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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

**SmartMart Unity Application Project**

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1. INTRODUCTION

The current online shopping system does not provide the actual shopping experience to the users where they just scroll through the webpage and select an item they need to purchase which becomes monotonous too soon. We propose a 3D shopping system where the user can navigate through the shopping mart and interact with the items as they would in real life. The proposed system has various aspects interfaced with it. The front end is the actual environment where the user interacts and explores the shopping mart. MySQL database is used to store the inventory, the customer details and the billing information. The database gets updated in real time it being integrated with the main application. Shopping is made more efficient and seamless with the integration of the recommendation system where various products get recommended taking into account the users’ purchase history. This gives a more personalized touch to each user adding on their shopping experience. This adds a new dimension to both the existing online shopping system and to the level of satisfaction of the customer.

1. METHODOLOGY

The work flow of the Virtual Supermarket is depicted in the figure below. The application starts with the initial scene where user has to login or signup.

After the validation is done, the main application starts with the cart placed at the entrance of the virtual supermarket. The cart is scripted such that the customer can move it around the mart with the help of the mouse control. The shelves contain products designed on Unity which are assigned unique tags to identify them. Each product is also associated with a script which allows the user to rotate, drag and drop it into the cart. As soon as the user selects the product, the details along with the recommendations are displayed on the monitor installed at the billing counter. The recommendations are based on user-item and item-item similarity metrics under the collaborative filtering technique.

Once the user completes the shopping, the cart can be dragged to the billing counter where appropriate billing information is displayed. These transaction details are stored in the database in real time. Once the billing details are generated, the user signs out and the session is over.

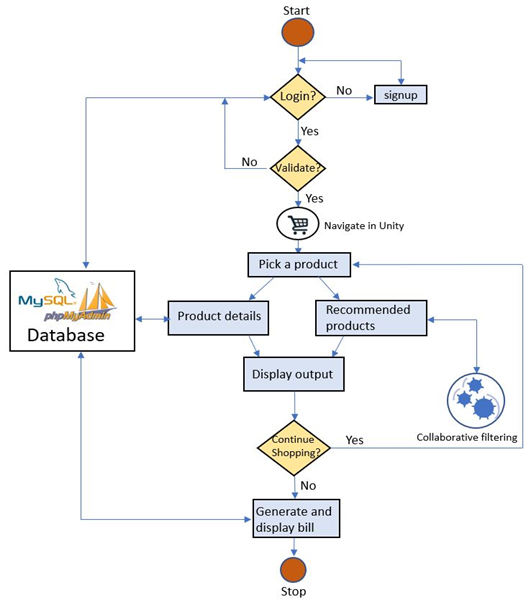


Figure 1 Workflow of SmartMart

1. REQUIREMENT SPECIFICATION

Minimum requirements for the project to run smoothly –

* Processor: Core i3 or equivalent
* RAM: 4GB
* Graphics: Intel Onboard HD Graphics
* Hard Disk: 250GB
* Windows 7 (64 bit)
  1. Unity

**Unity** is a cross-platform game engine for creating games in both 2D and 3D. Unity supports building games for many platforms such as iOS, Android, Windows, PlayStation, Oculus Rift, and many more.

For installing Unity go to 4.1

* 1. XAMPP

XAMPP is an AMP stack which stands for Cross platform, Apache, MySQL, PHP, perl with some additional administrative software tools such as phpMyAdmin (for database access. XAMPP is the most popular software package which is used to set up a PHP development environment for web services by providing all the required software components.

The XAMPP server is used to test PHP pages. It works as local server. It contains a MySQL database to manage or save data on a local server.

For installing XAMPP go to 4.2

* 1. Turicreate

There are many machine learning libraries in Python, most of which cannot be easily scaled to large datasets. TuriCreate enables us to create a wide range of ML models, without having to install additional packages. It is easy to use, contains useful plotting options, and is flexible regarding the data you might want to use.

TuriCreate can accomplish many [ML tasks](https://apple.github.io/turicreate/docs/userguide/), including item similarity based recommendation systems from user-item and item-item matrices, without the need of additional libraries.

For installing Turicreate go to 4.3

1. INSTALLATION AND SETUP
   1. Installation of Unity

* Go to [**Unity’s Download Page**](https://store.unity.com/download)<https://store.unity.com/download> and click “Download Installer for Windows”. A UnityDownloadAssistant-x.x.exe file should be downloaded to your “Downloads” folder (where x.x is the current Unity version).
* Open the downloaded installer. You will see a screen like this:
* Accept the license and terms and click Next.
* Select the components you would like to be installed with Unity and click “Next”. Note: If you ever want to change the components, you can re-run the installer.
* You can change where you want Unity installed, or leave the default option and click “Next”.
* Depending on the components you selected, you may see additional prompts before installing. Follow the prompts and click “Install”. Installing Unity may take some time. After the installation is finished, Unity will be installed on your computer.
* **Unity requires an account for use**. Start by opening Unity which can be done through the Desktop or Start Menu shortcuts.If you have a Unity account already, you can sign in here and skip the rest of this guide. If you do not have a Unity account, click “create one”.
* Fill in the forms to create your Unity account. Then click “Create a Unity ID”. Alternatively, you have the option of signing up with a Google or Facebook account.
* You will receive a confirmation email sent to the email used to signup for a Unity ID. Click “Link to confirm email” to confirm your email.
* Go back to the Unity application and click “Continue” after confirming your email.
* Select “Unity Personal” and click “Next”.

You are now setup to create games using Unity 3D Personal Edition.

* 1. Installation of XAMPP
* In the web browser, visit [Apache Friends](https://www.apachefriends.org/index.html) and download XAMPP installer
* During the installation process, select the required components like MySQL, FileZilla ftp server, PHP, phpMyAdmin or leave the default options and click the Next button.
* Uncheck the Learn more about bitnami option and click Next button.
* Choose the root directory path to set up the *htdocs* folder for our applications. For example *‘C:\xampp’.*
* Click the Allow access button to allow the XAMPP modules from the Windows firewall.
* After the installation process, click the Finish button of the XAMPP Setup wizard.
* Now the XAMPP icon is clearly visible on the right side of start menu. Show or Hide can be set by using the control panel by clicking on the icon.
* To start Apache and MySql, just click on the Start button on the control panel.

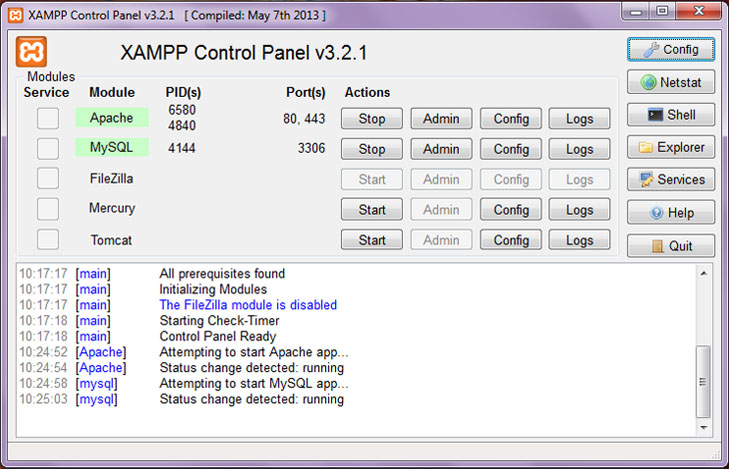
  
**Making server request**: Open your web browser and check whether the XAMPP service has properly installed or not. Type in the URL: http://localhost If you are able to see the default page for XAMPP, you have successfully installed your XAMPP Server

Figure 2 XAMPP control panel

**Note:**

 1) Suppose Apache is not starting, it means some other service is running at port 80. In this case, stop the other service temporarily and restart it.

2) All the website related files are organized in a folder called *htdocs* and then run index.php file by using http://localhost/index.php or http://localhost.

3) For every new website or application, its always better to create a different folder inside *htdocs*, to keep it organized and avoid confusion.

* 1. Installation of Turicreate

You will not be able to simply install/run TuriCreate from the Windows 10 Platform. You will have to install a **W**indows **S**ubsystem for **L**inux (WSL) first.

* In order to install any WSL the “**Windows Subsystem for Linux optional feature**” must be enabled.
* Open PowerShell as Admin and run following command:
  + *Enable-WindowsOptionalFeature -Online -FeatureName Microsoft-Windows-Subsystem-Linux*
* Restart your computer when prompted
* Launch the Microsoft Store and search for Linux. [Install](https://docs.microsoft.com/en-us/windows/wsl/install-win10)the Linux distribution of your choice. For this application, we used the Ubuntu 18.04 LTS distro. From the distro’s page, select get, and install.
* Launch the distro from the Start menu or by clicking the “launch” button on Microsoft Store.
* You will have to initialize your new distro. Follow the prompts to set up a new Linux account (username and password). You will need your password later when installing packages using sudo.
* Update and upgrade your distros packages. This will take a few minutes.
  + *sudo apt update && sudo apt upgrade*
* Now that You are done setting up your WSL with a Linux distro, you can proceed to

**Setup and Install A Virtual Environment.**

* Install dependencies:
  + *sudo apt-get install -y libstdc++6 python-setuptoolssudo apt-get install python3-pip*
* Install virtualenv using pip3:
  + *sudo pip3 install virtualenv*
* Create a new virtual environment:
  + *virtualenv venv*
* Activate your virtual environment:
  + *source venv/bin/activate*
* Now you can **Install Jupyter notebook in your virtual environment:**
  + *pip3 install jupyter*
* To test your installation of both, open Jupiter notebook:
  + *jupyter notebook*
* WSL does not support graphical user interfaces (GUIs). Therefore, instead of Jupyter Notebook opening in a new browser tab, you will get a link to the server (localhost). You will get something like this:
  + *The Notebook is running at:   
    http://localhost:8888/?token=6b0e4a3b7493fa0686a9906c89866fd0c344ae60d8fabbba  
    or   
    http://127.0.0.1:8888/?token=6b0e4a3b7493fa0686a9906c89866fd0c344ae60d8fabbba*
* Copy either of the two links from your terminal to your browser. Jupyter notebook should open with the welcome screen for a Jupyter notebook
* This is the final part of setting up your development environment with TuriCreate. Make sure you are still in your virtual environment (venv). **Install turicreate** using the following script:
  + *pip3 install turicreate*
* Create a new python file in your notebook, and type and run the following line of code to test your turicreate installation. If you don’t get an error message, it means your installation was successful.
  + *import turicreate as tc*

1. EXECUTING THE APPLICATION

* Extract the NUP.7z file and place the extracted folder in the htdocs of the xampp folder. This contains the php files for database, python files and the model for the recommendation.
* Extract the SmartMart.7z file and place it in the desired location. This is the unity game project.
* Open xampp control panel and start the Apache and MySQL to set up a local server.
* Using Ubuntu bash go to the directory where the Recommendation.py file is present and run the file using the command *python run Recommendation.py* command. This will enable the user-item recommendation.
* Similarly, to start item-item and popularity model go to the respective directory where Recommendation1.py and Recommendation2.py files are present using different ubuntu bash terminals and run the files using *python run Recommendation1.py* and *python run Recommendation2.py.*
* Now that the backend is setup launch the unity game engine and run the project.
* To check the real-time updating of the database go to <http://localhost/phpmyadmin/> on your web browser and click on the table that needs to be checked under the vrsupermarket database.
* The products that are being recommended can also be seen on the ubuntu terminal.
* Now you can move around the SmartMart and purchase the product you want!
* Now you can move around the SmartMart and purchase the product you want!

6. UNITY ANALYTICS

Unity **Analytics** is a powerful data platform that provides **analytics** for your Unity game. Used to Find out who the players are in your game and their in-game behaviour. Unity **Analytics** provides the data you need to manage your relationship with your players.

6.1 Setting up Unity Analytics

* To open the Services Window, go to **Window** > **General** > **Services**, or click the cloud button in the toolbar. .
* To get started with Unity’s services, you must first link your project to a **Unity Services Project ID**. A Unity Services Project ID is an online identifier which is used across all Unity Services. If you have not yet linked your project with a Services ID, create a new Project ID or select an existing one.
* If this is the first time you are using any of the Unity Services, you will need to select both an Organization and a Project name. Choose the organization of your choice, you want your Project to be associated with. Click **Create**.
* The Project name for your new Unity Services Project ID is automatically filled in with the name you picked for your Project when you first created it.
* To visualise on the Dashboard, In the Services window, select Analytics and then click the OFF button to toggle it ON. If you haven’t already done so, at this stage you will need to complete the mandatory Age Designation field for your project.
* With Analytics enabled, when you press the Play button, the Editor sends data to the analytics service. This means you can test your analytics now, without having to build and publish your game. To get there, in the services window, click Services -> Analytics -> Go To Dashboard.
* The **Go to Dashboard** button in the Analytics section of the Services window opens the dashboard in a web browser. The dashboard contains tools for visualizing, analysing, and taking action based on your Analytics data.

6.2 Analytics Event Tracker

Use the Analytics Event Tracker component to send both Standard and Custom Events. While you can send these events using a script, in some cases it can be more convenient to set up the event triggers and parameters directly from the Inspector window of the Unity Editor.

* Attach an Analytics Event Tracker component to any GameObject to send a Standard or Custom event. Use a separate tracker component for each different type of Analytics event that you send.

The Analytics Event Tracker component has two main sections:

1. When: Specifies when to dispatch the event.
2. Send Event: Specifies which event to send, and defines the required and optional parameters.

When to send an event:

There are three ways to trigger the tracker component to send an event: Lifecycle Event, UI and Timer. We have used the first two ways only in the project.

* Choose Lifecycle Event to dispatch the Analytics event when a specific MonoBehaviour lifecycle event occurs. This has been used in the project to track various events Dispatch when Unity invokes this GameObject’s Start() method.
* Choose UI if you are using a UI event to trigger the Analytics event. You must set up the UI event separately. For example, to dispatch an event when a button is clicked, you could add the AnalyticsEventTracker.TriggerEvent to the button’s OnClick() list. This has been used to add it to sign in and sign up buttons in the project to keep track of number of times the butto was pressed

Event parameters to be sent:

You can define up to ten parameters to send to the Analytics Service as part of an Analytics event. Many **Standard Events** have standard required and optional parameters, which automatically appear in the list when you select the event in the Analytics Event Tracker component. The required and optional parameters do count against the ten parameter limit, but you can set optional parameters to **Disabled** to remove them.

You can assign a fixed value to a parameter, which the tracker uses every time it dispatches the event. Alternately, you can assign a dynamic value by hooking the parameter to a field or property of a MonoBehaviour object. When you use a dynamic value, the tracker assigns the value of the associated field to the parameter when it dispatches the event.

Standard events:

Refer this for the Standard events list, The ones we used in the project can be seen in the picture attached below : <https://docs.unity3d.com/Manual/UnityAnalyticsStandardEvents.html>

Custom Events:

Custom Events can be any specific in-game action your user performs. They allow you to track the player behaviour that **Unity Analytics** does not track automatically, and for which there is no **Standard Event**. Each Custom Event can have up to ten parameters. There are no required parameters.

You can send a Custom Event to the **Analytics** Service using the [Analytics Event Tracker](https://docs.unity3d.com/Manual/class-AnalyticsEventTracker.html) component. Just select **Custom** instead of a Standard Event. You can also send Custom Events [using code](https://docs.unity3d.com/Manual/UnityAnalyticsCustomEventScripting.html):

As an alternative to using the [AnalyticsEventTracker](https://docs.unity3d.com/Manual/class-AnalyticsEventTracker.html) component, you can send Custom Events directly via script by calling [AnalyticsEvent.Custom](https://docs.unity3d.com/ScriptReference/Analytics.Analytics.CustomEvent.html):

// Reference the Unity Analytics namespace

using UnityEngine.Analytics;

// Use this call for wherever a player triggers a custom event

AnalyticsEvent.Custom(string customEventName, IDictionary<string, object> eventData);

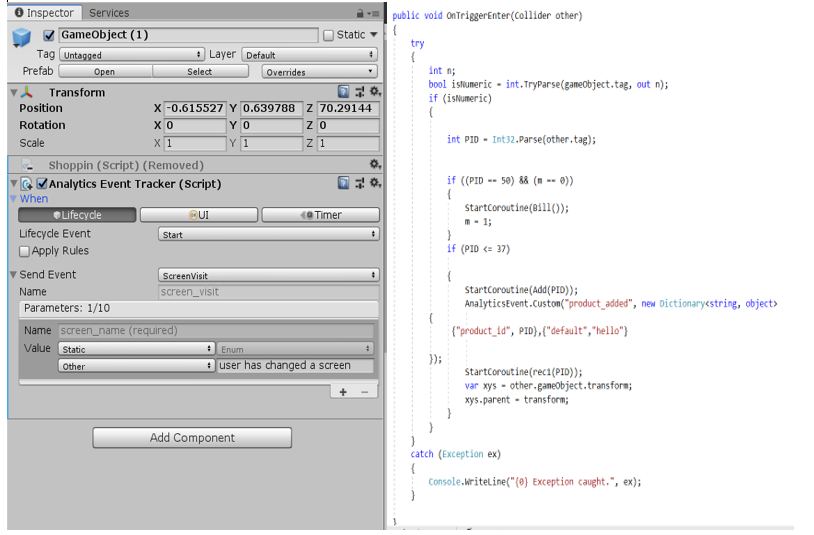


Figure 3 Screenshots to demonstrate the processes using Tracker and through Scripting.

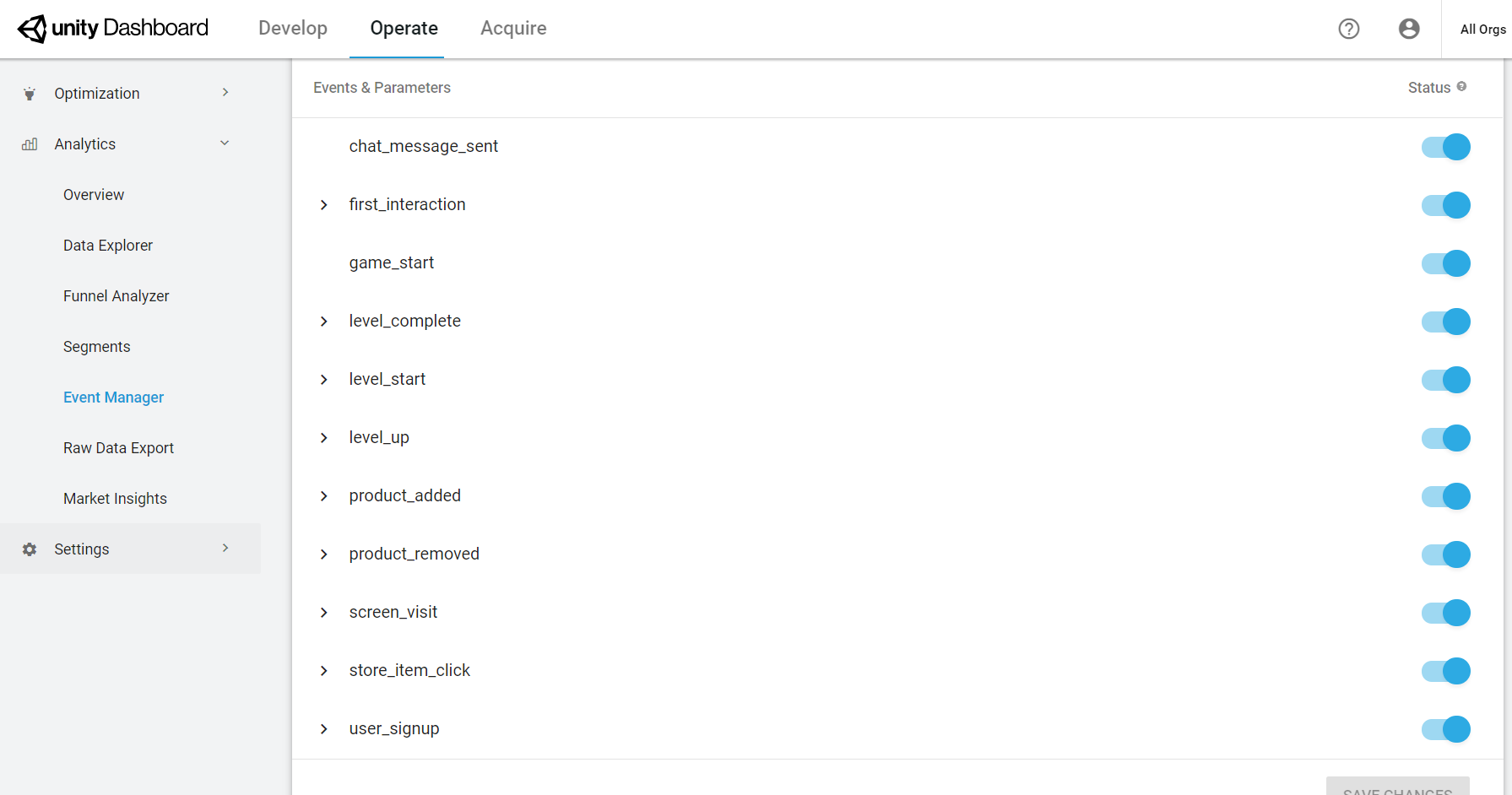


Figure 4 Screenshot to demonstrate the events (standard and custom) used in the project. Picture from the Event Manager from Unity Dashboard

7 HOSTING THE DATABASE ONLINE:

(*Refer to the NOTE at the end of this section*)

Step 1-Setting up the server and creating a instance of a Database.

• Select a Database hosting server. (ex-000webhost.com)

• Create a instance of the database in the server and configure the settings.

• Some of the DB details to note-DB name, DB username, DB password and server name.

Step 2-Export the Application Database.

• Log in to the phpMyAdmin application.

• Select the application database in the left navigation menu. The database is named "vrsupermarket\_normal".

• Select the “Export” menu item.

• On the resulting page, select the “custom” export method and the “SQL” output format.

• Click “Go”.

• An SQL export file will be created and downloaded to your desktop.

Step 3- Import the downloaded SQL files.

Example – For 000webhost

• Log in to 000webhost.

• Go to CPanel(Control panel).

• Under databases section open phpMyAdmin.

• Select the database instance created in step 1 and import all the SQL files downloaded in Step 1.

• Select the new database (previously created in the server) in the left navigation menu.

• Select the “Import” menu item.

• On the resulting page, select the SQL export file created in Step 3.

• Click “Go”.

• The original application database content will now be imported into the new 000webhost database. A confirmation message will be displayed.

Step 4-Update the below details in each php file.

• Change the server name, username, password and dbname in each php file. (Details entered in step 1).

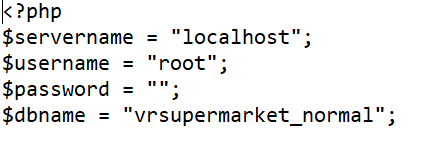


Figure 5 Contents that needs to be changed in the php file

Step 5-Upload the php files on to the server.

Example -For 000webhost

• Log in to 000webhost.

• Go to CPanel(Control panel).

• Under the File manager section.

• Upload the php files here.

7.1 Changes in the C# files

To deploy the game from the localhost to a server the following changes need to be made in the C# scripts to access the upload php files:(The number of links tells the number of places the link needs to be changed)

CharacterCreator script:1link

DataInsert script: 1link

Mouseover script: 1link

Shoppin script: 3 links

TFGH script: 1 link

Web script: 15 links

Example:

using (UnityWebRequest www = UnityWebRequest.Post("http://localhost/NUP/uni2d/InsertUser.php", form))

should be replaced with:

using (UnityWebRequest www = UnityWebRequest.Post("https://smartmart4life14.000webhostapp.com/InsertUser.php", form))

The general syntax on 000webhost service:

[*yourwebsite.000webhostapp.com/filename.php*](http://yourwebsite.000webhostapp.com/phpconnect.php)

Reference video on 000webhost:

<https://www.youtube.com/watch?v=3Im3veamB-s&ab_channel=Creagines>

NOTE:

1. This process might differ for different hosting services but the general idea is to deploy the database, upload the php files, edit the credentials on the php files and access the uploaded php files from C# script using the corresponding URL.

2. This excludes the deployment of recommendation system where-in the additional process will include the uploading of the model files namely- cos\_model, pop\_model, model\_file to the server and getting the recommendation from there. **Or might include the use of Unity APIs to use machine learning models.**

But the models have been tested for multiple users on the localhost server.

8 BUILD AND RUN THE GAME:

Building the game allows you to execute outside the unity environment. Go to File option and click on Build settings.

Choose the target platform (this is application has been tested on PC, MAC and Linux standalone) and click on build and run.

It will prompt you to specify the location where the game will be stored, give a convenient location. It will take sometime to build and a new window with the game will be opened.

9 SNAPSHOTS FROM THE GAME:



Figure 6 A glimpse of a scene from the game

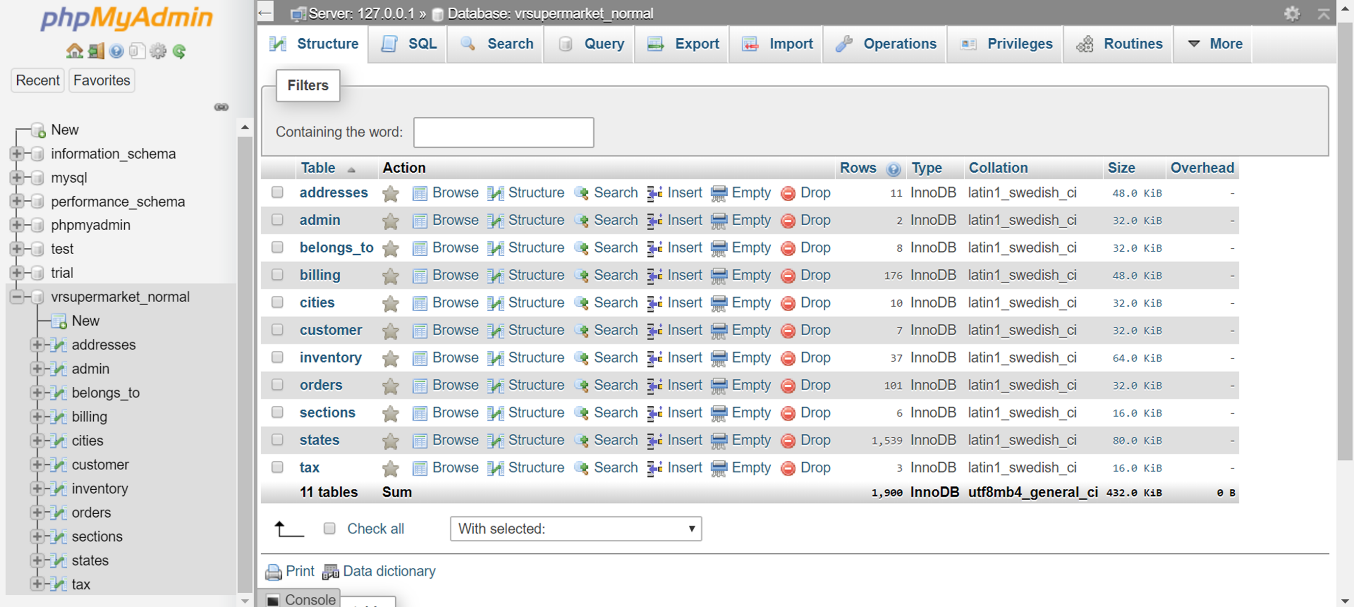


Figure 7 Tables in the database



Figure 8 Real-time recommendations based on the products you pick!

A basic walkthrough of the game can be found here:

<https://drive.google.com/file/d/1HIrarjNkQBf1DAizsFMtG0cuPCaPOsgx/view?usp=sharing>