TOWARDS THE DEVELOPMENT OF AUGMENTED REALITY FOR JEWELLERY
(REPORT)

Submitted By:
Abhishek Banka (IRM2013018)
Amritesh Singh (IRM2013020)

Table of Contents

1. Introduction

With augmented reality reaching common platforms such as smartphones and tablets, the market is ripe for an AR development explosion across every conceivable application niche. One such application is the use of this technology in the world of jewellery.

a. Purpose

We propose an AR-based system that provides an environment for users to place 2D/3D versions of jewellery into the real world through the use of AR markers. The proposed system allows users to decide where to place the object in real world. Once the object has been placed in the scene, it will be displayed accurately according to the aspects in the original scene. The proposed system solves the problem of viewpoint tracking and virtual object communication.

b. Scope

The system mainly consists of a single camera, for example, the webcam of a user's laptop, and a display showing the output of the virtual mirror. It will decide the appropriate accessories for the particular body part of the user in front of the camera. The system will also detect and track the movements of the user.

2. System Overview:

The following interfaces and modules will be integrated into the system to create an augmented reality application.

a. Modules:

The proposed system can be divided into five modules:

i. Camera:

A real world live video is streamed as input from camera to the device. It provides an input to the image capture module.

ii. Video Capture Module:

The live video feed from the camera is sent to the image capture module for analysis, by analyzing each frame in the video. It generates binary images that are provided as input to the image processing module.

iii. Video Processing Module:

The binary images are processed using an image processing technique to detect the AR marker. Detection of AR marker is essential to determine where to place the virtual object. Once the marker is detected, its location is provided as an input to the tracking module.

iv. Tracking Module:

This module calculates the relative posture (position and orientation) of the camera in real time.

v. Rendering Module:

There are two inputs to this module: the calculated pose from the tracking module, and the virtual object. It combines the original image and the virtual components using the calculated pose and renders the augmented image on the display screen of the device.

3. Non-functional requirements:

a. Responsiveness

The responsiveness of the system will depend on the availability of a high-end CPU, the integration of individual hardware components

b. Effectiveness

The system will be more effective if the size of the set of jewellery items available increases, providing more varied options to the user.

c. Quality

Optimization of hardware systems and the algorithms used will result in a high quality product.

d. Cost

The cost of incorporating all the functionality and hardware for the system is high.

e. Usability

The product should not pose difficulty of usage to users with limited understanding of augmented reality and software systems.

4. **Tools Used:**

The following interfaces are integrated into the system to create an augmented reality application.

a. Hardware interfaces:

A high-end computing device is required for the development of the proposed system. The system also consists of an integrated webcam to stream and render the live video feed to the device.

b. **Software interfaces:**

i. A simulation engine, **Unity**.

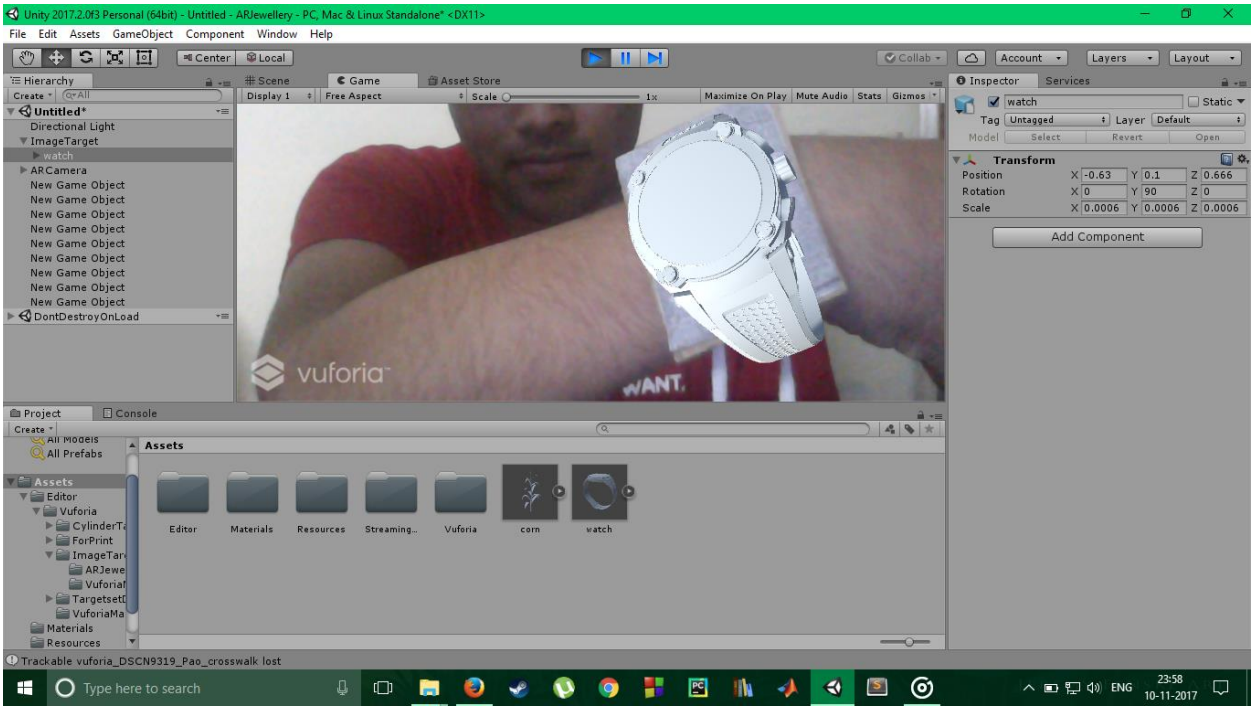
ii. An augmented reality development package for Unity, **Vuforia**.

5. **Setting Up the Project:**
    a. **On Vuforia website:**
        i. Go to **Develop → License Manager** and get development license key.
        ii. Go to **Develop → Target Manager** and create a database of targets or markers by uploading single images.
        iii. Download and store the database as a Unity package in the project folder.

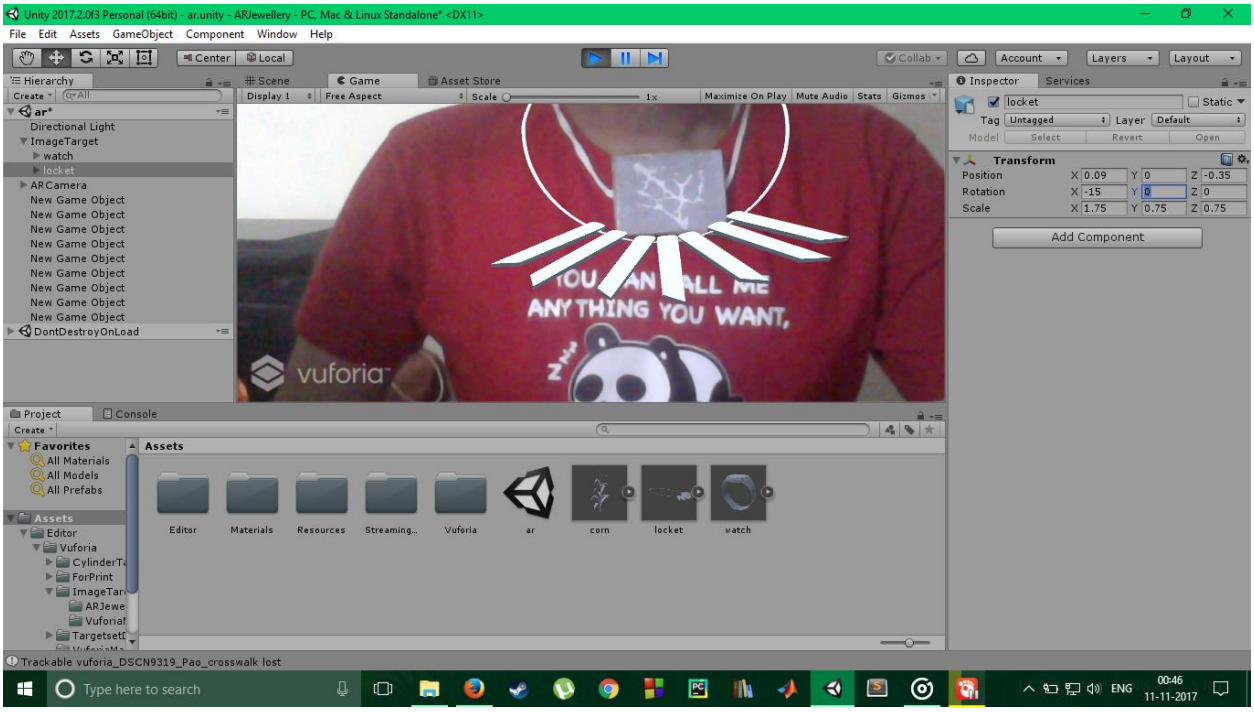
    b. **Inside Unity:**
        i. Open the project folder in Unity.
        ii. Go to **File → Build Settings → Player Settings** and open the **Inspector**. Go to **XR Settings** and check **Vuforia Augmented Reality**.
        iii. Go to **Assets → Import Package → Custom Package** and import the database downloaded earlier.
        iv. Go to **GameObject → Vuforia → Image** and upload an image to be used as marker. In **Inspector**, go to **Image Target Behaviour (Script)** and select the desired **Database** and **Image Target**.
        v. Go to **GameObject → Vuforia → AR Camera** to create camera object and place this object above the marker. In **Inspector**, go to **Open Vuforia configuration → Datasets** and check the boxes for **Load ARJewellery Dataset** and **Activate**. Also, paste the license key obtained earlier in the relevant text box.

6. **Running the Project:**
    - **a.** Go to **Assets → Import New Asset** and import the desired object (.obj) file.
    - **b.** Drag and drop the object onto the workspace and manipulate its position, orientation, and scale as desired with respect to the marker.
    - **c.** Make the object a child of the **ImageTarget**.
    - **d.** Press the **Play** button to turn on the webcam.
    - **e.** Place a hard copy of the marker image in front of the webcam.
    - **f.** The virtual object is displayed on the screen.
    - **g.** Repeat steps (a) to (f) for different accessories.

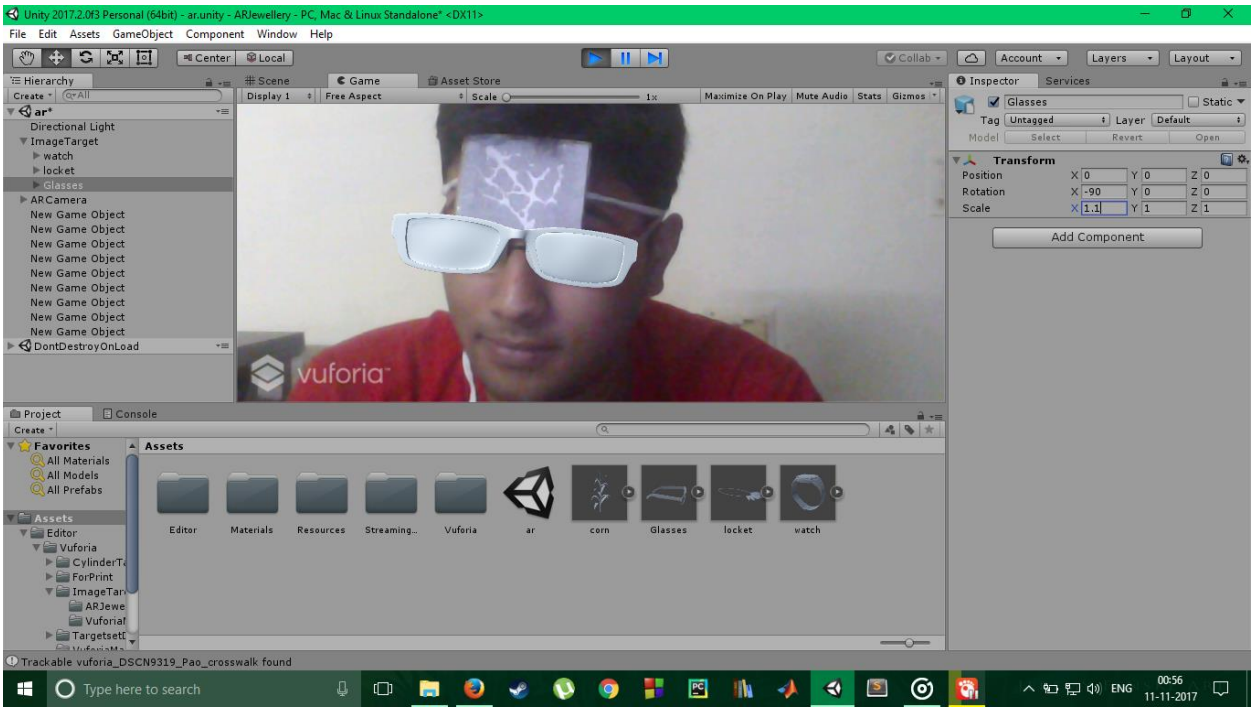
7. Screenshots



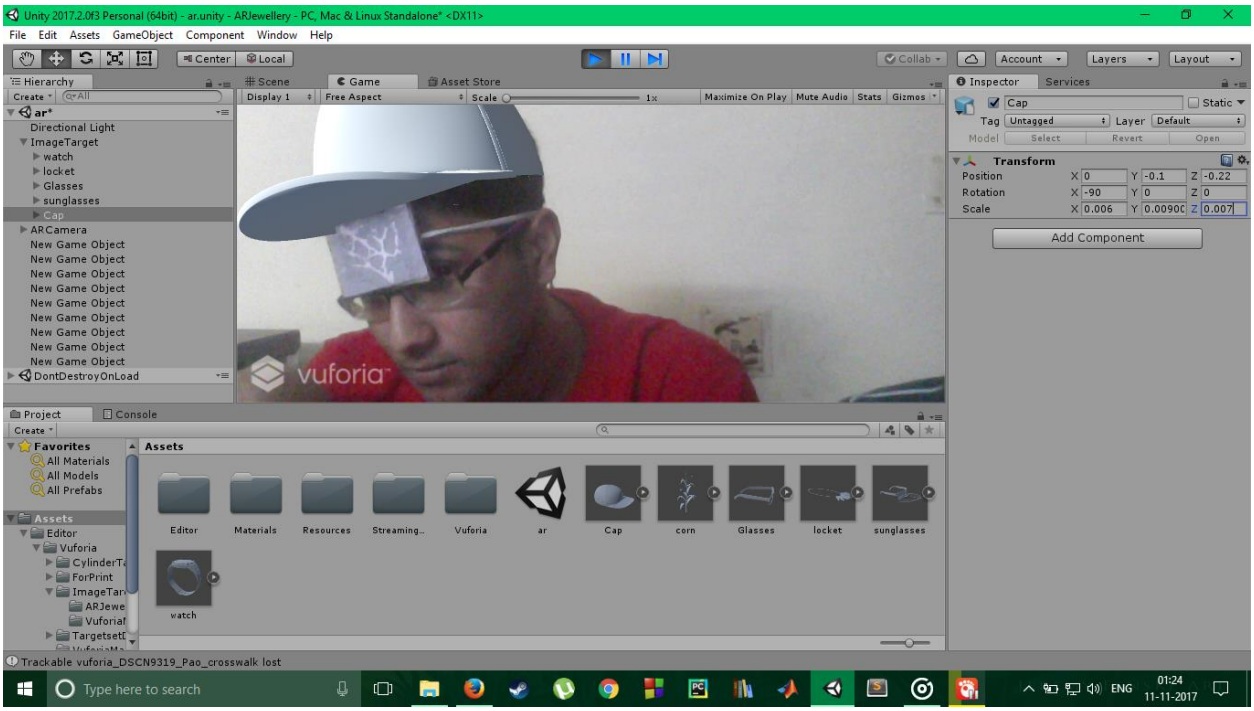
Accessory 1: Watch



Accessory 2: Necklace



Accessory 3: Spectacles



Accessory 4: Cap

8. Conclusion:

Therefore, the software requirements specification document is intended for the development of an AR-based system providing an environment for users to place 2D/3D versions of jewellery into the real world through the use of AR markers and displaying it accurately according to the aspects in the original scene, while also solving the problem of viewpoint tracking and virtual object communication.

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