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| **COMSAT’S UNIVERSITY ISLAMABAD ATTOCK CAMPUS** |
| **SmARt Shopping Project** |
| **SRS DOCUMENT** |
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1. **Introduction**

This Software Requirements Specification gives a total portrayal of SmARt Shopping Project , as a last structure undertaking of Comsat’s University Computer Science Department, including every one of the functionalities and specifications. This record will allude to usefulness, that is the thing that the subsequent application should do, outside interfaces which associates the clients, execution, qualities, that is if the application is versatile, or viable, and structure requirements forced on the usage, for example, execution language, input exception and yield exception .

* 1. **Problem Definition:**

So as to characterize the issue, one ought to envision a situation where a standard client enters to a market. At the point when a client enters to a grocery store, he winds up in a colossal swarmed condition that has heaps of rayon and chaotic measure of items. For a client to accomplish his motivation he should attempt simultaneously, for example, finding the accurate spots of the items he is looking for, while he is attempting to convey the items that he is happy to purchase and focus on his surroundings, for example, other individuals. Our group means to take care of this issue which is making shopping simpler for a normal client by improving the cooperation between the client and his condition. At the end of the day, this present reality issue which this venture expects to deal with is to gather data from the encompassing zone with no exertion by a standard client, specifically client in a grocery store. The ideal data to be gathered is relied upon to comprise of finding the areas of the ideal items, what's more, grouping the items as per their expenses and diverse different classes in immense grocery stores.

* 1. **Purpose:**

This record plans to determine the necessities for SmARt Shopping venture that actualizes expanded reality, and to give point by point data about highlights of the subsequent application, interfaces of the application, and what the application is prepared to do. This product necessities particular record tends to the ones who will build up this framework, Comsat’s individuals and the departmental teachers who are liable for graduation ventures. It will clarify the situation of the ideal venture and important strides so as to achieve the assignment, for example, in general depiction of the task, the meaning of the issue that this undertakings displays an answer, and definitions and shortened forms that are pertinent to the undertaking. One of the fundamental intentions is to build up the reason for understanding between the engineers and the providers on what this undertaking is to do. The total depiction of the capacities to be performed by the product indicated in this record will help the potential designers to decide whether the product determined in this archive addresses their issues or how the product ought to be altered to address their issues. The other one is to decrease the advancement exertion. The arrangement of this SRS will help think about the entirety of the necessities before configuration starts, and lessen later overhaul, recoding, and retesting. The survey of SRS can uncover exclusions, misconceptions, and irregularities right off the bat in the improvement cycle when these issues are simpler to address.

* 1. **Scope:**

The task which will be exhibited in this record is called SmARt Shopping Application. This application is intended to be utilized by any individual who is eager to do shopping in gigantic grocery stores. It is intended to run on a hand-held cell phone associated with a head-mounted showcase. It will enable clients to improve their nature of shopping , and make it simpler for them. The guaranteed functionalities of the application will be actualized by methods for object acknowledgment, object following and utilizing expanded reality devices. By the application, this present reality scene caught in the stores will be enhanced by the data acquired from the ongoing sources of info which enable clients to do an intelligent shopping. The application will begin to run by the longing of the client. In the first place, the client utilizing this application is relied upon to browse the items which are characterized and recorded already in the application database. After the client picks the requests and records them, the application interface will change into a continuous camera which is fit for perceiving the premium articles, for example, rayon names including the ideal items, items themselves, or representatives of the market. The collaborate with the client will be kept up by naming the moving or stationary perceived intrigue protests progressively. Since the client will utilize a head-mounted presentation, he will have the option to consolidate this present reality with the improving information with no interruption. The application will likewise give data about the discovered items' expense and quality. The collaboration will proceed until the client stops application. Marking items will be both as indicated by the picked rundown and the recently determined highlights of the distinguished articles. A rayon, which has items at a bargain, is additionally marked when it's perceived regardless of whether the client doesn't add any items to the rundown from that rayon. The rayons that incorporate the picked items will be named unique in relation to the ones who has deal, which can be comprehended from the highlights of the rayons. So as to keep up the precision of the application, a few suspicions will be made, for example, labels that will assist us with recognizing the rayon marks, the states of the items, and some shading and label suppositions of items will be made so as to give data about cost or nature of the items .

* 1. **User and Literature Survey:**

Despite the fact that there exists a few applications which join the expanded reality ideas and picture preparing, the task which will be clarified in this report has novel capabilities. Different applications which consolidate increased reality and picture handling are for the most part intended for diversion showcase. For instance of it , an iPhone application which perceives the foot in the camera, puts a ball picture on the screen, before the foot. As the player hits the ball picture, this ball pushes ahead and the foot is perceived at constant. As expressed previously, this application is only for diversion and doesn't take care of any genuine issue. The finished tasks which have the intend to discover an answer for a true issue, don't just utilize picture preparing and increased reality. Those ventures use GPS data, and pre-characterized properties about areas. For instance, there exists a task called Car Find which utilizes GPS data of the vehicle and the driver. At the point when the driver is away from his vehicle, he runs the application and the application adds a few pointers to the bearing of the vehicle, and encourages the driver to discover the vehicle. So this venture gets support from different applications and isn't only a mix of enlarged reality and picture preparing. The past tasks which are additionally an answer for a certifiable issue for the most part depend on the single pictures, not on the recordings, so they are not constant applications. Identified with shopping, there exists a task which perceives the furniture examples and puts them on the picture of space for the customer to see whether it's appropriate for their room or not. Despite the fact that this venture is identified with shopping and helps the customer, it does exclude expanded reality, rather, it utilizes the taken picture of the room and afterward puts the perceived furniture on the screen. Henceforth, this undertaking isn't constant. In any case, the introduced task in this report is a continuous undertaking which joins both picture handling and expanded reality ideas by a communication with the entire condition planning to be an answer for a true issue. The potential clients of the clarified application are everyone who do shopping and needs to locate an ideal item in a proficient manner without losing a lot of time and without giving heaps of consideration.

* 1. **Definitions and Abbreviations:**

SRS: Software Requirements Specification

AR: Augmented Reality , a term for a live direct or indirect view of a physical real world environment whose elements are augmented by virtual computer generated sensory input such as sound or graphics.

OpenCV: Open Source Computer Vision Library

IDE: Integrated Development Environment

GPS: Global Positioning System, is a space-based global navigation satellite system that provides reliable location and time information in all weather and at all times and anywhere on or near the Earth when and where there is an unobstructed line of sight to four or more GPS satellites.

Head-Mounted Display: a display device, worn on the head or as part of a helmet, that has a small display optic in front of one or each eye.

ER: Entity – Relationship Diagram, a specialized graphic that illustrates the interrelationships between entities in a database. ER diagrams often use symbols to represent three different types of information. Boxes are commonly used to represent entities. Diamonds are normally used to represent relationships and ovals are used to represent attributes.

GUI: A graphical user interface, a type of user interface that allows users to interact with programs in more ways than typing such as computers.

UML: Unified Modeling Language, a standardized general-purpose modeling language in the field of software engineering.

* 1. **References:**

1. IEEE Std 830-1998: IEEE Recommended Practice for Software Requirements Specifications
2. Fowler, Martin. “ UML distilled: a brief guide to the standard object modeling language.” Booch Jacobson Rumbaugh, 2004
3. Bruade, Eric J. “Software Engineering: An Object-Oriented Perspective.” Wiley, 2001
   1. **Overview:**

This record contains a detailed description about the undertaking SmARt Shopping Project. In the presentation part, it for the most part gives a general diagram about the undertaking including the meaning of a genuine issue that venture plans to fathom, the extent of this task, and the data about comparable activities and how they contrasts from this venture. Additionally in this part, the motivation behind the SRS and the extent of the task are clarified. In addition, client and writing review of this part clarifies the comparative ventures done before is pronounced. Second some portion of the record is the general portrayal of the task. This part clarifies the item point of view of the application, the capacities incorporated into the application and the limitations, suppositions and conditions of the ideal application. The particular necessities of the task are clarified in the third piece of the report. This part incorporates interface prerequisites and practical/nonfunctional necessities of the venture. In the fourth piece of this record, information models and their portrayals are clarified in detail with the connection between them. The conduct model and its depictions are referenced in the fifth part including the state charts. Next part incorporates the group structure and presentation of the colleagues of the undertaking. The last part is determination part which gives a concise outline about the entire record.

**2. Overall Description**

This section will give information about product perspective, product functions, constraints, assumptions and dependencies.

**2.1. Product Perspective:**

SmARt Shopping Application is absolutely a free application which isn't identified with some other framework and not a segment of a bigger framework. This application has just one sort of client, and consequently there is no usefulness contrasts between clients. That is the reason, the application just has one sort of UI. The interface of the application has a beginning menu, which comprises of a rundown of predefined items that the general store gives. The interface enables the client to look over the items. After the decision, the interface changes into a constant camera scene, and until the client stops the application, the interface stays as a video. This video comprise of the genuine scene advanced by encompassing data by naming regarding increased reality. The interface stops by the interest of the client. Regarding equipment, we'll utilize a convenient gadget with a camera ,show screen and control catches associated with it. We will perceive the information which is caught by the camera and the screen will show that caught video with increased reality marks. As far as programming interfaces, this application will run on Windows 7 Operating System, and it will be actualized utilizing Eclipse IDE with OpenCV module incorporated on it as a numerical bundle. OpenCV is picked as a scientific bundle since it bolsters essential picture preparing, basic investigation , camera alignment , movement examination, object acknowledgment, fundamental GUI , and picture marking . Additionally OpenCV is a quick library which is appropriote for constant video input-yields. Since our application doesn't require tremendous measure of memory, that is the data caught can fit into the memory of the gadget, we won't require auxiliary stockpiling gadgets.

**2.2. Product Functionalities:**

The significant functionalities of our application are:

**Creating Lists from the Products** The program enables client to pick the items that he needs and adds them to the rundown or erase the items that he doesn't need from the rundown.

**Object Detection** The program identifies predefined objects(products, rayons, sales reps) as per their shapes and hues.

**Real-Time Object Tracking** The program tracks the identified items progressively regardless of whether the direction of the camera changes.

**Labeling** The program can mark the recognized items as indicated by their highlights like needed, at a bargain, high-caliber and well known.

**2.3. Imperatives, Assumptions and Dependencies :**

So as to keep up the precision, following suspicions are made:

* Rayon can be perceived up to 5 meters.
* Products can be perceived up to 1 meter.
* Products will be interestingly characterized by geometric shape and shading couple.
* Different capabilities of a similar sort of item data will be acquired by letters on them.
* Rayon banners will have the type of square marker designs.
* Sales individual is accepted to wear a one of a kind shading that no item has a similar shading on it.
* Sales individual will be perceived up to 3 meters.

The application needs to process and reply continuously, be that as it may, clearly, this application is restricted by the exhibition of the convenient gadget and the camera. The application doesn't have any wellbeing and security concerns.

3.Specific Requirements:

The specific requirements of this project will be considered in following three subsections, which are interface, functional and non-functional requirements.

* 1. **Interface Requirements:**

As clarified previously, since there are only one sort of client, the application will have just a single interface. The interface of the application will be a straightforward beginning menu toward the start and afterward transform into a constant camera mode with improved information. At the point when the client begins the application, this demonstration will call the capacity Start(), and this capacity will bring the item determination mode on the screen. The item determination mode screen will be partitioned into two sections, one of the segments will be the predefined item list, and the subsequent segment will show the picked item list. The client will have the option to move around between the sections, left and right, and inside the segments, here and there. The client will have the option to call the capacity AddProduct() by picking a passage in the primary segment, this capacity call will bring about including the item into the subsequent section, to be specific the interest rundown of the client. The client will likewise have the option to call the capacity DeleteProduct() by deselecting with the assistance of control catches, and this capacity will bring about expelling the item section from the interest rundown of the client. At the point when the client is finished picking the items that he wishes to purchase, he will have the option to spare the rundown by squeezing the spare catch with the assistance of control catches and this demonstration will call the capacity Load(), and move to the camera mode. At the point when the client moves into the camera mode, until he stops the application by methods for control catches calling Quit(), each other capacity calls will be made by the application itself as indicated by the info originating from the earth.

**3.2.Functional Requirements:**

Functional requirements of this application can be categorized in two parts, namely user functional requirement, the functions called with the user activity , and device functional requirements, the functions called automatically.

3.2.1.1. Start application :

Description: The user shall start the application. Assumption: The application is loaded on the device. How: By running the application.

3.2.2. Product Selection Mode Handler Functional Requirements :

3.2.2.1. Add product

Description: The user shall add the product to the list. Assumption: The list is already defined and displayed on the screen. The screen is on menu mode, it’s not displaying the output of the camera yet. How: The user adds the current product to the list.

3.2.2.2. Delete product

Description: The user shall delete the product from the list Assumption: The list is already defined and displayed on the screen. The screen is on menu mode, it’s not displaying the output of the camera yet. How: The user deletes the current product from the list.

3.2.2.3. Load List

Description: The user shall load the list to the program’s memory Assumption: The list is already defined and displayed on the screen. The screen is on menu mode, it’s not displaying the output of the camera yet.

How: The user saves the list to the program’s memory.

3.2.2.4. Quit :

Description: The user shall exit from the application whenever he wants Assumption: There will be no assumption for the system to execute this function. How: Using ESC button of the keyboard the user exits the program

3.2.2. Real Time Handler Functional Requirements :

3.2.2.1. Recognize Rayon :

Description: Rayon patterns are recognized according to their square marker patterns which are hung in front of each rayon. Assumption: Rayon patterns are already defined in program’s memory. Each rayon has a unique square marker pattern. Patterns should be closer than 5 meters to be recognized. How: When the rayon patterns which are already defined are matched with object on the screen, the object is recognized with 80% accuracy.

3.2.2.2. Label Rayon :

Description: Rayons are labelled after they are recognized. Assumption: Rayon patterns are recognized How: After the rayon patterns are recognized, they are labelled differently according to some features like including products on-sale and including chosen products by the user.

3.2.2.3. Recognize Product :

Description: Product patterns are recognized according to their shapes and colors. Assumption: Product patterns are already defined in program’s memory. Objects should be closer than 1 meters. Every product has a unique pattern. How: When the product patterns which are already defined are matched with object on the screen, the object is recognized with 80% accuracy.

3.2.2.4. Label Product :

Description: Product patterns are labelled after they are recognized. Assumption: Product patterns are recognized. How: After the product patterns are recognized, they are labelled differently according to their quality, cost and popularity.

3.2.2.5 Recognize Salesmen:

Description: Patterns of the salesmen are recognized according to the color of their shirt. Assumption: All the salesmen will be wearing the same color. How: When the salesman patterns which are already defined are matched with object on the screen, the object is recognized with 80% accuracy.

3.2.2.6 Label Salesmen:

Description: Salesmen are labelled after they are recognized. Assumption: Salesman patterns are recognized. Objects should be closer than 3 meters. How: After the salesmen are recognized, they are labelled.

* 1. **Non-functional Requirements:**

3.3.1. Performance Requirements:

To begin with, this application will be utilized by a solitary client. There will be no various client dealing with since the application runs on a solitary versatile gadget without requiring any system. The measure of the info is colossal since the information of the application is the video caught by a solitary camera. The data among the information will be accomplished by diminishing contribution to a lot of highlights of the intrigued articles, which is additionally fundamental in object acknowledgment. Intrigue items might be more than one while, the product needs to deal with various article acknowledgment with a solitary camera. Likewise, the articles might be moving, or stationary, and this reality ought not impact the presentation of the application. The significant issue here is the application should reply progressively, in particular, the perceiving and naming tasks must be dealt with in under 1 second. Likewise the application ought to have the option to perceive more than %80 of the intrigued articles at the same time caught. The suppositions to perceive and follow the items has just been characterized in 2.3 Contraints, Assumptions, Dependencies part of this report.

3.3.2.Desighn Constraints:

The SmARt Shopping Application will pursue the accompanying plan imperatives: Programming language that will be utilized during the undertaking is C++. Since OpenCV will be utilized for object acknowledgment parts and enlarged reality instruments of the task, C++ is the most suitable programming language that supports OpenCV quickly. The framework will run on a compact gadget which likewise bolsters a camera. Likewise, the processor speed, the nature of the illustrations card ought to be adequate enough to have the option to run the program. The movability of the framework relies upon the versatility of the gadget wherein framework will run. Since this will be an ongoing application and journals will be utilized so as to keep up the speed, framework can be utilized in anyplace that client will convey his note pad. Since the framework will run on a solitary machine and it won't be needy to a greater framework or some other PCs, there won't be any security or unwavering quality issues. Savvy shopping venture is intended to be extensible, that is available to changes. At whatever point new examples are added to the memory of the program, by the assistance of certain options, the application will deal with remembering them. Besides, the beginning up menu is available to increments or expulsions, if essential.