PES UNIVERSITY, BANGALORE

Department of Computer Science and Engineering

Software Requirements Specification For:

Crowd management at POS terminals in a retail store

Prepared by: **TEAM 09**

Brainiacs

Jeffrey S Varghese , Basava Prabhu, Pavan Kumar Nuthi, Ishita Bharadwaj

TABLE OF CONTENTS

Proposal of the project

Purpose

Retailers who are unable to mitigate challenges that come in the way to provide a seamless billing experience to their customers are more likely to suffer. They can lose customers and thus sales. Customers get demotivated to visit the store if they have experienced huge POS waiting times. It's not the fault of the retailer, but the ancient, lagging POS systems in place that makes the billing process extremely difficult. With the changing trends in every industry, queue management also requires advancement and improvements. The purpose of our project is to mitigate this problem and effectively manage the crowd in order to provide a faster and smooth experience to the customers.

Intended Audience

The intended audience includes the customer waiting in line for their turn at the billing counters and also the retail store management to detect overcrowding and to simply fast track the billing processes so that the customer need not wait for long. This can in turn help the retailers to not lose customers. The customers interact with our product by walking past the IR sensors installed especially to count the people entering the billing queue lines.

Project Scope and Product Features

Crowd monitoring systems (CMSs) provide a state-of-the-art solution to manage large crowds objectively. In recent years, researchers have discovered the potential of CMSs for crowd behavior research and have started to leverage CMSs to derive new insights regarding crowd movement behavior. The crowd state (i.e., walking velocity, density, and flow rate) at a retail outlet can be effectively determined using a comprehensive CMS.

Basic concept behind this project is to measure and display the number of persons entering the billing counter area. Either LCD or laptop monitor can be used to display the number of people waiting in line at the billing counters. We can thus infer the approximate crowd at the counters. This works in two ways. That means the counter will be incremented if a person enters the billing area and will be decremented when the person is finished with his/her billing. A certain threshold of the number of people allowed to stand in a queue for a particular counter will be maintained to prevent overcrowding.

References-

- How can retailers release the pressure on billing counters during COVID times
- A Mobile Based Crowd Management System
- Improvise Queuing and Crowd Management with Queue Manager
- Prediction and Diversion Mechanisms for Crowd Management Based on Risk Rating
- Enhancing Crowd Monitoring System Functionality through Data Fusion: Estimating Flow Rate from Wi-Fi Traces and Automated Counting System Data

Feasibility

Economical Feasibility

This study is carried out to check the economic impact that the system will have on the retail domain as a whole. The amount of funds that the company can pour into the research and development of the system is limited. The expenditures are justifiable as the main attraction of our product will be the IR sensing arduino hardware. Thus the developed system will be well within the budget and this can be achieved by using technologies that are freely available. Only some customized products such as Arduino UNO, IR sensor, jumper wires, LCD display(optional) may be purchased.

Technical Feasibility

This study is carried out to check the technical feasibility, that is, the technical requirements of the system. The system does not have high demand on the available technical resources. The developed system has a modest requirement of Arduino UNO, IR sensors, jumper wires, LCD display(optional), as only minimal or null changes are required for implementing this system.

Social Feasibility

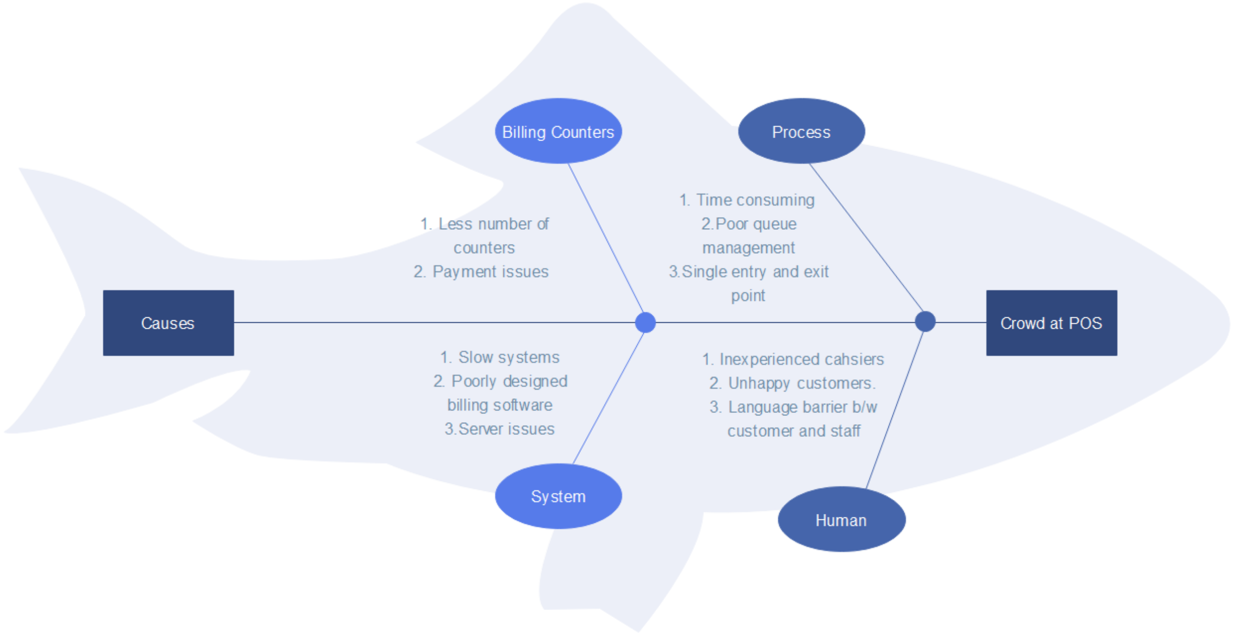
The aspect of study is to check the level of acceptance of the system by the customers and the management. The customer must not feel threatened by the system, instead must accept it as a necessity and be redirected to another counter/queue if the current counter is running on it’s maximum capacity . The level of acceptance by the users solely depends on the methods that are employed to educate the user about the system and to make him familiar with it. His level of confidence must be raised so that he is also able to make some constructive criticism, which is welcomed, as he is the final user of the system.

Functional Requirements

Desktop.App	The retail management should have a desktop app to supervise the crowd at the counters.
Crowd.counting	There will be an IR sensor to count the number of people lining up for billing and exiting the billing area.
Crowd.management	This feature should provide for steps to be taken by the customer and management to resolve overcrowding and long waiting time.

	Steps can include(opening or closing some billing counters as crowd increases and decreases respectively)
Overcrowding.alert	To alert the management of overcrowding at the billing counters. This should be displayed for at least 10 seconds.
Crowd.Density.Analysis	Crowd density is usually characterized by the number of persons accommodated per unit area. The greater crowd density usually means the higher degree of population aggregation and also the larger security risk of the throng.
Traffic.congestion	This analyzes if there is a manageable crowd at every counter or not. The count of customers should be within a threshold.
Crowd.counter.flow.dictation	This dictates how to allocate customers to different counters to equally distribute the crowd. There should be a maximum of 5 people assigned in a queue per billing counter.

Fishbone diagram: Causes for Crowd formation at POS.

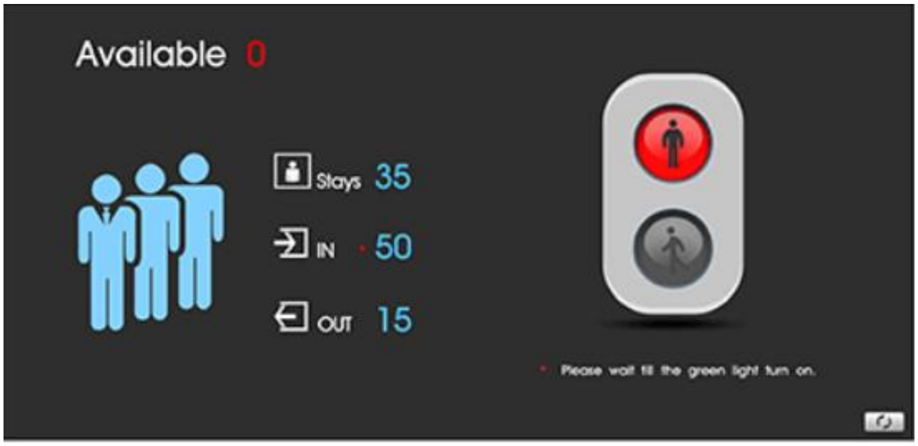


External Interface Requirements

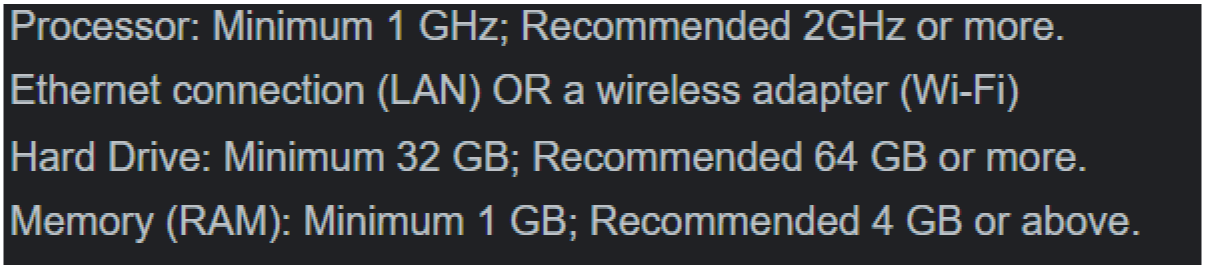
- **User Interface**

The software must display the following data to the user/retailer.

a. Number of customers waiting for billing outside the queue.
b. Number of customers who are present in the queue.
c. Threshold of maximum number of customers allowed .
d. Estimated waiting time for customers outside.
e. Stop or Go signal for customers outside.
f. Similar to the one shown below:



- **Hardware Interface**



Processor: Minimum 1 GHz; Recommended 2GHz or more.

Ethernet connection (LAN) OR a wireless adapter (Wi-Fi)

Hard Drive: Minimum 32 GB; Recommended 64 GB or more.

Memory (RAM): Minimum 1 GB; Recommended 4 GB or above.

Works with any of the following operating systems:

- Windows 32/64 bit.
- MacOS
- Linux

Additional IoT based sensors:

Depending upon the type of solution which is feasible to implement, we can use the following sensors to detect the presence of a crowd/customers.

Heat sensor:

Pressure/Force Sensor:

IC chips attached to shopping carts:

- **Software Interface**

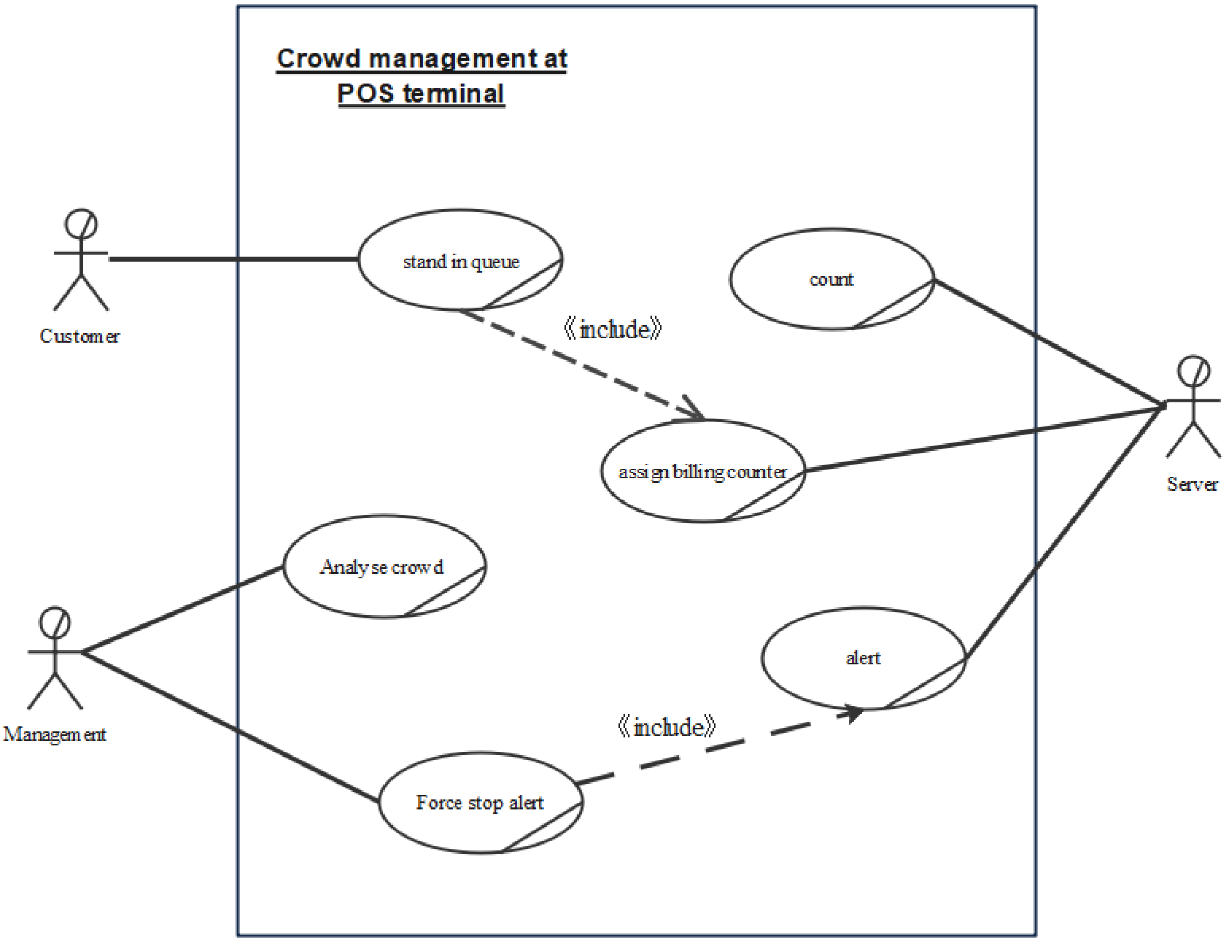
The software is developed for Windows 7,8,10,11,,MacOS, Linux based OS. It is expected to work on the systems present at the POS terminal of the retail organization.

Additional software to integrate sensor outputs to the software program. We will be simulating a crowd , hence there is no need for such software.

Communication Interface

- Direct communication with customers using an LED Display.
- Communication standard: HTTP, HTTPS, FTP,Sensors.
- Electronic forms: HTML/XML forms
- Display format: Text, Image or audio.
- Synchronization methods: Google drive, third party backup options.

Analysis Models



Other Non-Functional Requirements

- **Performance requirements**

  PE-1:Website Response Time-The website's response time when there are less than 200 simultaneous users trying to use the website then the response time shall be under 3ms.In case the number of users are between 200 and 500 then the response time shall be under 5ms.

  PE-2:Database Response Time-Any response to a user query shall take no longer than 4 seconds for the query response from when the user enters the query.

PE-3:Scalability-The website can scale upto a maximum of 1000 simultaneous user/store managers who shall have a response time of no longer than 2 second.

- **Safety requirements**

No safety requirements are identified.

- **Security requirements**

SE-1:The users/store managers shall be required to log in to the Crowd Management System to perform any operations of a given store.

SE-2:All network transactions that involve personally identifiable information shall be encrypted.

- **Software quality attributes**

Availability: The Crowd Management System shall be available to the user/store manager for the entire day and in case there is any operating fault then the service outage period won't exceed 30 minutes.

Usability: The Crowd Management System is designed for ease of use to the user/store managers to ease the process of completing their shopping.It is designed so that the users can easily complete the purchase from the store with ease.The process of Crowd Management has been kept simple and easy to track.

The system is-

- Easy to use for input preparation,operation and interpretation of the output.
- Provides consistent user interface standards and conventions with our frequently used system .
- Easy for new infrequent users to learn to use the system.

Maintainability: The system is maintainable and is easy to add code to the existing features and add new features to the existing system in case the user need it

Efficiency: The system uses appropriate utilization of processors capacity,disk space and memory efficiently to make the system usable in real time.

Change management procedure:

Changes to this system can be made only under the following conditions:

- Bugs reported
- Loophole is detected
- System fails new test cases

The sequential steps for the change control and management of the system is as follows:

- Creating a request for change
- Reviewing and assessing a request for change
- Planning the change
- Testing the change
- Creating a change proposal
- Implementing changes
- Reviewing change performance
- Closing the process