Application Specific Image Feature Extractor

CSE 7th Semester Mini-Project
Software Requirements Specification (SRS) Document

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INTRODUCTION

This document seeks to enumerate the overall software requirements of the project "Application Specific Image Feature Extractor". The final software will conform to the functionalities of the software as described in this document.

I. **Purpose-**

This document aims at describing the capabilities of the software "Application Specific Image Feature Extractor". It also states the multiple constraints and limitations pertaining to this software. The audiences for this document are the developers and users.

II. **Scope-**

The software "Application Specific Image Feature Extractor" is an application which will take the image of a commodity in a departmental store and output the description of the object which will include the price, weight etc. The software will work in conjunction with additional camera hardware which will be used to obtain the image of the object to be classified. The user will have to place the object in front of the camera and the software will automatically obtain the image and add the corresponding price of the object as stated in the database, to the customer's bill. The system can be further upgraded to incorporate analysis of an image containing multiple objects and simultaneously processing and recognizing each object parallelly.

III. **Overview-**

This document provides a high level view enumerating the requirements, the dependencies and an outline of the workings presented at an execution level context.

OVERALL DESCRIPTION

Product Perspective -

In a departmental store, a bar-code scanner is used at the billing counter to log the commodities purchased by the customers and generate bills. The process of finding the bar-code on the commodity is often cumbersome for the cashier manning the billing counter. Moreover many a times, the bar-code on the commodity is damaged or unreadable by the bar-code scanner causing the cashier to manually enter the bar-code number into the system. All these predicaments translate into loss of precious business time for the corporations or individuals owning the stores. This application seeks to speed up the billing process by replacing the bar-code scanner with a camera. The commodity to be billed may be placed in any orientation in front of the camera. The application will click a snapshot of the same, analyse the image and subsequently add the corresponding price of the commodity to the customer's bill.
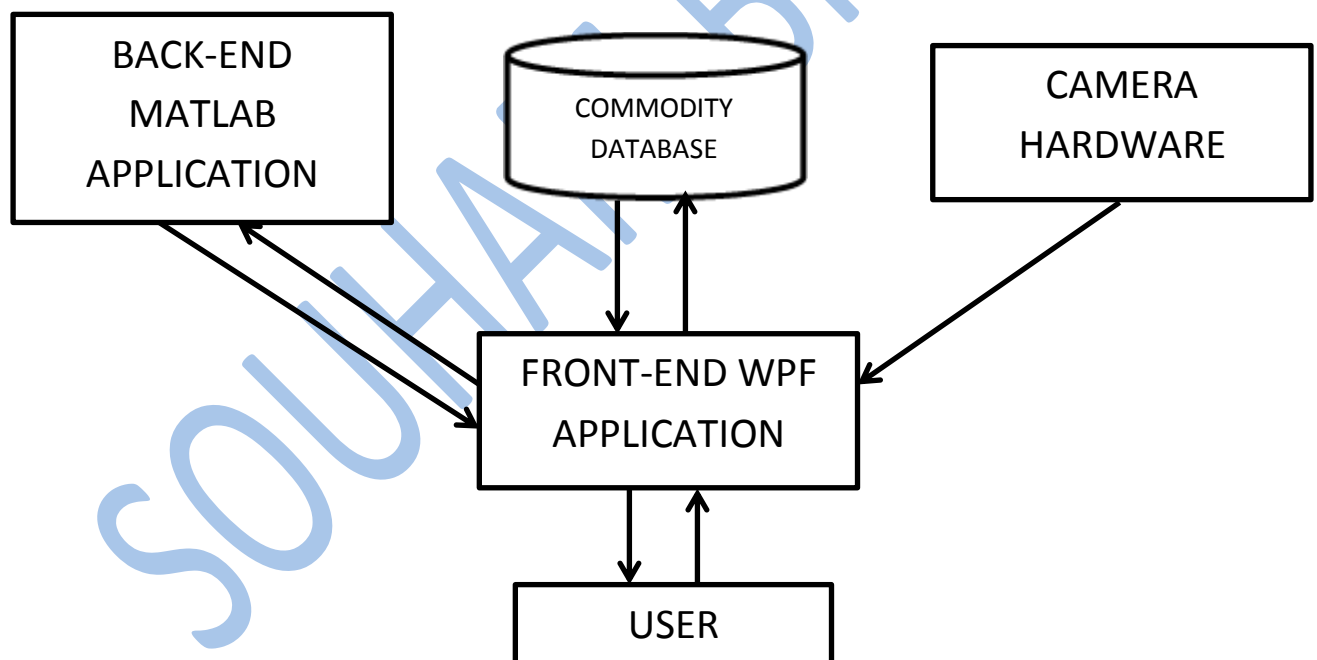
I. **System Interfaces-**
    There will be an interface between the database containing details of the commodities present in the departmental store and the current software system.

II. **Hardware Interfaces-**

An interface between the camera hardware being utilized as the scanning device and the computer system processing the bill and generating the invoice is elicited. Furthermore, support for bill printing can be added to make the entire system more versatile.

III. **Software Interfaces-**

Back end database containing records of commodities should preferably be MySQL which should be interfaced with this application. The front-end part will be interfaced to a backend MATLAB instance which will actually perform all the classification and image processing tasks.

IV. **Communication Interfaces-**

If support for credit card billing is desired, then a communication interface with the bank server will be desired. In the present version, it is assumed that such functionality is not desired.

V. **Memory Constraints-**

At least 1 GB RAM, and 1 GB of Hard Disk Space.

VI. **Operations-**

The software will be operated by only one user, that is the person manning the billing counter.

VII. **Site Adaptation Requirements-**

The terminals at the client side will have to support the software, hardware and system interfaces mentioned previously.

Product Functions-

A summary of the functions the User will be able to perform –

1. User will be able to scan a commodity to the bill using camera.
2. User will be able to generate customer invoice of items scanned.
3. Upon being linked with commodity database User will be able to bill the customer.
4. Upon addition of printing hardware, User will be able to generate physical bill of items scanned.

User Characteristics-

Education Level **–** At least a High-School pass out possessing elementary computer knowledge.

Experience **–** User should have some experience working with data and tables i.e. experience working in Microsoft Excel etc.

Technical Expertise **–** Should be fluid in typing and general computer operation.

Constraints-

1. The final working of the software will depend on the quality of images taken by the camera hardware being used. Therefore, it is recommended that a camera having optimum quality specifications be utilized for the operation.
2. The software is highly dependent on the network connection between the point of operation and the database servers maintaining commodity information. Hence, a reliable network connection between the two nodes is highly recommended.

Assumptions and Dependencies-

1. It is assumed that the departmental store only sells goods which are branded or canned or are distinctive as a single unit and are not sold by weight and/or size.
2. A database containing commodity information is assumed to exist which the given software shall query for billing operations.

SPECIFIC REQUIREMENTS

This section contains the software requirements to a level of detail sufficient for designing the system, and testing the system.

External Interface Requirements-

The interfaces and the various input/outputs to the system are listed below –

1. *Video Feed-* A control/window to show the live video feed from the camera hardware.
2. *Identified Object-* A control to show the object identified by the camera.
3. *Confirmation Button-* If an object is correctly identified, the user will have to press this button to add it to the customer invoice.
4. *Incorrect Identification Button-* If an object is incorrectly identified, or not identified at all, the user has to press this button to open the *New Commodity Window*.
5. *New Commodity Window-* A Window to provide an interface to add a new item to the database of commodities. The process of adding new item to the database will involve taking multiple images of the commodity in question and accordingly training the image recognition model to identify similar images correctly in the future.

Functions-

The min functions performed by the system are listed below –

1. *Billing-* The user places the commodity in front of the camera, whose feed is shown in real-time in the *Video Feed* control/window. The object upon being recognized, is shown in the *Identified Object* window/control, waiting for the user to press the *Confirmation Button*. Provided the object is correctly identified, the user presses the *Confirmation Button* following which, the details pertaining to the object is pulled from the commodity database and is added to the customer invoice. If the object is incorrectly identified, the user will press the *Incorrect Identification Button* following which, the user will be taken to the *New Commodity Window* for the addition of the new item in question.
2. *Addition of New Item-* The process of training the object recognition model involves placing the object in front of the camera and taking multiple images of it. The *New Commodity Window* will have the provisions to carry out all such functions at the press of a button. The multiple images recorded will be

used to train the model which will be followed by validation and testing of the model using more images captured by the camera. It is imperative that the object be kept in front of the camera for the entire process following which, a confirmation message will be displayed. The newly added item will be recognized in the future by the system.

Performance Requirements-

1. *Static Requirements-*
   a. *No. of Terminals-* **4** including mouse, keyboard, network connectivity and camera interface.
   b. *No. of simultaneous users-* **1**, that is the person performing the billing operation. Although multiple users (upto **10** for a single medium scale departmental store) may simultaneously access and update the commodity database
   c. *Amount and type of information to be handled-* Mostly, the system will be dealing with images, hence images of resolution at around **800x800** in **JPEG** format will be handled by the system. The size of a single image will be typically around **500 KB**.

2. *Dynamic Requirements-*
   a. A single image recognition process should take less than 0.5 seconds.
   b. An entire transaction process from placing of items to generation of customer invoice should take lesser than 30 seconds given that the number of items to be billed is lesser than 5.
   c. The commodity database should be able to handle upto 10 simultaneous read/update operations and should according provide the necessary network bandwidth.

Logical Database Requirements-

The commodity database will contain the following information

1. *Item Name* – Commercial name of the commodity.
2. *Item Rate* – The price of a single unit of the item.
3. *Item ID* – A unique identifier assigned to the item which can be used to refer it directly.

Design Constraints-

1. Based on the processor, the maximum resolution of image to be successfully recognized may be affected.
2. The number of simultaneous accesses is limited by the network bandwidth.
3. The quality of the images taken by the camera hardware is major factor in the design of the image recognition model.

Software System Attributes-

   I.   **Maintainability-**

The software will be developed in a modular manner. The modules will have the capability to be deployed in other scenarios. Therefore, provision to interface new modules and functionality will be provided.

   II.   **Portability-**

Portability is limited as the application will be developed using C# and MATLAB limiting the platform of operation to mostly windows based systems and system supporting the

   III.   **Reliability-**

For sufficient reliability, it is imperative that the camera hardware be of a certain quality standard required for proper and robust image recognition. For a reliable interface with the commodity database, it is also important that the network connection possess sufficient bandwidth.

Use Case Diagram-