Implementing Markerless Augmented Reality, Object Position Awareness

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Abstract

With the rapid advancement of technology and hardware, mobiles and other hand held devices are becoming more and more widely used by people for their accessibility. Any successful mobile application has thousands of downloads and the best applications have millions. One new rising category of these mobile applications is augmented reality location based applications. Our game aims to tackle this field using object detection and geographical location in order to implement a real time markerless augmented reality location based mobile game that enhances awareness of object positioning by using the sensors of the mobile device.

1 Introduction

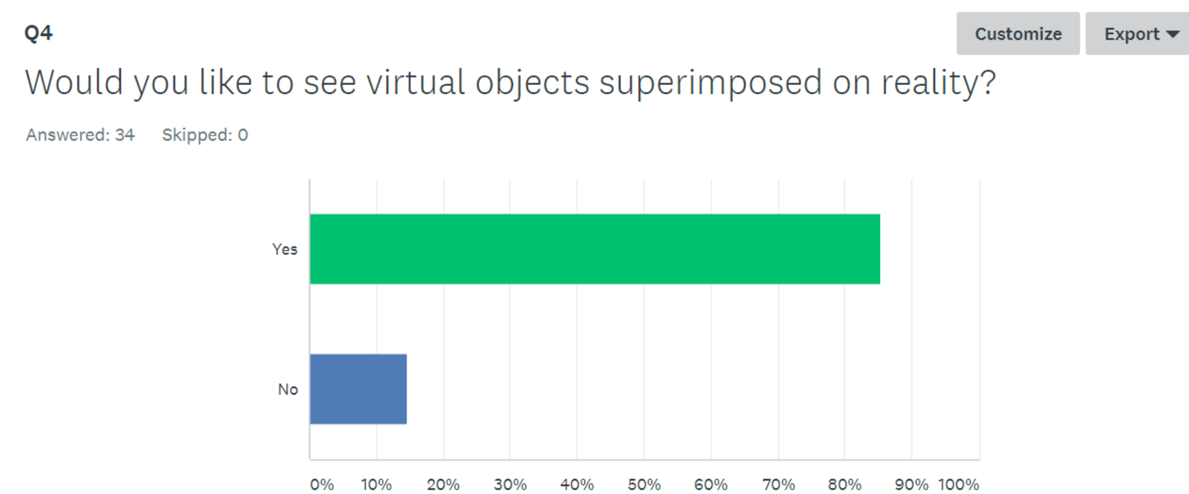
1.1 Background

The top level domain of this project is HCI, delving deeper into this category the system makes use of artificial intelligence and computer vision in order to compute and perform operations that allows object detection [11] to occur, which provides markerless augmented reality to display augmented information which is our selected domain. Our project discusses the problems of object detection to be able to apply an object to a real time place and to snip into it. The use of geolocation [2] will help pinpoint the user's object when it's applied. The compass sensor helps to know the orientation of the applied object, so we can get a more detailed discretion of the location of the augmented object.

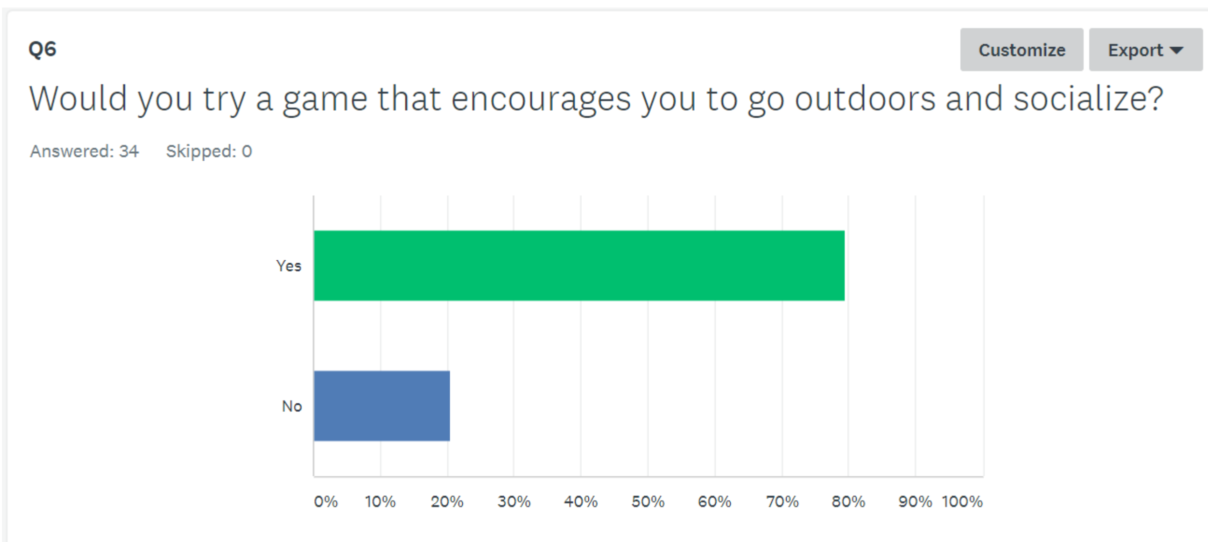
1.2 Motivation

In Egypt 2016, Tourists have decreased by roughly 50 percent [1], and there weren't any attraction to Egypt because besides the fantastic touristic places, there wasn't a real mean to come through Egypt. So our project may motivate tourists to come to Egypt to play our game, to attract them to certain areas where they can play on, and have certain quests to be able to conquer the game.

Market motivation: Through out the applications on google play and app-Store, Augmented games attracted the attention of all the users. Pokemon GO a location based augmented reality game made in 2016 have 100 million downloads. That means that most people are looking for these kind of games.



According to our surveys, people are interested in putting augmented objects on real time objects and snip it.



According to our surveys, people are interested in going out and socializing with others in order to play the game. A location based game would help people interact with one another in order to win.

1.3 Problem Definitions

Our goal is to create A Markerless Real-time Augmented Reality Application that enhances awareness of Object positioning . The Geolocation helps locate the user when running the project to mark the pasted object and store the coordinates in a cloud database. The object detection detects real time objects, and projects the augmented object on the detected real time object. The compass sensor will be able to get the orientation of the augmented object. The sensors will give extra information on where object is located like orientation or position facing.

2 Project Description

Our system will create a markerless real-time augmented reality application that implements geolocation and object detection, with the help of the smartphones for the use of sensor fusion.

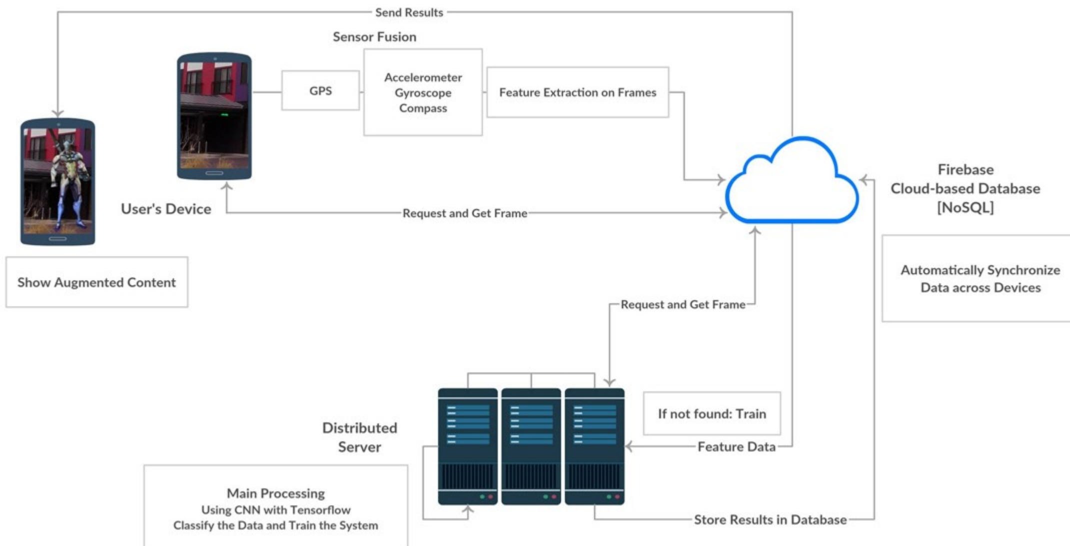
2.1 Objective

Our objective is to develop a location based game that will allow the user to place an object in a markerless real time place [2]. The sensors in a mobile device will get a more accurate reading with the geolocation. The game will give a sense of entertainment for the user to have fun with a new augmented reality application. The game will give the developer a new way to handle object positioning in real time places using a smartphone.

2.2 Scope

1. The system will be able to detect real time objects.
2. The system will recognize the object.
3. The system will augment the augmented object in real time markerless objects.
4. The system will detect the coordinates of the placed augmented object.
5. The compass sensor in the mobile device will get a more specific reading on the placed augmented object.
6. The augmented object would defend and attack.

2.3 Project Overview



First, The mobile device will collect the information from the mobile sensors, which are the geolocation, compass and the frames of the real time object. The mobile will apply a feature extraction algorithm [11], which will extract the main features of the captured frames. This will enable us to send the data more lightly and swiftly to the cloud database. The sensors will be recorded the moment the user decide where to place an object. The sensors will be combined and store it with extra information like event-time stamp [12]. Then both of the information is sent to the cloud database. The cloud database (firebase) will be able to store the raw data and the sensor fusion. The cloud database will then send the feature extracted frames to the servers to be processed. The servers will then apply the object recognition algorithm CNN using the Tensorflow API to identify the real time objects in the feature extracted. If the accuracy is high, then the server already trained itself on that project. Else the server will train itself to recognize these objects again, by requesting a frame from the mobile device and train itself with the original frame. The servers will then send the processed data to the cloud database for storage. The mobile device will request the processed data from the cloud database. If the processed data existences then the cloud database will send it to the mobile device to output it into an augmented reality object.

3 Similar System Information

Second surface [2]: multi-user spatial collaboration system based on augmented reality: is an application that allows the user to post pictures, videos or drawings in real time objects using augmented reality. The main problem was to post a post in a place and being pinned in the same place and on real time object. The researches used Vuforia [2] and dictionaries to store classifiers to be able to pin the posts without markers. Our project will use the markerless part in this paper which will help us to place an object without marker.

iAR [7]: an exploratory augmented reality system for mobile devices: is a system made to capture a real time object and project it using augmented reality. The main motivation is to use object detection to detect the real time object and project it. The main problem of the work was to find the right algorithm to work with, as there were many algorithms to detect real time objects [7]. The researchers used Feature Point Extraction algorithm [7] to detect the edges of the real time object, and Randomized Trees Classification to locate the object. This paper could help us to understand object detecting in order to place an object in real time.

Application of augmented reality for supporting instrument service tasks [10]: a system designed to recognize an instrument and project the manual and useful information about it. The problem was to get an accurate reading to get the match right. The paper used Good Features To Track [10] to detect the object and recognize it by using classifiers. This paper would help our project to recognize real time objects. The results for the F-FEM-CON device [10] are significantly worse then the Microsoft results because the F-FEM-CON has a large number of very similar features, which led to the confusion of the algorithm.

Speeded-Up Robust Features (SURF)[5]: This paper is written to explain the SURF algorithm and it's uses. The SURF algorithm is used to detect objects in real time [5]. One of its application was a graffiti scene and the SURF [5] showing the size of the oriented descriptor window at different scales. We will use this paper to help understand the principles of SURF algorithms.

Standalone edge-based markerless tracking of fully 3-dimensional objects for handheld augmented reality [4]: The primary aim of this work is to allow the development of standalone augmented reality applications for handheld devices based on natural feature tracking of fully 3-Dimensional objects. The OpenGL ES graphics library [4] was used to detect the visible edges in a given frame, taking advantage of graphics hardware acceleration when available. This paper will help us to place a 3D object [4] in a markerless plane.

Show Me How You Move and I Will Tell You Who You Are [9]: In this paper they have created a system used to is to provide researchers concerned with geoprivacy with means to evaluate various sanitization techniques and inference attacks on geolocated data [9]. The main idea is to offer a generic and flexible tool so that anyone can easily plug a new sanitization technique or inference attack [9]. In order to make in work they used Density-joinable cluster algorithm. It clustering algorithm taking as input a minimal number of points minpts, a radius and a trail of mobility traces. This project could help us track the users using geolocation.

Analysis and Comparison of Feature Detection and Matching Algorithms for Rovers Vision Navigation [6]: In this paper, the cost of time, amount of features, amount of matching points and ratio of false match of these three methods mentioned above are studied and compared by experiments. The paper took a picture and ran three algorithms Harris, SIFT and SURF.)Harris corner detection algorithm [6] has the highest speed and costs the least time, and the number of matching points can be artificially set. SIFT could detect a large amount of feature points with plentiful matching points and high matching accuracy. SURF is a speed up algorithm of SIFT. This paper helped in our project to be sure which algorithm is going to be used depending on the speed and accuracy.

Deep People Counting with Faster R-CNN and Correlation Tracking [3]: The system uses Faster R-CNN head-shoulder detector to detect people with multiple poses and different views. In addition to that, the system uses kernelized correlation filter(KCF) [3] to track people. They achieve robust people counting by taking advantage of Faster R-CNN [3] based head-shoulder detection and correlation tracking results.

3.1 Similar System Description

The similar system is called Deep People Counting [3], the project's main problem is to detect people from the head and count them in a crowd. The system uses Faster R-CNN [3] head-shoulder detector to detect people with multiple poses and different views. In addition to that, the system uses kernelized correlation filter(KCF) to track people. The combination of these two methods allows the system to count people in crowded open scenes. Due to the difference of the perspective between oblique and vertical camera views, the people's appearance is different at different situations. The system is able to reliably detect people in both views. In the system Second Surface [2], the system was able to add an augmented object superimposed on a real time objects markerlessly. The researches used Vuforia [2] and dictionaries to store classifiers to be able to pin the posts without markers. Our project will use the markerless part in this paper which will help us to place an object without marker.

3.2 Comparison with Proposed Project

Project/Key Points	API	Algorithms	Object Detection	Geo Location	Sensors	Accuracy
Proposed System	Tensor Flow	CNN	Yes	Yes	Yes	N/A
Deep People Counting	N/A	Faster R-CNN	Yes	No	No	High
Second Surface	Vuforia	N/A	Yes	Yes	Yes	High

3.3 Screen Shots from previous systems

This system detects the face and shoulders of people passing through. This will able to detects the number of people passing and maybe eventually identify them.

4 Project Management and Deliverables

4.1 Tasks and Time Plan

Task Name	Start Date	End Date
Submit Ideas	2-Jul	15-Jul-17
Announce Proposal For Students	16-Jul-17	22-Jul-17
Proposal Evaluation	26-Sep-17	-
SRS Evaluation	3 Days After Mid-term	-
Prof. Jiro Tanaka	3-Dec-17	11-Dec-17
Evaluation Implentation	After Mid Term by 3 days End of march	-
Technical Evaluation	1 week of may	-
SDD Evaluation	3 Days After Final	-
Final Thesis	After final exam by 2 weeks	-
Cermoney	1 day after Final thesis	-

4.2 Budget and Resource Costs

Product Name	Price
HTC Desire 628 Dual Sim	2,799
Seagate Personal Cloud 1-Bay Network Attached NAS Storage	3,888
MSI GTX 970 4G GDDR5	3,250

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