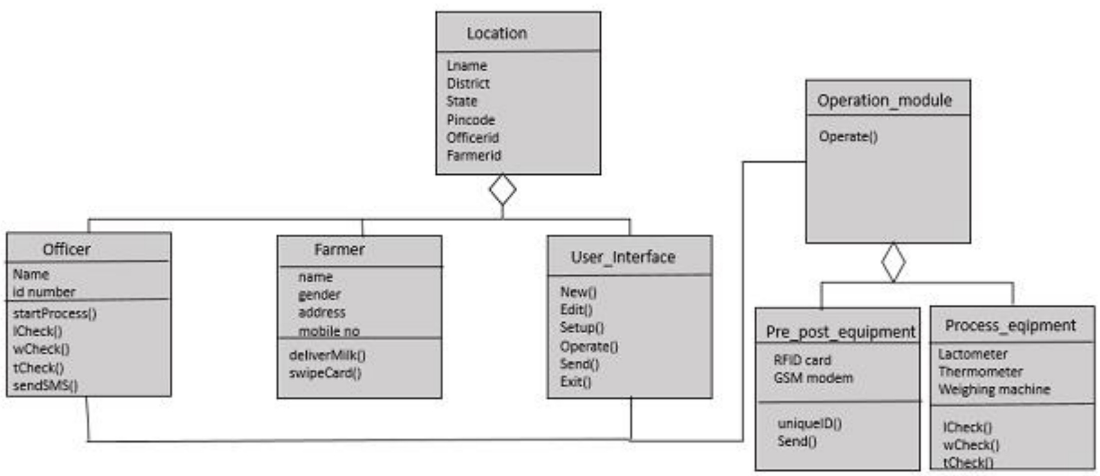


Fig 6.2.4: Class diagram

In the above class diagram,there are seven classes namely farmer,officer,UI,operation module, process_equipments,pre and post process equipments,location.The connecting lines between classes represents association. Location is the aggregation of all its sub classes and Process is aggregation of process_equipments,pre and post process equipments.

6.2.5 Use Case Diagram

A use case defines a goal-oriented set of interactions between external entities and the system under consideration. The external entities which interact with the system are its actors. A set of use cases describe the complete functionality of the system at a particular level of detail and it can be graphically denoted by the use case diagram.

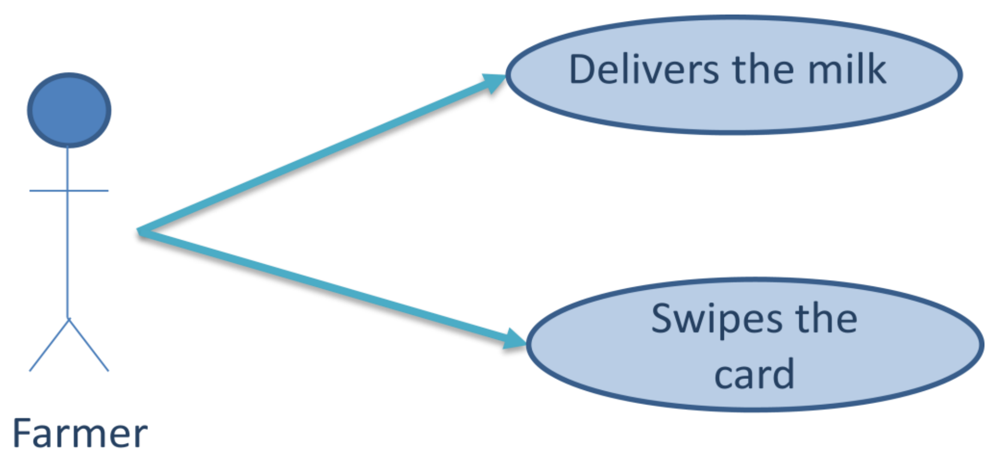


Fig 6.2.5 a: Use Case diagram

In the above use case diagram, the actor is the farmer and performs two activities namely, he swipes the RFID card once he enters and delivers the milk.

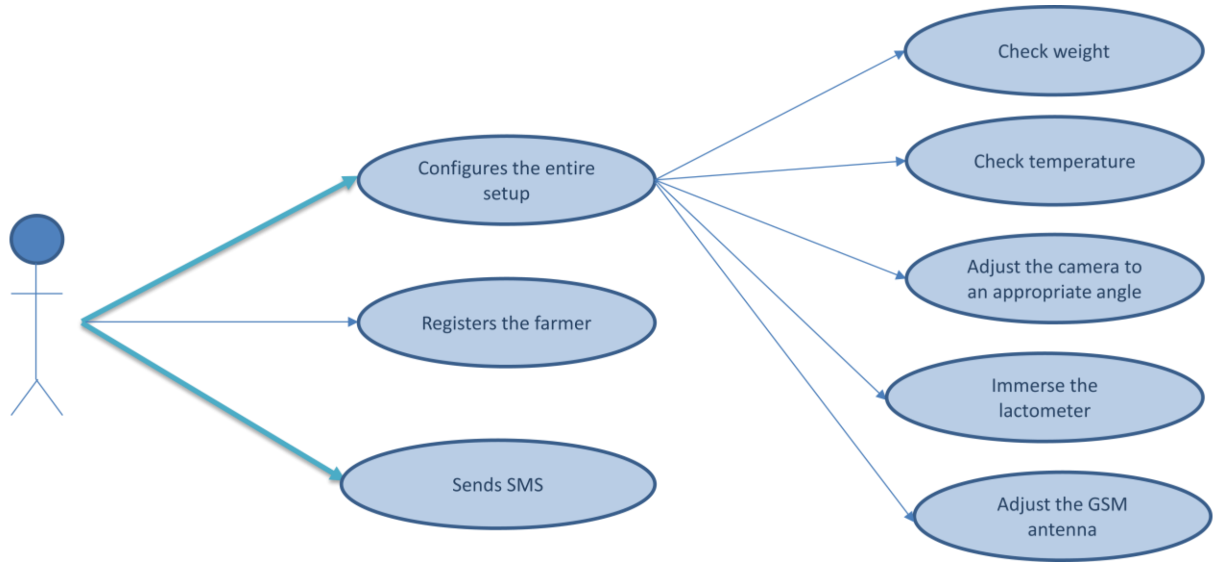


Fig 6.2.5 b: Primary Use Case diagram

In the above use case diagram, the actor is the officer in the milk cooperative society. He is involved in the following activities, he registers the farmer, configures the entire setup, sends SMS at the end of the process. During setup, he first checks the total weight of the milk, then takes the milk sample and checks the temperature and then immerse the lactometer, adjust the camera appropriately to lactometer and he adjusts the antenna of GSM modem so that cellular networks can be easily detected.

6.2.6 Activity Diagram

An activity diagram shows the sequence of steps that make up a complex process. An activity is shown as a round box containing the name of the operation. An outgoing solid arrow attached to the end of the activity symbol indicates a transition triggered by the completion.

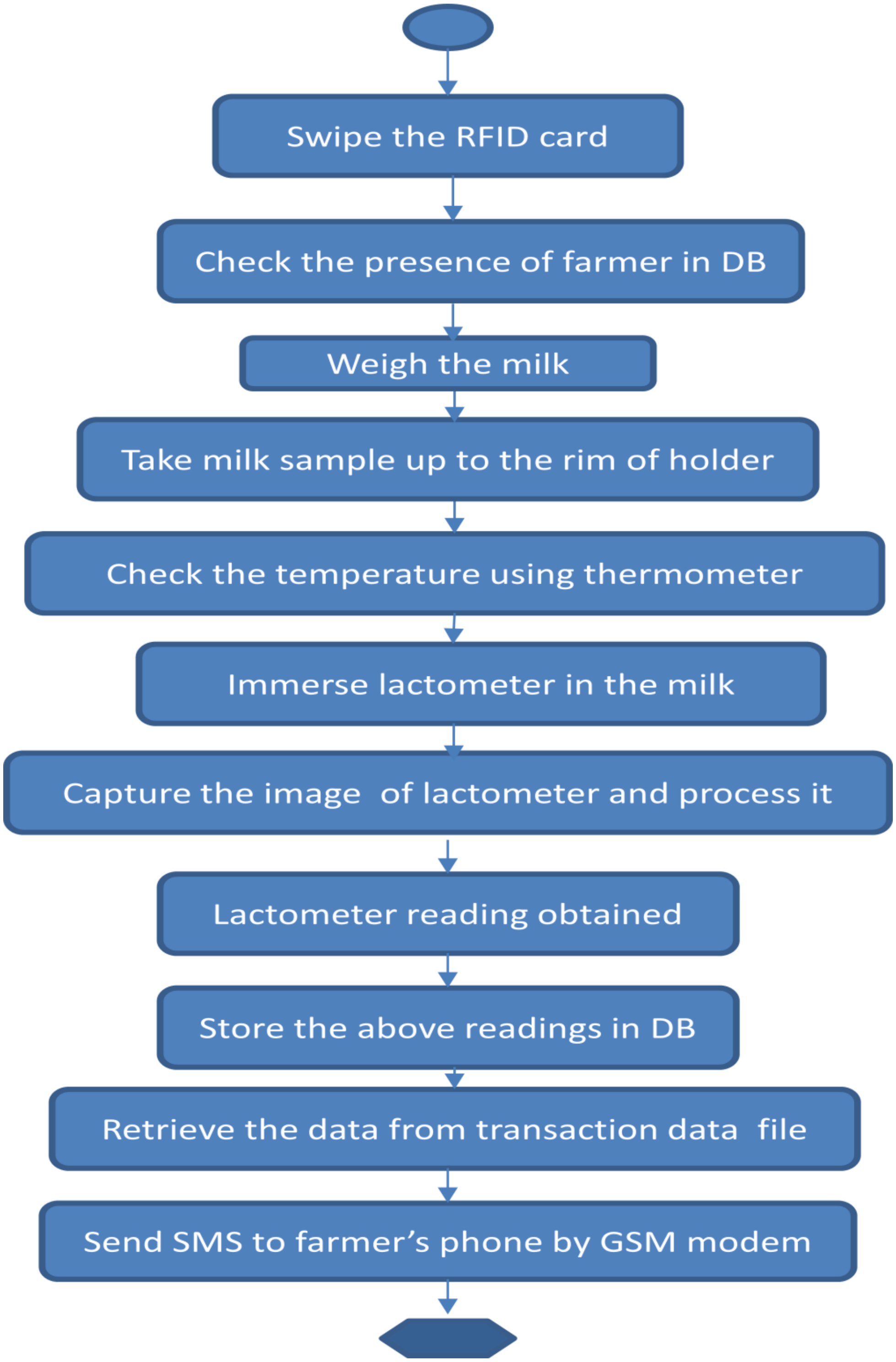


Fig 6.2.6: Activity Diagram

The above activity diagram explains the sequence of steps involved in the system. The process begins,when the farmer swipes the RFID card,his presence is checked in the DB.

After this,operation module is started. First,the weight of the total milk delivered by the farmer is checked using a electronic machine. Then its is checked for its quality by measuring the temperature using thermometer ,density of the milk is obtained by the processed image of the lactometer immersed in the holder containing milk sample up to the rim, it is then captured by the camera. Once the processing is over, the above details are stored in the DB and the same is retrieved when a message is to be sent to the farmer by the GSM modem at the end of the transaction.

6.2.7 Sequence Diagram

Sequence diagram are an easy and intuitive way of describing the behavior of a system by viewing the interaction between the system and the environment. A sequence diagram shows an interaction arranged in a time sequence. A sequence diagram has two dimensions: vertical dimension represents time, the horizontal dimension represents the objects existence during the interaction.

Basic elements:

- Vertical rectangle: represent the object is active (method is being performed).
- Vertical dashed line: represent the life of the object.
- ”X”: represent the life end of an object. (Being destroyed from memory)
- Horizontal line with arrows: messages from one object to another.

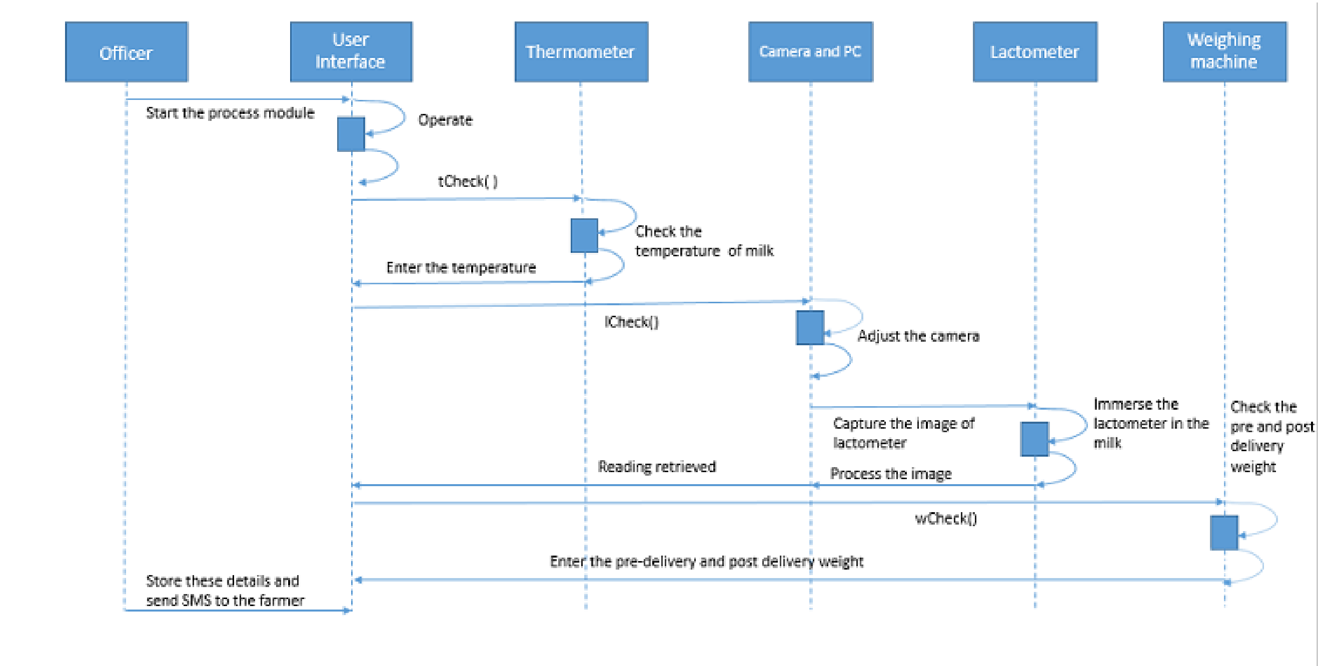


Fig 6.2.7 : Sequence Diagram

After the user registration module, the operation module begins which follows the sequence shown in above diagram. First take the milk sample in a milk holder upto the rim and check the temperature using thermometer and enter manually in UI. Then immerse the lactometer and adjust the camera apporiately. Click the image of lactometer and process it ,the reading is retrieved in the UI.

Check the weight of the can on the weighing machine placed to hold milk,which is called pre-delivery weight.Then place all the milk delivered in the can placed on the electronic machine and check the post delivery weight.the difference between the two gives the accurate weight of milk .

The above sequence diagram explains the sequence of steps involved in the process. The process begins,when the farmer swipes the RFID card,his presence is checked in the DB. After this,operation module is started. First,the weight of the total milk delivered by the farmer is checked using a electronic machine. Then its is checked for its quality by measuring the temperature using thermometer ,density of the milk is obtained by the processed image of the lactometer immersed in the holder containing milk sample up to the rim, it is then captured by the camera.

Once the processing is over, the above details are stored in the DB and the same is retrieved when a message is to be sent to the farmer by the GSM modem at the end of the transaction.

Summary

This chapter mainly concentrates on few fundamental design concepts such as system development methodology, system architecture, class diagram, flowchart, sequence diagram, use-case diagram, activity diagram, data flow diagram etc.

Chapter 7

IMPLEMENTATION

The implementation phase of the project is where the detailed design is actually transformed into working code. Aim of the phase is to translate the design into a best possible solution in a suitable programming language. This chapter covers the implementation aspects of the project, giving details of the programming language and development environment used. It also gives an overview of the core modules of the project with their step by step flow.

The implementation stage requires the following tasks.

- Careful planning.
- Investigation of system and constraints.
- Design of methods to achieve the changeover.
- Evaluation of the changeover method.
- Correct decisions regarding selection of the platform
- Appropriate selection of the language for application development
-

7.1 UR Module

7.1.1 Introduction:

In the existing system, all the farmer's data is recorded in a pass book manually. As we have already seen in the problem statement, this is prone to human errors and this module aims at eliminating it.

The RFID card and reader interaction marks the beginning of this module. After the unique number of the farmer is identified, it is sent to the PC via a RS232 cable. The UI form is then displayed using which various operations can be carried out.

Thus the farmer is then registered onto the database from which all his details can be retrieved by the officers in the collection centers.

7.1.2 Basic Architecture:

The RFID device serves the same purpose as a bar code or a magnetic strip on the back of an ATM card. It provides a unique identifier for that object. And, just as a bar code or magnetic strip must be scanned to get the information, the RFID device must be scanned to retrieve the identifying information.

RFID belongs to a group of technologies referred to as Automatic Identification and Data Capture (AIDC). AIDC methods automatically identify objects, collect data about them, and enter those data directly into computer systems with little or no human intervention.

RFID methods utilize radio waves to accomplish this. At a simple level, RFID systems consist of three components: an RFID tag or smart label, an RFID reader, and an antenna. RFID tags contain an integrated circuit and an antenna, which are used to transmit data to the RFID reader (also called an interrogator). The reader then converts the radio waves to a more usable form of data. Information collected from the tags is then transferred through a communications interface to a host computer system, where the data can be stored in a database and analyzed at a later time.

In this module, we use RS232 cable as the communications interface. An RS232 serial port may be used as a standard feature of a personal computer, used for connections to modems, printers, mice, data storage, uninterruptible power supplies, and other peripheral devices.

The user interface, in the industrial design field of human–machine interaction, is the space where interaction between humans and machines occurs. The goal of this interaction is effective operation and control of the machine on the user's end, and feedback from the machine, which aids the operator in making operational decisions.

In this module, we use a user friendly form which takes inputs from the officer. The UI form has a main dialog which consists of various operations like New data, Edit data, Settings, Operate, Send SMS and Exit. Exit marks the completion of the entire transaction while New Data marks the entry of all the personal details of the farmer. Edit data is a sub module used to change the details. It is possible to navigate through the contents of the database in the form and also clear the field contents if necessary. Settings is chosen in order to change the Comport settings after checking the same in Control Panel->Hardware and Sound->Device Manager->Other devices.

Operate sub module directs the control to the Operation module which forms the central processing unit of the entire project. SendSMS, as the name states is used to send all the transaction data to the farmer’s mobile phone after passing on the control to the GSM and SMS module.

7.1.3 Set up:

RFID card reader is connected to the PC using RS232 cable. USB to RS232 converter is set up after installing the driver that is provided in the package. RFID card is swiped appropriately such that a ''beep' sound is observed confirming the registration.

7.2 Operation Module

7.2.1 Introduction

In the existing system, after the farmer submits his pass book, the milk delivered, is tested manually. First the temperature is checked using thermometer, then the lactometer reading corresponding to density of milk and the quantity of milk is checked. Then the weight and density entries are made in the passbook.

After user registration,the milk delivered is tested in the following order:

The weight of the milk is checked using electronic weighing machine connected to the system using RS232 cable. The sample of the milk is taken and the temperature of the milk is checked and the lactometer in the milk is immersed and the image of lactometer is captured.

Captured image is processed using OpenCV library and the lactometer reading is obtained from the processed image and is retrieved onto the UI.

All the process readings are saved in the transaction data file.

7.2.2 Basic architecture

Once the user registration is completed, the milk delivered has to be tested for quality.

The user registration module thread invokes the operation module by a creation of a file, as the operation module is programmed to commence on creation of a temporary file.The temporary file here is redirection control between two modules.Check the weight of the container using electronic weighing machine which can be connected to the system using RS232 cable or entered manually. This weight is called the Pre delivery weight. Pour the the milk in the milk holder placed on the weighing machine. Similarly weigh again and the weight obtained now is called the post-delivery weight which can be entered manually or through the cable. The difference between the two will give the actual weight of the milk.

Take the sample of milk in a standard beaker and fill it till the rim of it. Immerse the thermometer and check the temperature and enter it manually. Then immerse the lactometer and let it settle down for some time, by then set the camera and place it in an appropriate position. Click the image either using the inbuilt camera or the external camera, its recommended to use external camera due to its high resolution in case of some issues with the external camera, then go for the inbuilt camera the captured image is then stored in a temporary file in the jpg format.

The logic behind obtaining the lactometer reading is to calculate the number of rows containing the black pixels. Using OpenCV functions, process the captured image in the following steps.

- Convert the image to a matrix using Mat datatype.
- Display the image
- Resize the image using resize() and pass the following parameters
- Original image matrix
- New empty matrix for storing the resized image
- Number of rows to be present in the resized image
- Number of columns to be present in the resized image

By selecting the number of rows and columns, one can reduce the processing time. Here we are keeping the number of rows constant and reducing the number of columns by half of that present in the original image, the reason behind this is explained below.

Consider pvalue as pixel value,rptr1 is the pointer corresponding to first element in the first row,rptr2 is the pointer corresponding to first element in the second row, LOWEND and HIGHEND are the two constants initialized to 0 and 5 respectively, which are used to compare the difference between the two pixels represented by rptr1 and rptr2,

WHITE is the white pixel value, i.e, 255.line and line_seperator are components of picture_element structure used to find the number of graduations.

- Apply RIP(Relative Intensity Pixel) algorithm to process the non-black pixels
- Initialize rptr1 and rptr2 to the first element of first row and first element of second row simultaneously.
- Find the difference in the pixel value of rptr1_pvalue and rptr2_pvalue,if the value is between LOWEND and HIGHEND then change their values to wvalue.
- Continue the above step for other rows in that column,by checking the difference between the consecutive rows.
- Repeat 2 and 3 step for the other columns similarly until all the pixel values are covered.

Now apply CBP (Count Black Pixel) algorithm to differentiate between the noise and black pixels representing graduations on the lactometer

- Initialize the rptr1 to first row
- Traverse the row and check each element's pvalue in the matrix,
- If its black then check if its consecutive pixels are black as well
- If not then traverse the other elements to check if there are any continuous black pixels
- If in any row if there are contiguous black pixels and single discontinuous black pixel then assign the WHITE to the non contiguous-black pixel.
- Repeat the above procedure for all the rows

- The number of lines corresponding to number of rows in the matrix is the number of graduations in the lactometer.

The lactometer reading is stored in a file temporarily, which invokes the next process on the user interface to begin that is, the lactometer reading is retrieved on the UI. Then the above information is stored in the transaction data file.

7.2.3 Set up:

DS-415 benchscale electronic weighing machine is connected to the the PC via RS232 cable. An external camera of the specification Frontech 10xDigital zoom of focal length 3.85mm and 20MP resolution is connected to the PC via a usb port. Milk sample is taken upto the rim of the milk holder. Thermometer is immersed into the milk. After the temperature is noted down, thermometer is replaced by the lactometer. Before capturing the image, it’s important to note that the milk sample is placed against a light background in bright lighting conditions. Camera is then adjusted using the camera stand to an appropriate angle in order to capture the image of lactometer.

7.3 DB Module:

7.3.1. Introduction:

Like discussed in the previous module, we see that all the farmer’s data are stored on paper in the form of a passbook. This method of storing data, may result in loss of the data or prone to error. Thus, it is a better practice to store it in a database which brings us to the beginning of this module.

This module acts like a storage unit of all the information collected in all the previous modules. All the information can be retrieved from this database as and when required. We may use SQLite 3.0 or sequential files for the implementation of this module.

7.3.2. Basic architecture:

SQLite is a software library that implements a self-contained, serverless, zero-configuration,transactional SQL database engine. SQLite is the most widely deployed SQL database engine in the world. SQLite is not a separate process that is accessed from the client application, but an integral part of it.

Simple functions like Add, Delete, Modify may be used in order to add, delete or modify the data in SQLite 3.0 after SQLite 3.0's library functions are integrated with the PowerBasic 9 software where the UR Module is built. The same may be carried out with the help of **sequential files**. There are two submodules in this: **Master data** and **Transaction data files.**

Master data table or the master data record consists of all the details of the farmer that are entered in the user registration form. Transaction data table or the transaction data record consists of the details about the milk weight, lactometer reading, temperature which is obtained after the operation module. These details are used to instantiate the GSM and SMS module.

The RFID number acts as the primary key in the master data table that can be used as the foreign key in the transaction data table.

7.4 GSM and SMS module:

7.4.1. Introduction:

A transaction completed after the delivery of the milk is recorded in the pass book using which the monthly payment is made to the farmer. Pass book entry is time consuming and prone to errors which is why this module is introduced.

In this module, the data from the transaction data table is retrieved after the SendSMS sub module is activated in the user registration form. This data is then sent to the farmer's mobile phone.

7.4.2. Basic architecture:

A **GSM modem** is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. From the mobile operator perspective, a GSM modem looks just like a mobile phone.

When a GSM modem is connected to a computer, this allows the computer to use the GSM modem to communicate over the mobile network. While these GSM modems are most frequently used to provide mobile internet connectivity, many of them can also be used for sending and receiving SMS and MMS messages.

A GSM modem can be a dedicated modem device with a serial, USB or Bluetooth connection, or it can be a mobile phone that provides GSM modem capabilities.

A GSM modem exposes an interface that allows applications such as NowSMS to send and receive messages over the modem interface. The mobile operator charges for this message sending and receiving as if it was performed directly on a mobile phone. To perform these tasks, a GSM modem must support an “extended AT command set” for sending/receiving SMS messages, as defined in the ETSI GSM 07.05 and and 3GPP TS 27.005 specifications.

In this system we use SIM900A modem. This GSM Modem can accept any GSM network operator SIM card and act just like a mobile phone with its own unique phone number. Advantage of using this modem will be that you can use its RS232 port to communicate and develop embedded applications. Applications like SMS Control, data transfer, remote control and logging can be developed easily.

Using various AT commands, the SMS can be sent to the mobile phone. Using this module, the farmer will be immediately informed about his completed transaction and also a copy of the same is stored in the transaction data table or file.

7.4.3. Set up:

Once the process is completed, then GSM modem is connected externally to the PC using RS232 cable. A driver must be installed that is provided in the package for
USB to RS232 conversion. This GSM modem's antenna should be placed such that the cellular networks can be detected easily.

Summary

The chapter discusses the implementation details of the different modules of the system and gives the step by step flow of each of them. Along with these, this chapter also highlights some of the important features of the platform and language used for implementation purpose

Chapter 8

TESTING

System testing is actually a series of different tests whose primary purpose is to fully exercise the computer-based system. Although each test has a different purpose, all work to verify that all the system elements have been properly integrated and perform allocated functions .The testing process is actually carried out to make sure that the product exactly does the same thing what is supposed to do. In the testing stage following goals are tried to achieve:-

- To affirm the quality of the project.
- To find and eliminate any residual errors from previous stages.
- To validate the software as a solution to the original problem.
- To provide operational reliability of the system.

8.1 Testing Methodologies

There are many different types of testing methods or techniques used as part of the software testing methodology. Some of the important testing methodologies are:

8.1.1 White box testing

White box testing (clear box testing, glass box testing, and transparent box testing or structural testing) uses an internal perspective of the system to design test cases based on internal structure. It requires programming skills to identify all paths through the software. The tester chooses test case inputs to exercise paths through the code and determines the appropriate outputs. While white box testing is applicable at the unit, integration and system levels of the software testing process, it is typically applied to the unit. While it normally tests paths within a unit, it can also test paths between units during integration, and between subsystems during a system level test.

Though this method of test design can uncover an overwhelming number of test cases, it might not detect unimplemented parts of the specification or missing requirements, but one can be sure that all paths through the test object are executed. Using white box testing we can derive test cases that:

- Guarantee that all independent paths within a module have been exercised at least once.
- Exercise all logical decisions on their true and false sides.
- Execute all loops at their boundaries and within their operational bounds.
- Execute internal data structure to assure their validity

8.2.2 Black box testing

Black box testing focuses on the functional requirements of the software. It is also known as functional testing. It is a software testing technique whereby the internal workings of the item being tested are not known by the tester. For example, in a black box test on software design the tester only knows the inputs and what the expected outcomes should be and not how the program arrives at those outputs.

The tester does not ever examine the programming code and does not need any further knowledge of the program other than its specifications. It enables us to derive sets of input conditions that will fully exercise all functional requirements for a program. Black box testing is an alternative to white box technique. Rather it is a complementary approach that is likely to uncover a different class of errors in the following categories:-

- Incorrect or missing function.
- Interface errors.
- Performance errors.
- Initialization and termination errors.
- Errors in objects.

Advantages

- The test is unbiased as the designer and the tester are independent of each other.
- The tester does not need knowledge of any specific programming languages.
- The test is done from the point of view of the user, not the designer.
- Test cases can be designed as soon as the specifications are complete.

8.2 Unit Testing

Unit testing involves the design of test cases that validate that the internal program logic is functioning properly, and that program inputs produce valid outputs. All decision branches and internal code flow should be validated. It is the testing of individual software units of the application .it is done after the completion of an individual unit before integration. This is a structural testing, that relies on knowledge of its construction and is invasive. Unit tests perform basic tests at component level and test a specific business process, application, and/or system configuration. Unit tests ensure that each unique path of a business process performs accurately to the documented specifications and contains clearly defined inputs and expected results.

8.2.1 Functions for checking comport

Function	Tests done	Remarks
COMM OPEN	Tested to OPEN a serial port	creating a relationship between a file number and a specific serial port device
COMM CLOSE	This function is to close open serial port	Closes one or more communication ports, as specified by the PowerBASIC

		file number held in each *hComm* parameter
COMM RECV	Tested to check if binary data is received from the comport	Program execution will halt until *count&* bytes are available, so it is wise to check how many bytes are available before making a COMM RECV request.
COMM SEND	Tested to check send a string of binary data through serial port	The data is appended to any data that may already be waiting in the transmit buffer. If *string_expression* is empty, no data is added to the transmit buffer.

Table 8.2.1: Functions for Checking comport

8.2.2 Functions for SMS transmission

Function	Tests done	RESPONSE
AT+CMGS=?	Test if the GSM is ready to send SMS	OK
AT+CMGW=?	Test if the message can be written in memory	OK
AT+CMSS	Test if SMS can send from the memory	OK
AT+CNMI	Test the new message is indicated or not	OK
AT+CMGR	Test if the message is read or not.	OK

Table 8.2.: Functions for SMS Transmission

8.2.3 Functions for the operation module

Function	Tests Done	Remarks
Imread()	Checks for the image and reads the image	
Imshow()	Used to check the presence of the image and display it	

8.2.4 Functions for setting the controls

Function	Tests done	Remarks
CONTROL SET TEXT	This function is tested to check whether the control can be set to desire value	Success

CONROL GET TEXT	Tested to check for updating the control value	Success
DIALOG SET TEXT	Tested to retrieve the text in a dialog	Success
DIALOG GET TEXT	Tested to set the text in dialog	Success

Table 8.2.4: Functions for setting the control

8.3 Integration Testing

Upon completion of unit testing, integration testing begins. Individual modules are combined and tested as a group. Integration testing is black box testing. The purpose of integration testing is to ensure distinct components of the application still work in accordance to user requirements. Integration testing is considered complete, when actual results and expected results are either in line or differences are explainable based on client input. It concentrates on data transfer between modules. Integration testing is a logical extension of unit testing. Two units that have already been tested are combined into a component and the interface between them is tested. Integration testing identifies problems that occur when units are combined .The errors that arise can be attributed to those occurring due to the combination of modules, resulting from errors across interface.

8.4 System Testing

System testing checks complete end-end scenarios, as a user would exercise the system. The system has to be tested for correctness of the functionality by setting it up in a controlled environment. System testing includes testing of functional and nonfunctional requirements.

It helps to verify and validate the system. All components of system should have been successfully unit tested and then checked for any errors after integration.

Functionality to be tested	Input	Tests done
Working of Front-End	User information	The user information must

	(FARMER)	be in master report.
Working of RFID reader	User (Farmer) scans the RFID card in RFID reader	The RFID number must be displayed in the client screen (UI)
Working of GSM modem	User clicks on “done” after the procedure is done.	Farmer must receive the message.
Working of the DIP module	Officer clicks on “lacto” when he’s reading to capture the image and take the lactometer reading	After the process is complete, the lactometer reading is saved in a file called ‘milkres’ from which it is later retrieved.

Table 8.4: System Testing

8.5 Quality Assurance

Quality assurance consists of the auditing and reporting functions of management. The goal of quality assurance is to provide management with the data necessary to be informed about product quality, thereby gaining insight and confident that the product quality is meeting its goals. This is an “umbrella activity” that is applied throughout the engineering process**.** Software quality assurance encompasses:-

- Analysis, design, coding and testing methods and tools
- Formal technical reviews that are applied during each software engineering
- Mulitiered testing strategy
- Control of software documentation and the change made to it.
- A procedure to ensure compliance with software development standards.
- Measurement and reporting mechanisms

8.5.1 Quality Factors

An important objective of quality assurance is to track the software quality and assess the impact of methodological and procedural changes on improved software quality. The factors that affect the quality can be categorized into two broad groups:

- ✓ Factors that can be directly measured.
- ✓ Factors that can be indirectly measured

These factors focus on three important aspects of a software product

- Its operational characteristics
- Its ability to undergo changes
- Its adaptability to a new environment.
- Effectiveness or efficiency in performing its mission
- Duration of its use by its customer.

8.6 Simulation Parameters used for Testing

- The following simulation parameters were used for testing each modules which was described in module description.

Parameters	Value
Number of RS232	2
Number of GSM modem	1
Number of RFID reader	1
Network Type	GSM
Message Speed	Variable
Baud Rate	9600

Propagation	Two Way Ground
Antenna	Omni Antenna
Voltage	5v
Message Size	50-60 byte
Channel	Wireless Channel
Compatibility	Windows XP/7/8 (64 bit)

Table 8.6: Simulation Parameters

Summary

The chapter discusses the tests that are done on the system to check its functionality. Testing is carried out at three different levels from the module level to the system level checking for errors at each stage. The remarks have also been documented.

Chapter 9

RESULTS AND PERFORMANCE EVALUATION

The following snapshots and graphs define the results or outputs that we will get after step by step execution of each proposed protocol for different values of time and speed.

9.1 Snapshots

Step 1:

After the package is deployed and MILDATA.exe is run, a dialog box containing few details is seen.

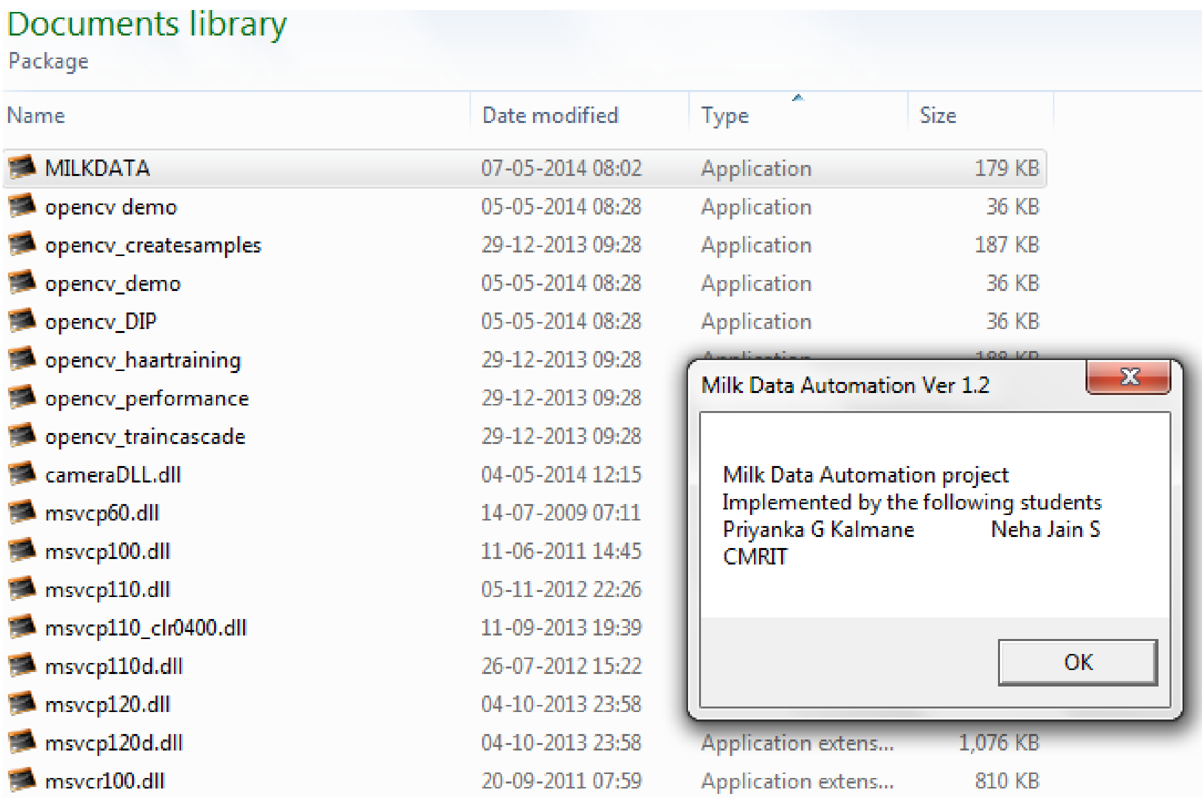


Fig 9.1.1 Image when the package is first executed

Step 2:

After choosing the position of the camera window, and other details like database cleanup, the Main form opens through which we can navigate to the other sub modules as shown.

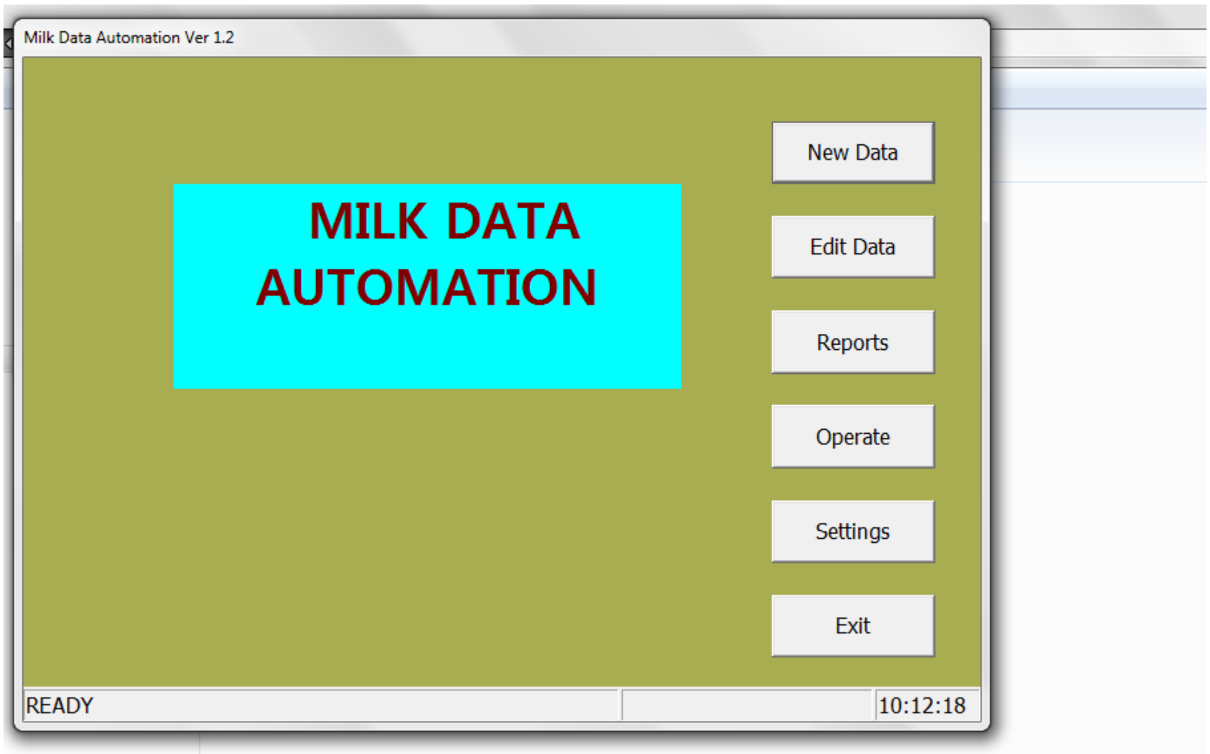


Fig 9.1.2 User Interface Form

Step 3:

The below snapshot shows us the new form into which all the personal details of the farmer is entered.

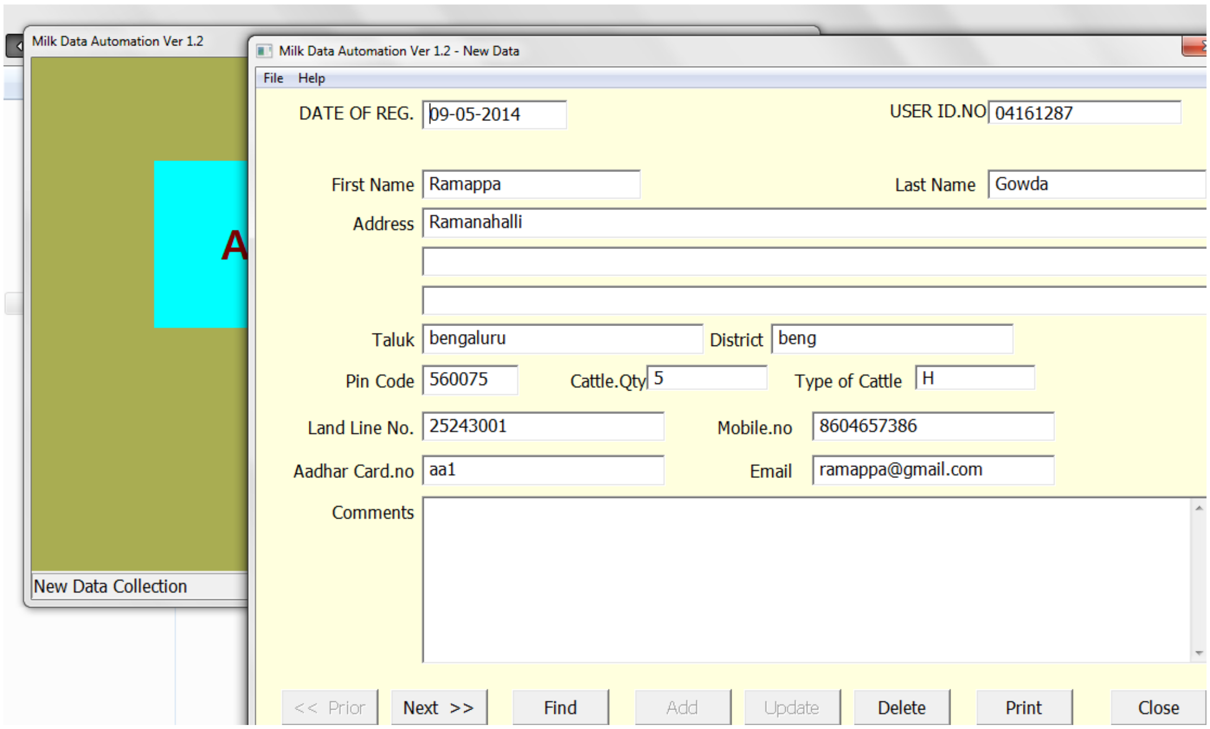


Fig 9.1.3 New Data Form

Step 4:

The below is the snapshot obtained after choosing the Operate sub module. An external webcam needs to be selected in order to obtain the image of the milk sample and the lactometer reading. The DIP module is initiated.

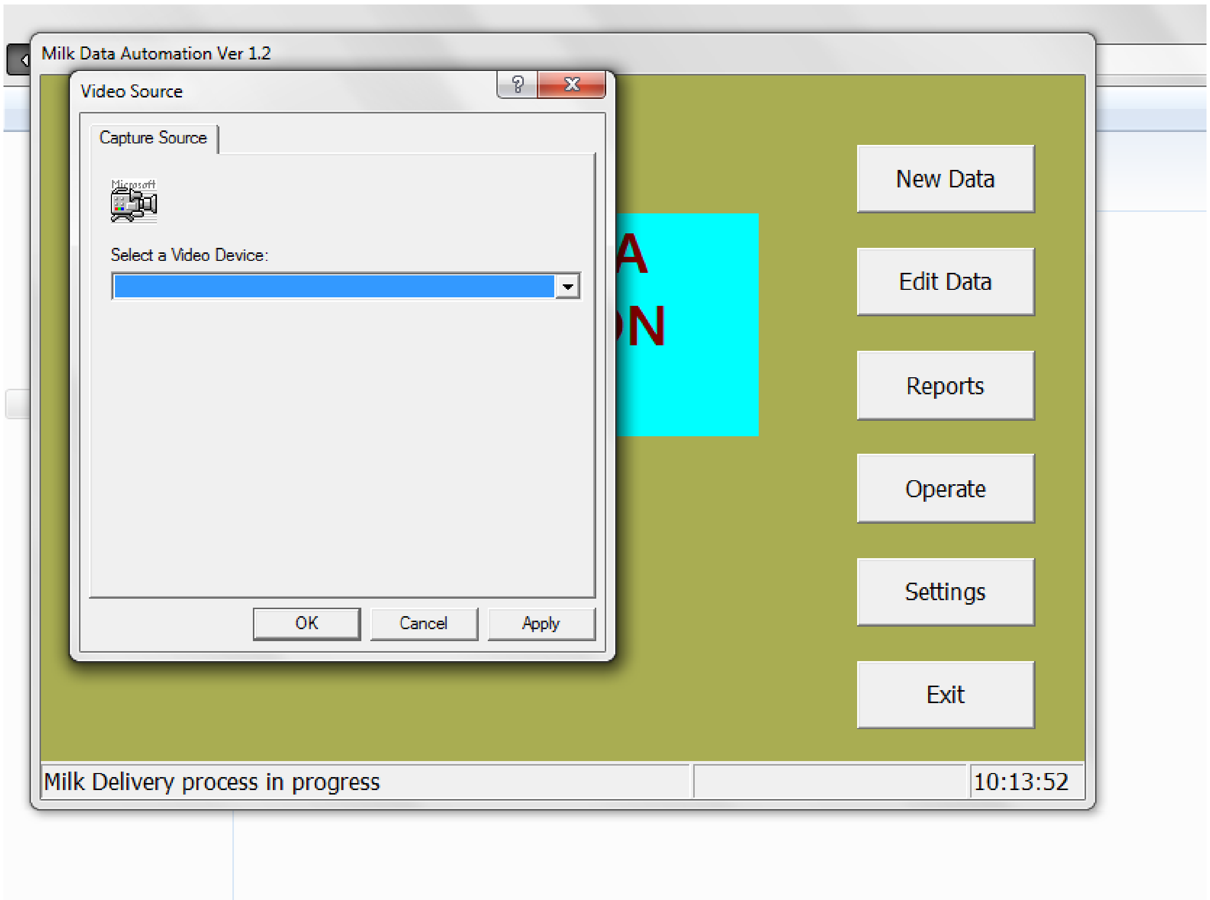


Fig 9.1.4 Operate module initiation

Step 5:

After choosing the external camera, a window with the required farmer details like name and number appears and a place to fill in the weight and the temperature readings can be seen on the window. By clicking on the lacto button we can obtain the readings of lactometer immersed in the milk sample.

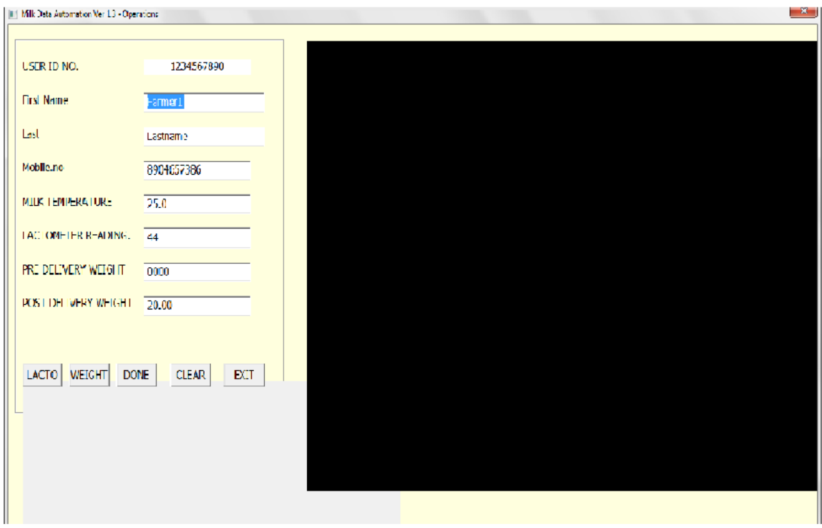


Fig 9.1.5 Image of the lactometer to be captured

Step 6:

These is the snapshot obtained while the DIP process is at work.

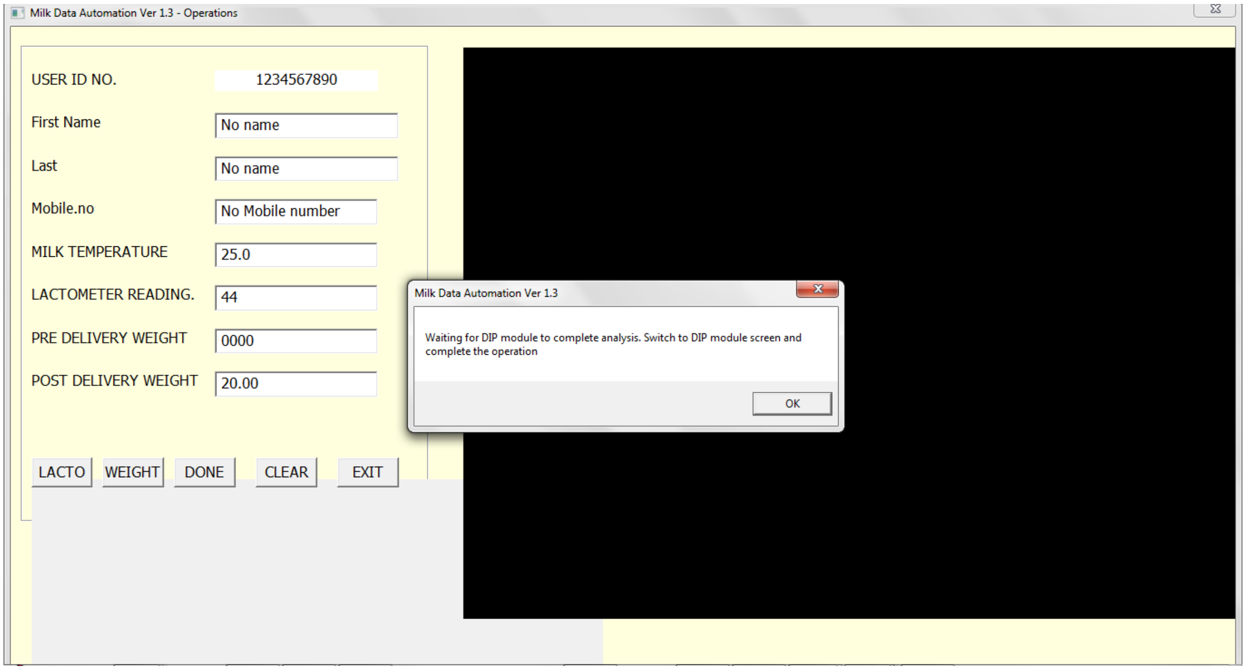


Fig 9.1.6 Image captured and DIP module initiated

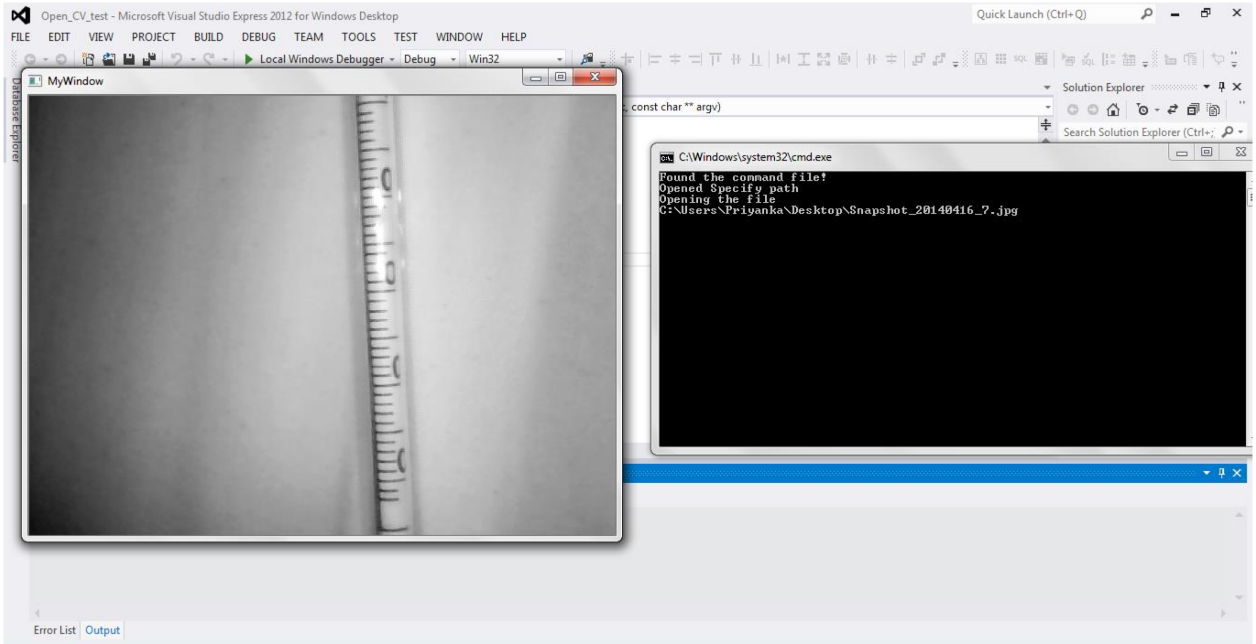


Fig 9.1.7 DIP module working in progress (1)

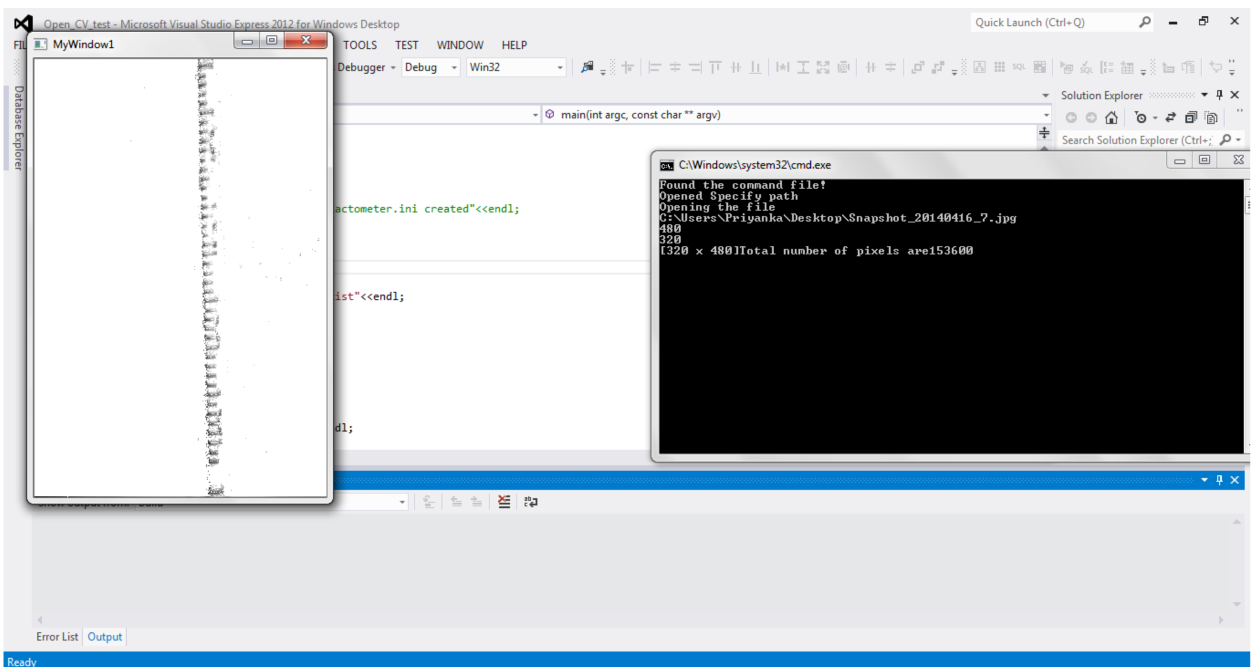


Fig 9.1.8 DIP module working in progress (2)

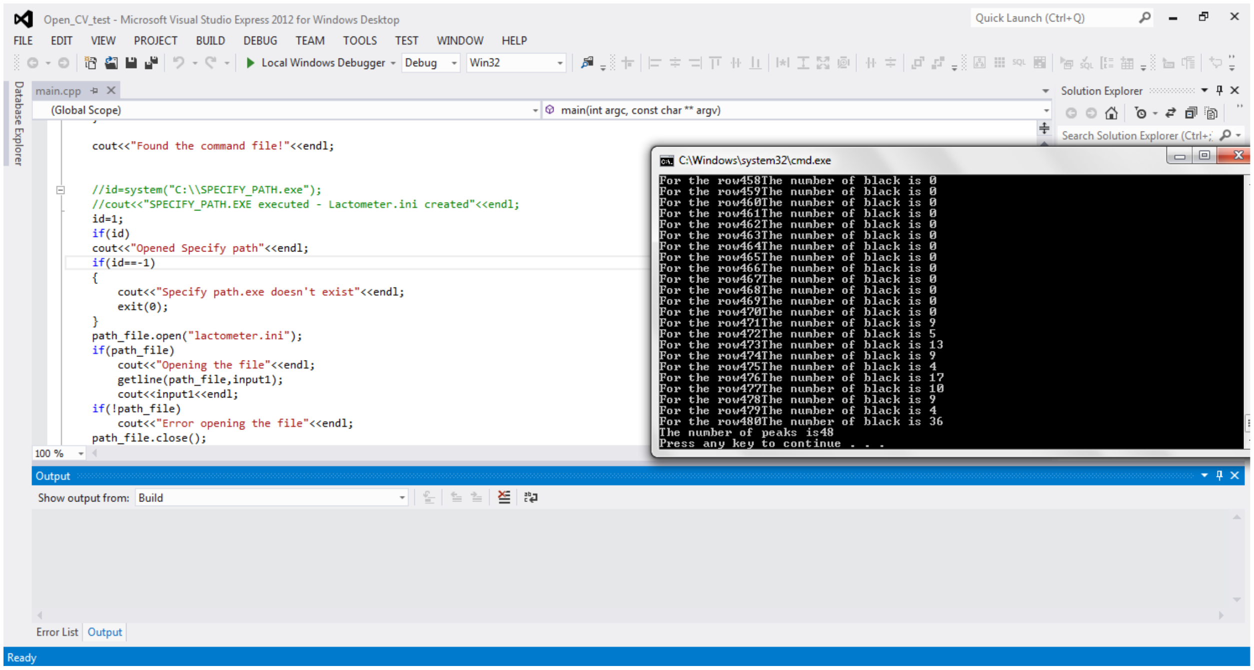


Fig 9.1.9 DIP module working in progress (3)

Step 7:

The last step is where the message is sent to the farmer's phone about the transaction that took place and the module can be "Exit"ed after this.

Summary

This chapter gives a graphic view of the execution of the system. The output screens show each of the execution stages of each module in the system.

Chapter 10

CONCLUSION & FUTURE SCOPE

10.1. Conclusion

In traditional practice of collecting milk a farmer was given a passbook which contain farmer no, date, fat% of milk, volume of milk, amount of milk. When the farmer comes to society to deposit his milk he hands over the passbook to the officer and pours the milk into a milk container where the measurement of the milk is being done and written in the passbook. A small sample is being drawn from the milk for testing which is being kept in plastic bottles. The testing of the same milk to verify the fat content of the milk to find out the milk quality and price to be paid is done after the milk collection process. The above process is inaccurate, inefficient and time consuming. Our software provides complete computerized solution covering all functions of Accounting and report generation. We can conclude from the project that we can successfully eliminate human intervention and errors. The method is now more reliable, faster and also more accurate. Moreover, there is no scope for alteration of information by unauthorized sources. As we store the location information and other details, the higher authorities can retrieve the details from the central server anytime.

10.2. Future Scope

In future, A new, alternative model for labour-efficient dairy production is emerging. Part of this trend in automation, robotic milking may dramatically reduce labour requirements. This would Establish and expand market for traditional dairy products.

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APPENDIX

Acronyms & abbreviation

Acronyms	**Abbreviation**
DB	Database
UI	User Interface
UR	User Registration
SMS	Short Message Service
GSM	Global System for Mobile Communications
RFID	Radio Frequency Identification