

Pimpri Chinchwad College of Engineering and Research,  
Department of Computer Engineering 2018

SAVITRIBAI PHULE PUNE UNIVERSITY

A PRELIMINARY PROJECT REPORT ON

## Automatic Shopping Cart with Advanced Billing System

SUBMITTED TOWARDS THE  
PARTIAL FULFILLMENT OF THE REQUIREMENTS OF

BACHELOR OF ENGINEERING (Computer  
Engineering)

BY

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Exam No: B151224262  
Exam No: B151224244  
Exam No: B151224264  
Exam No: B151224241

Under The Guidance of

Prof. Jameer Kotwal



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Pimpri Chinchwad College Of Engineering and Research  
DEPARTMENT OF COMPUTER ENGINEERING

## CERTIFICATE

This is to certify that the Project Entitled  
Automatic Shopping Cart with Advanced Billing System

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is a bona de work carried out by Students under the supervision of Prof. Jameer Kotwal and it is submitted towards the partial fulfillment of the requirement of Bachelor of Engineering (Computer Engineering) Project.

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## Abstract

Previously standing in billing lines was more tedious than shopping. The long hours wait used to disinterest the shopping experience in malls. Due to this, there was a decline in the number of visiting customers. This tremendously decreased the turnover of the shopping malls. In today's world shopping experience is becoming convenient as the world has become digitalized. This is one of the conveniences that will be providing with new and easy shopping experience. To reduce the waiting time in a long queue for the payment of purchased items, we are developing an automatic shopping cart with advanced billing system. The system scans the product placed into the cart and accordingly generates the lump sum amount. This system consists of screen, camera, microcontroller, etc. Products will be captured by camera and will be processed using image processing algorithm SIFT. The user has to place the product into the cart, camera will capture the image of the product and this image will be compared with the images stored in the database using SIFT. Once the image is matched with the database image, the product price will be displayed on the screen. If user removes any product from the cart again image is captured by the camera and this image is compared with the database image. If it matched then respective amount of the product is subtracted from the total amount. And the final amount will be displayed.

## Acknowledgments

It gives us great pleasure in presenting the preliminary project report on 'Au-tomatic Shopping Cart with Advanced Billing System'.

We would like to take this opportunity to thank my internal guide Prof. Jameer Kotwal for giving us all the help and guidance we needed. We are really grateful to them for their kind support. Their valuable suggestions were very helpful.

I am also grateful to Prof. Archana Chaugule, Head of Computer Engineering Department, Pimpri Chinchwad College of Engineering and Research for his indispensable support, suggestions.

In the end our special thanks to Prof. Mahendra Salunke for providing various resources such as laboratory with all needed software platforms, con-tinuous Internet connection, for Our Project.

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# Chapter 1

## Synopsis

### 1.1 Project Title

Automatic Shopping Cart System With Advanced Billing System

### 1.2 Project Option

Internal Project

### 1.3 Internal Guide

Prof. Jameer Kotwal

### 1.4 Technical Keywords (As per ACM Key-words)

1. SIFT
2. Image processing
3. Tensor ow
4. Open CV
5. Euclidean distance

## 1.5 Problem Statement

To reduce the time consumption during shopping in malls is to be tackled using this project. The increasing crowd is creating a lot of problem during billing and hence this problem is to be solved efficiently.

## 1.6 Abstract

In today's world shopping experience is becoming convenient as the world has become digitalized. This is one of the conveniences that will be providing with new and easy shopping experience. To reduce the waiting time in a long queue for the payment of purchased items, we are developing an automatic shopping cart with advanced billing system. The system scans the product placed into the cart and accordingly generates the lump sum amount. This system consists of screen, camera, microcontroller, etc. Products will be captured by camera and will be processed using image processing algorithm SIFT. The user has to place the product into the cart, camera will capture the image of the product and this image will be compared with the images stored in the database using SIFT. Once the image is matched with the database image, the product price will be displayed on the screen.

## 1.7 Goals and Objectives

Goal and Objectives:

To reduce the time of scanning the products by replacing the scanner to image processing techniques.

To reduce the long queues by implementing the SIFT algorithm.

To increase the overall revenue of the shopping malls by increasing the ROI.

## 1.8 Relevant mathematics associated with the Project

System Description:

Input: Product, Database

Output: Total billing amount

Identify data structures, classes, divide and conquer strategies to exploit distributed/parallel/concurrent processing, constraints.

Functions : Insert products, Capture Images, SIFT implementation, Increment count, Decrement count, Get product amount, Display

Mathematical formulation:

$$\sum_{i=1}^n X_i$$

Where X are products and i is total number of products

Success Conditions: Products should be correctly identified and respective amount should be computed.

Failure Conditions: Products when removed are not detected and amount is not deducted.

## 1.9 Names of Conferences / Journals where papers can be published

IJSER (International Journal Of Scientific And Engineering Research)

## 1.10 Review of Conference/Journal Papers supporting Project idea

Object Recognition in Shopping Cart

Authors :- Pradeep Gurunathan, Vishal Guruprasad, Ganveer N

Smart Shopping Cart For Automated Billing Purpose Using Wireless Sensor Networks

Authors :- Udit Gangwal, Sanchita Roy, Jyotsna Bapat

Smart Trolley In Mega Mall

Authors :- J. S. Awati, S. B. Awati

## 1.11 Plan of Project Execution

The project plan execution gives us the idea about the time period required to complete the respective tasks. Following is the PERT chart that explains our project timeline.

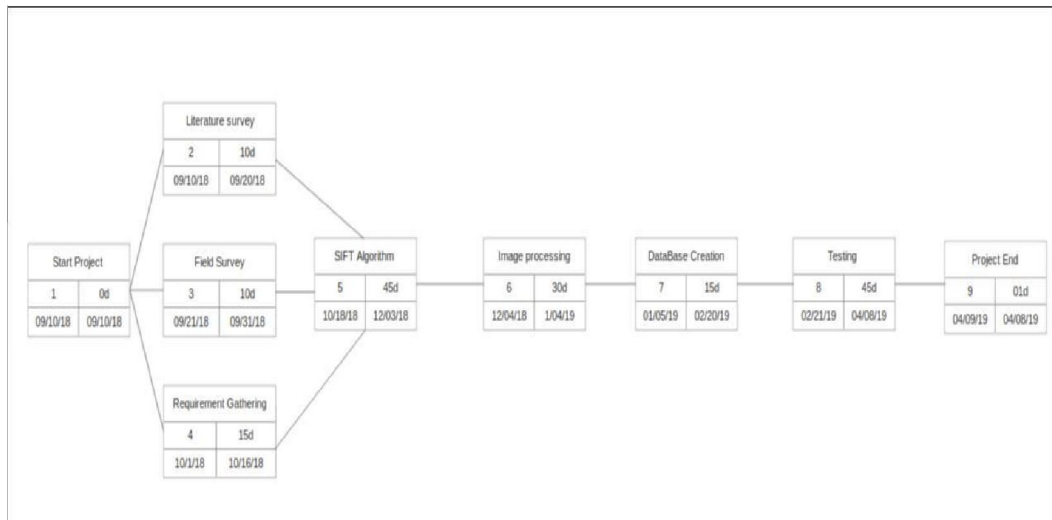


Figure 1.1: Pert Diagram

# Chapter 2

## Technical Keywords

### 2.1 Area of Project

Image Processing

### 2.2 Technical Keywords

SIFT, Image processing, tensorflow, Open CV, Euclidean distance

# Chapter 3

## Introduction

### 3.1 Project Idea

The basic idea is to give a efficient shopping way to customers. The main purpose is to reduce the waiting hours for billing in malls. This can be achieved by automation and hence we are automating the shopping cart. This will include the automatic scanning of products and generation of lump sum amount.

### 3.2 Motivation of the Project

The long queues in the shopping malls creates impassiveness among the cus-tomers. This may cause the reduction in the ROI (Return on investment). Thus shopping malls are facing a lot of complications. Due to this the work-ing or ow of the malls has to be changed. This is the main motivation behind this project.

### 3.3 Literature Survey

#### { Object Recognition in Shopping Cart

Authors :- Pradeep Gurunathan, Vishal Guruprasad, Ganveer N The paper provides algorithm which successfully detects and iden-ti es multiple grocery items using the Scale Invariant Feature Transform (SIFT) and image matching techniques. Integrating object detection techniques based on color into the algorithm would expand the type of detectable items rather than limiting the algorithm to items with unique labels and uniform shapes.

{ Smart Shopping Cart For Automated Billing Purpose Us-ing  
Wireless Sensor Networks

Authors :- Udita Gangwal, Sanchita Roy, Jyotsna Bapat

It describes the implementation of a reliable, fair and cost e cient Smart Shopping Cart using Wireless Sensor Networks and Image Processing techniques. It uses a passive sensor to reduce the communication requirement. The experimental set-up is tested for various test cases, with various products tested for all the possible cases mentioned in broadcast technique to communicate with the Base Station as each cart is associated with a unique ID. The system is cost-e ective as it requires only one passive sensor (the load-cell) and a camera-based barcode scanner (which is way cheaper than any other type of barcode scanners) per cart.

{ Smart Trolley In Mega Mall

Authors :- J. S. Awati, S. B. Awati

Microcontroller based design, has acquired the status of most hap-pening eld in electronics. This is highly specialized eld that has the power of integrating thousands of transistors on single silicon chip. The microcontroller based trolley automatically follows the customer. Also it maintains safe distance between customer and itself. It gives number of products in trolley and total cost of the products on the spot.

# Chapter 4

## Problem Definition and scope

### 4.1 Problem Statement

To reduce the time consumption during shopping in malls is to be tackled using this project. The increasing crowd is creating a lot of problem during billing and hence this problem is to be solved efficiently.

#### 4.1.1 Goals and objectives

Goal and Objectives:

- To reduce the time of scanning the products by replacing the scanner to image processing techniques.

- To reduce the long queues by implementing the SIFT algorithm.

- To increase the overall revenue of the shopping malls by increasing the ROI.

#### 4.1.2 Statement of scope

- The project cannot capture images of products whose size is greater than the size of the cart which in turn will create a problem for huge products such as bed, tables, cupboards and other furniture products.

- The size of the cart plays an important role when we consider the number of products to be purchased. Thus, cart size will create a hindrance in number of products shopped.



## 4.2 Applications

The major application of automatic cart is in shopping malls. The main purpose is to reduce the time required to scan the products in the queue of billing.

## 4.3 Hardware Resources Required

Sr. No.	Parameter	Minimum Requirement
1	CPU Speed	2 GHz
2	RAM	3 GB
3	Arduino Kit	1 GB

Table 4.1: Hardware Requirements

## 4.4 Software Resources Required

Platform :

1. Operating System: Windows
2. IDE: OpenCV
3. Programming Language: Cpp

# Chapter 5

## Project Plan

### 5.1 Project Estimates

The waterfall model illustrates the software development process in a sequential way. It is a linear process. This means that any phase in the development process begins only if the previous phase is complete. In this waterfall model, the phases do not overlap.

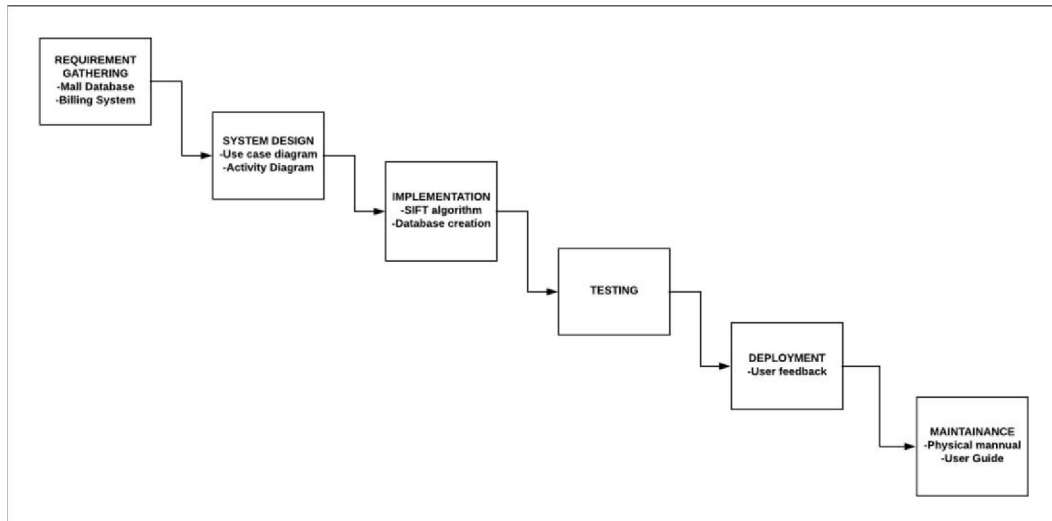


Figure 5.1: Waterfall model

#### 1. Requirement Gathering and analysis

All possible requirements of the system to be developed are captured in this phase and documented in a requirement specification document.

## 2. System Design

The requirement specifications from the first phase are studied in this phase and the system design is prepared. This system design helps in specifying hardware and system requirements and helps in defining the overall system architecture.

## 3. Implementation

With inputs from the system design, the system is first developed in small programs called units, which are integrated in the next phase. Each unit is developed and tested for its functionality, which is referred to as Unit Testing.

## 4. Integration and Testing

All the units developed in the implementation phase are integrated into a system after testing of each unit. Post integration the entire system is tested for any faults and failures.

## 5. Deployment of system

Once the functional and non-functional testing is done; the product is deployed in the customer environment or released into the market.

## 6. Maintenance

There are some issues which come up in the client environment. To solve those issues, patches are released. Also to enhance the product some better versions are released. Maintenance is done to deliver these changes in the customer environment.

### 5.1.1 Cost Estimate

1. COCOMO Model: COCOMO (Constructive Cost Estimation Model) was proposed by Boehm [1981]. According to Boehm, software cost estimation should be done through three stages: Basic COCOMO, Intermediate COCOMO, and Complete COCOMO.
2. Basic COCOMO Model : The basic COCOMO model gives an approximate estimate of the project parameters. The basic COCOMO estimation model is given by the following expressions:  
$$E_{ort} = a_1 * (KLOC)^{a_2}$$
$$T_{dev} = b_1 * (E_{ort})^{b_2} \text{ Months}$$
Where,  
(a) KLOC is the estimated size of the software product expressed in Kilo Lines of Code,  
(b)  $a_1$ ,  $a_2$ ,  $b_1$ ,  $b_2$  are constants for each category of software products,  
(c)  $T_{dev}$  is the estimated time to develop the software, expressed in

months,

(d) Effort is the total effort required to develop the software product, expressed in person months (PMs). The effort estimation is expressed in units of person-months (PM). It is the area under the person-month plot. It should be carefully noted that an effort of 100 PM does not imply that 100 persons should work for 1 month nor does it imply that 1 person should be employed for 100 months, but it denotes the area under the person-month curve.

## 5.2 Project Schedule

### 5.2.1 Project task set

Major Tasks in the Project stages are:

Task 1: Literature Survey

Task 2: Field survey

Task 3: Requirement Gathering

Task 4: Database Creation

Task 5: SIFT algorithm implementation

Task 6: Testing

### 5.2.2 Timeline Chart

Timeline chart explains the sequential time period required for implementing project tasks and the events associated with it.

## 5.3 Team Organization

The team consists of four members. Each member has contributed in each and every phase. The phases required in completion of the project are re-quirement gathering, designing, development, testing, back-end (database), documentation, etc.

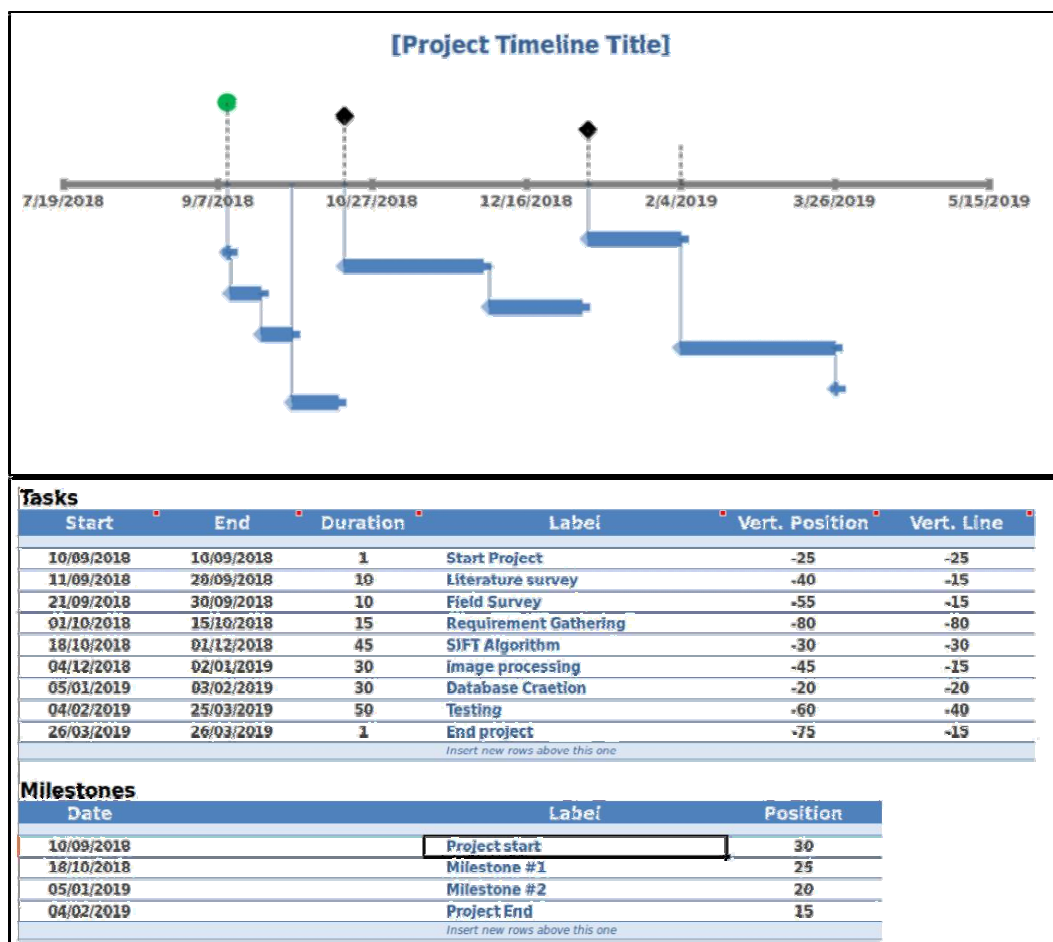


Figure 5.2: Timeline Chart

## Chapter 6

Software requirement specification (SRS is to be prepared using relevant mathematics derived and software engg. Indicators in Annex A and B)

### 6.1 Introduction

The purpose of the document is to gather and analyze all ideas that have come up to define the system, its requirements with respect to consumers. Also, prediction and sorting is carried out with respect to how we hope this product will be used. This is done for the better understanding of the project, concepts that may be developed, and document ideas that are being considered, but this may be discarded as the product develops. In short, the purpose of this document is to provide a overview of our software product, its parameters and goals. This document describes the target audience and its UI, hardware and software requirements. It defines how our client, team and audience see the product and its functionality. Nonetheless, it helps any designer and developer to assist in software delivery life cycle (SDLC) processes.

## 6.2 Usage Scenario

There are two users or actors which are as follows

Developer- Who will create project, will accept real time data, and Build project and also Deploy project.

End user-Who will use analyzed data for analysis purpose.

## 6.3 Functional Model and Description

### 6.3.1 Use Case Diagram

The relationship between user and various scenarios which involves user are represented using use-case diagram. It is the simplest representation between user and the system.

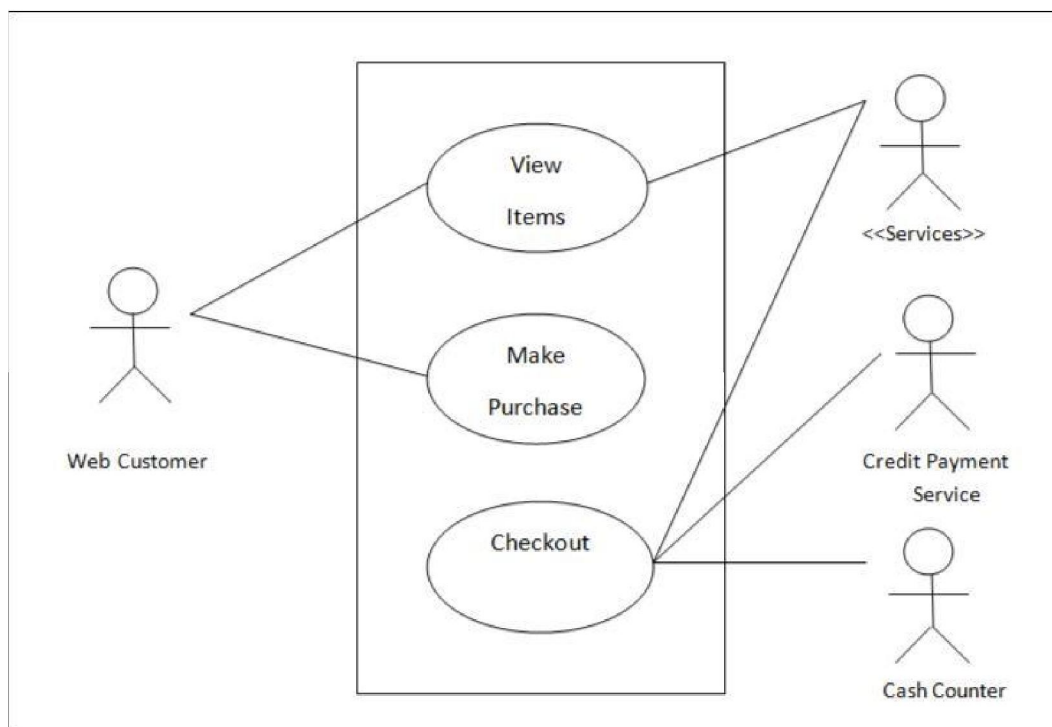


Figure 6.1: Use case diagram

### 6.3.2 Activity Diagram

Activity diagram represents a sequential flow of actions or the activities to be undertaken. It is similar to flowchart or data flow diagram.

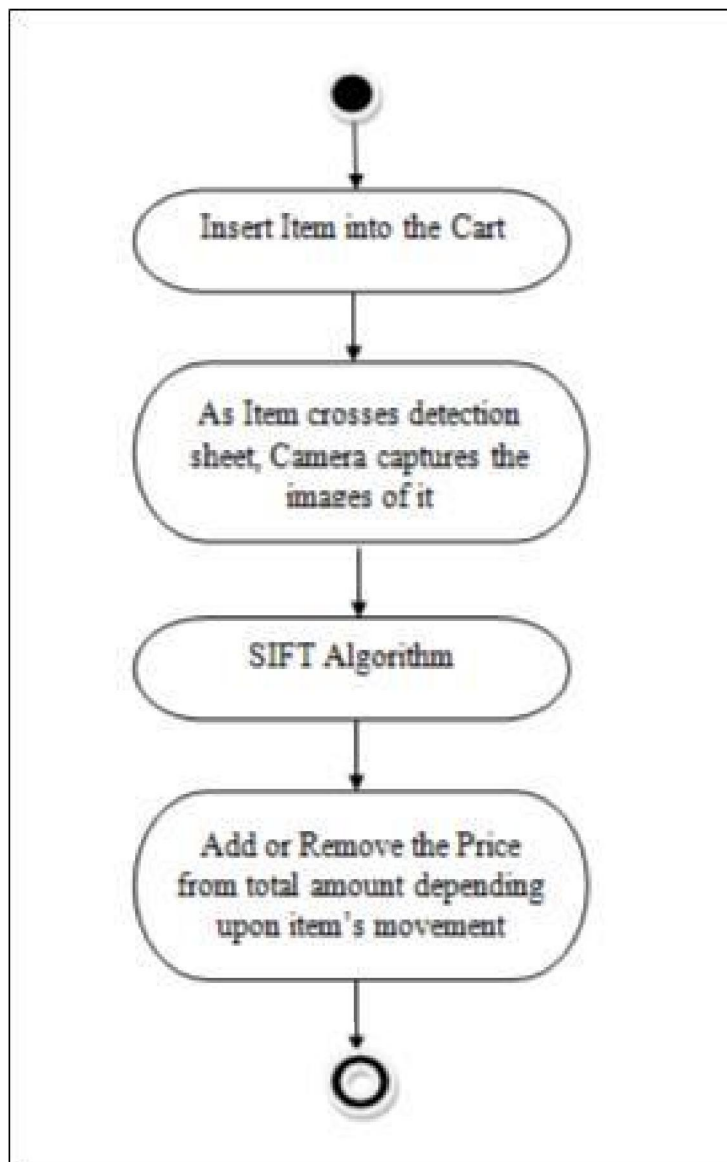


Figure 6.2: Activity diagram



### 6.3.3 Non Functional Requirements:

Reliability

Modifiability

Portability

Reusability

Scalability

Performance

Security

Testability

Usability

### 6.3.4 Data Flow Diagram

A data flow diagram (DFD) is a graphical representation of the "flow" of data through an information system, modelling its process aspects.

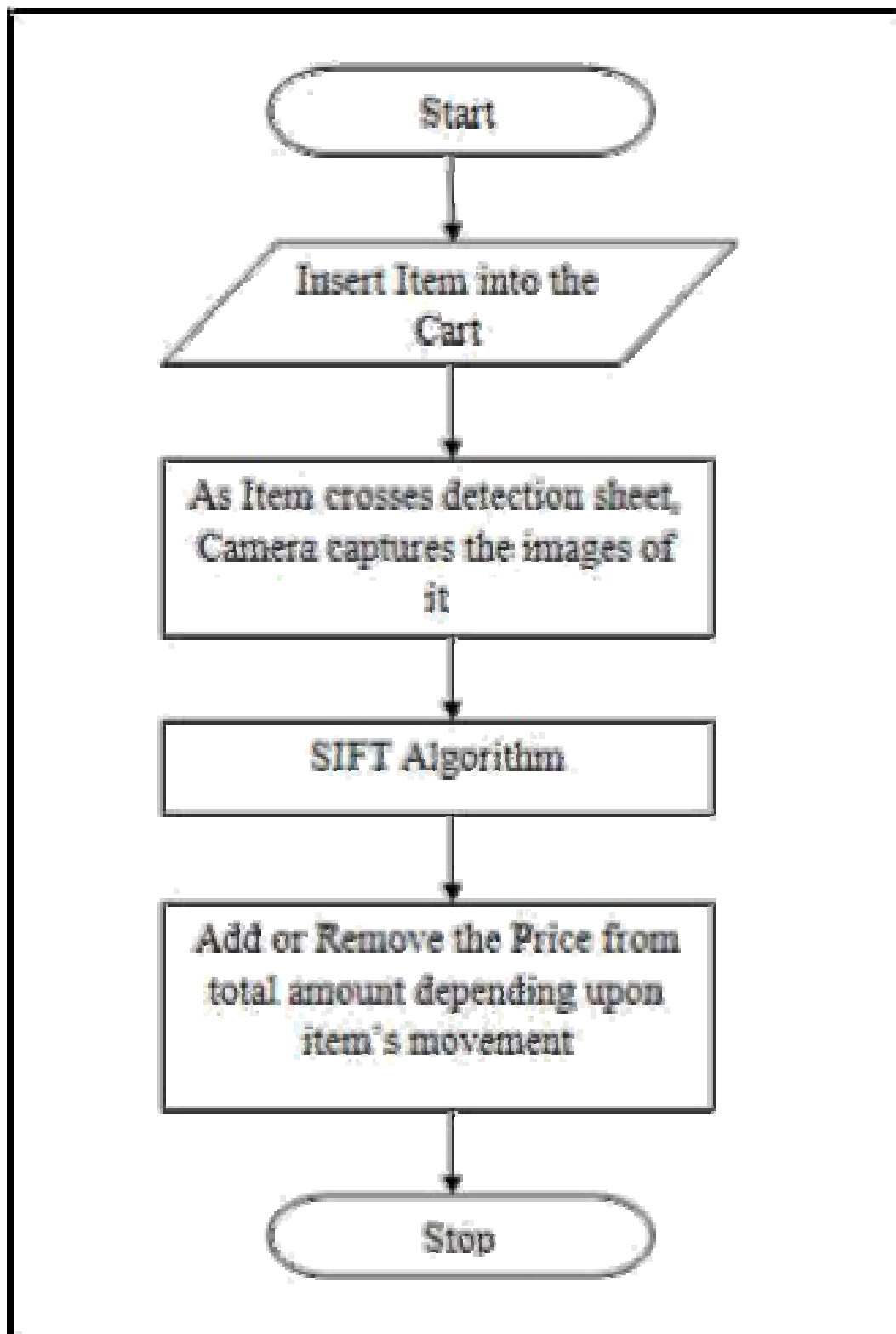


Figure 6.3: Use case diagram

# Chapter 7

## Detailed Design Document

### 7.1 Introduction

Detailed design of the system is the final design activity before implementation begins. The detailed design should represent the system design in various views where each view uses a different modeling technique.

#### 7.1.1 Database description

Database consists of all the detailed information regarding each and every product. Some of the information entities are Product ID, Product Name, Product Price and images of that particular product.

### 7.2 Component Design

#### 7.2.1 Class Diagram

Class Diagram is a type of structured diagram that describes the structure of a system by showing the various classes in the system, their attributes, operations or functions and the relationships among objects.

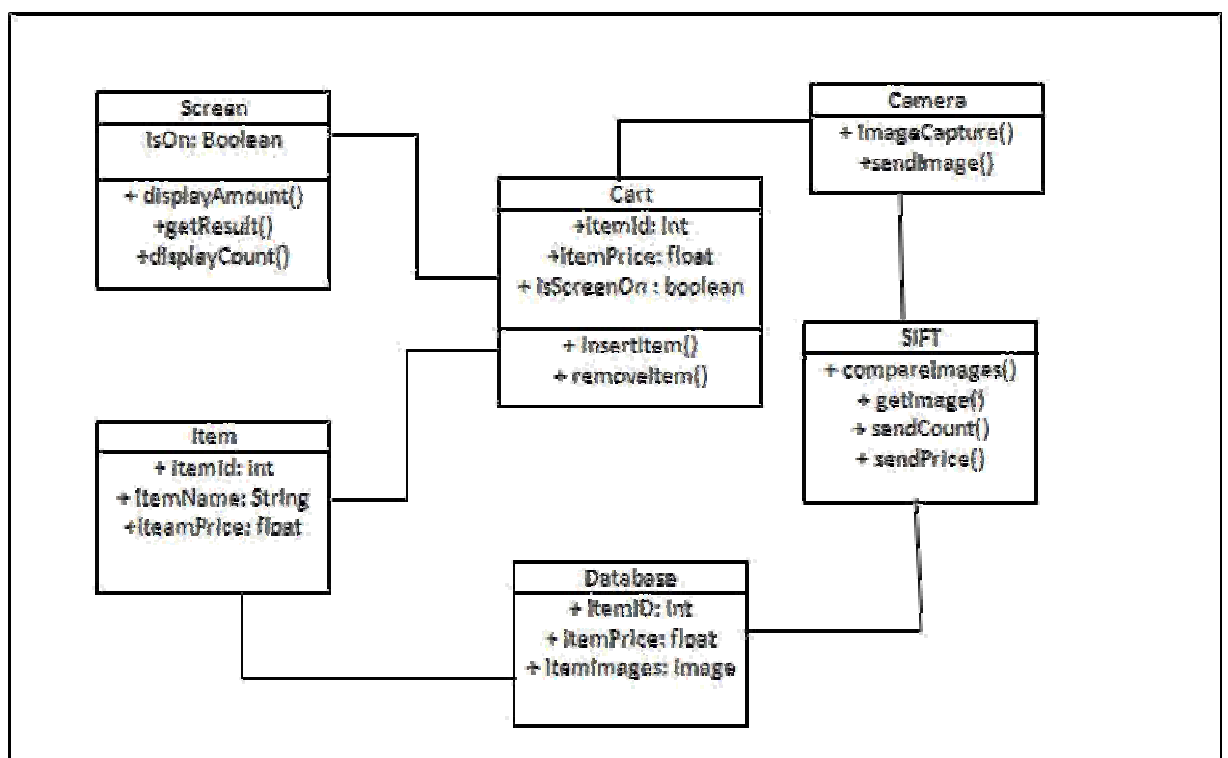


Figure 7.1: Class Diagram

## Chapter 8

### Conclusion

Thus, a system called Automatic Shopping Cart with Advanced Billing System will be developed using SIFT algorithm, Image Processing, Machine Learning. As we have overcome the two measure problems of computational time and physical wastage of time thus, the time complexity is reduced. These problems were overcome by using the image capturing technique in the shopping cart itself. The computational time could be greatly reduced by using above technologies. In turn, the waiting time of the user will be reduced and the shopping experience will be enhanced.

# Annexure A

## References

### Object Recognition in Shopping Cart

Authors :- Pradeep Gurunathan, Vishal Guruprasad, Ganveer N

The paper provides algorithm which successfully detects and identifies multiple grocery items using the Scale Invariant Feature Transform (SIFT) and image matching techniques. Integrating object detection techniques based on color into the algorithm would expand the type of detectable items rather than limiting the algorithm to items with unique labels and uniform shapes.

### Smart Shopping Cart For Automated Billing Purpose Using Wireless Sensor Networks

Authors :- Udit Gangwal, Sanchita Roy, Jyotsna Bapat

It describes the implementation of a reliable, fair and cost efficient Smart Shopping Cart using Wireless Sensor Networks and Image Processing techniques. The experimental set-up is tested for various test cases, with various products tested for all the possible cases mentioned in broadcast technique to communicate with the Base Station as each cart is associated with a unique ID. The system is cost-effective as it requires only one passive sensor and a camera-based barcode scanner per cart.

### Smart Trolley In Mega Mall

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# Annexure B

## Plagiarism Report

Plagiarism report