

M.A.M System

Mobile Aided Manufacturing

Final Report

Wordcount:1660+300

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1.Introduction

Our Application is aim to help the user to have a better way to assemble things like toys or furniture. It is true that some people love that, but most people suffer from it.

Our Application provides 3D viewing of the things to be assembled instead of 2D drawings and an interactive tutorial system to tell the user how to operate step by step. We also add a AR function to the application so that if you have small parts to install you can know exactly where it would be on the real things. With these function people can assemble things effectively and will have a big fun during the process.

2. Overall Design

The Overall Design is broken into 2 Parts the Server and the Client as shown in figure below

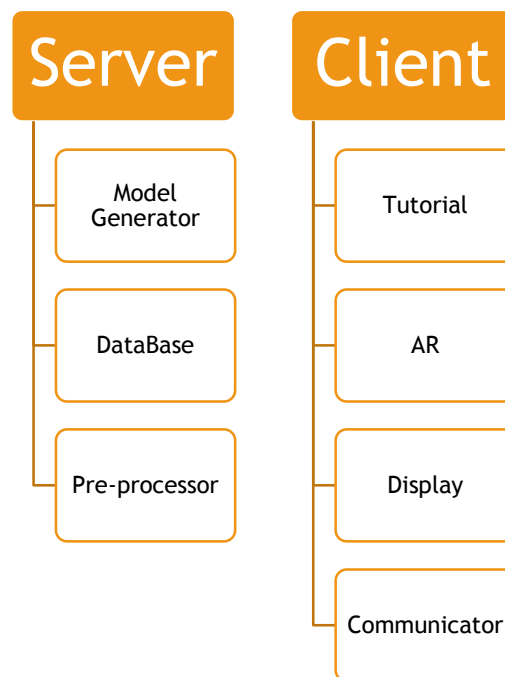


Figure.1 Block Diagram

2.1 Model Generator

Model Generator play the role of generating the 3D model, in our project we are using CATIA V5 R14 as our 3D model generator cause it's strong usability and functionality.

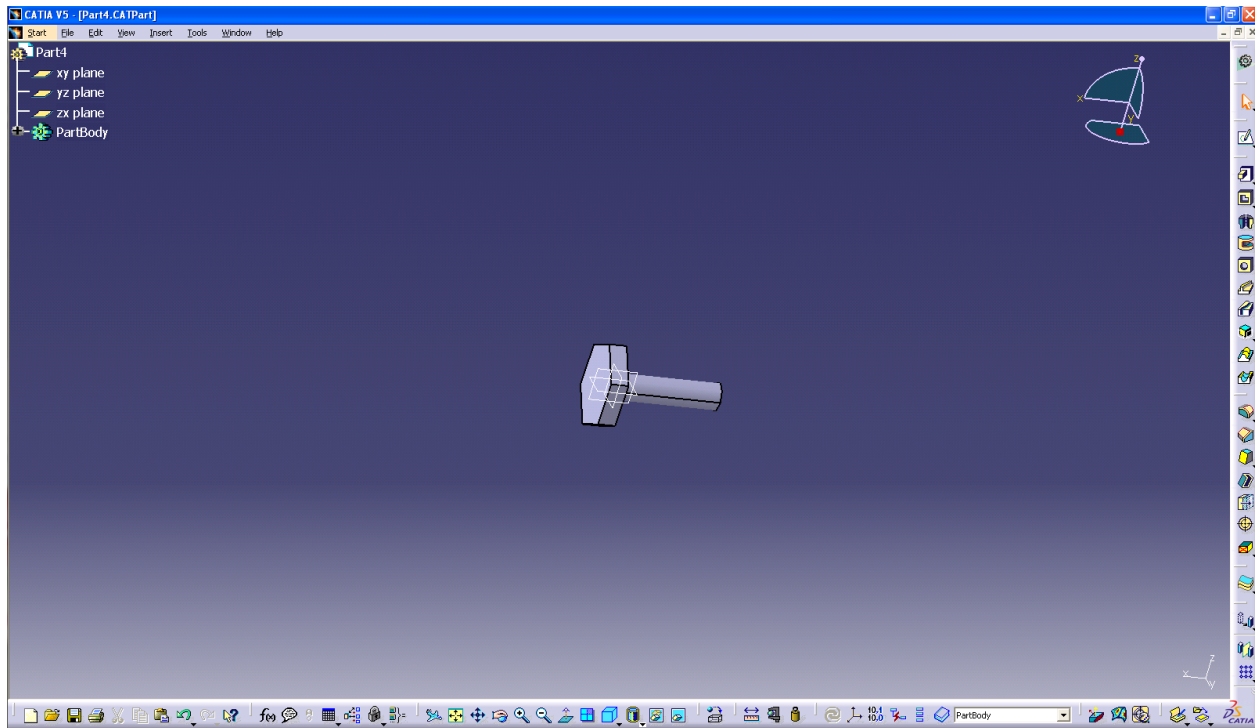


Figure.2 CATIA V5 R14 Working Bench

We choose the file type .stl as our 3D model file type.

2.2 Pre-processor

In the Pre-processor we need to do several things.

Change the file type from .stl to .obj, since .stl is a common type among the 3D model develop software but cannot be read as a text document by android so we have to change it to .obj a pure text file that only contain the geometry information. We are using blender to do this.

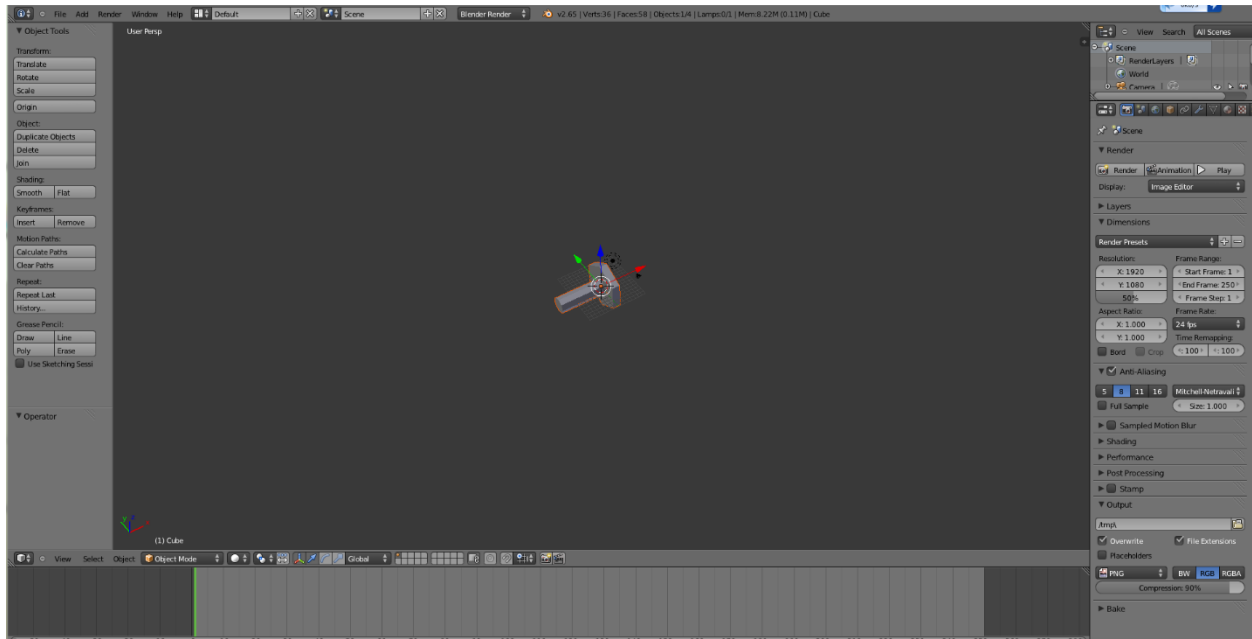


Figure.3 Blender Working Bench

After changing the file format, we need to order their name in a certain order for the tutorial.

Name “main” to the object that always visible in the tutorial and “Part 1” to the model that will show in step 1 until you assign all the model a proper name.

2.3 DataBase

The DataBase holds a several tables with the information of every part of the project.

	A	B
1	Name	Directory
2	main	D:\Model\Project1
3	part1	D:\Model\Project1
4	part2	D:\Model\Project1
5	part3	D:\Model\Project1

Figure.4 DataBase Table

For every project we use a separate table.

2.4 Communicator

The Communicator will first read the DataBase in the server then download the model to the phone base on the information read from the project table.

2.5 Display

The display part display the 3D model that downloaded by the Communicator and allow the user to zoom, rotate, move the model. We are using Unity as our engine.

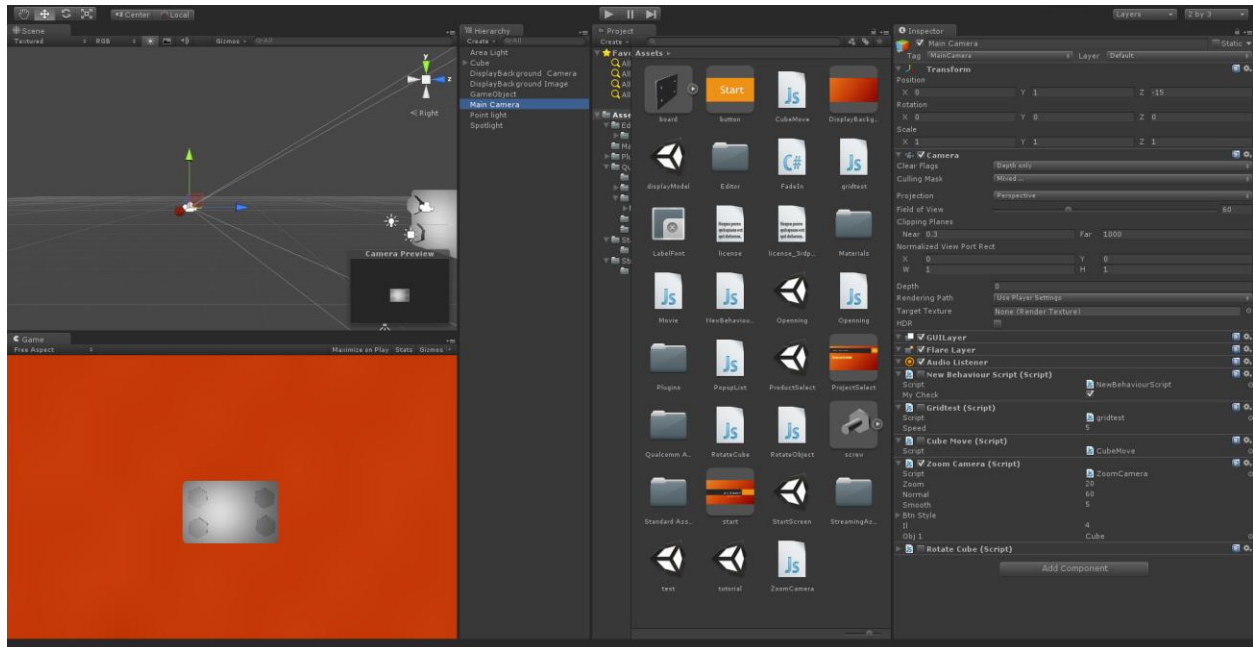


Figure.5 Unity Software

2.6 Tutorial

The tutorial part will provide a step by step tutorial to the user showing what to do by first showing the main part and then part1 and so on.

2.7 AR

This part will allow the user to start the AR function. We are using Vulforia Qcar for unity extension as our AR package.

3. Statement of Functionality

3.1 Starting screen



Figure.6 Start Screen

Press “Start” to start the application.

3.2 Choose Project

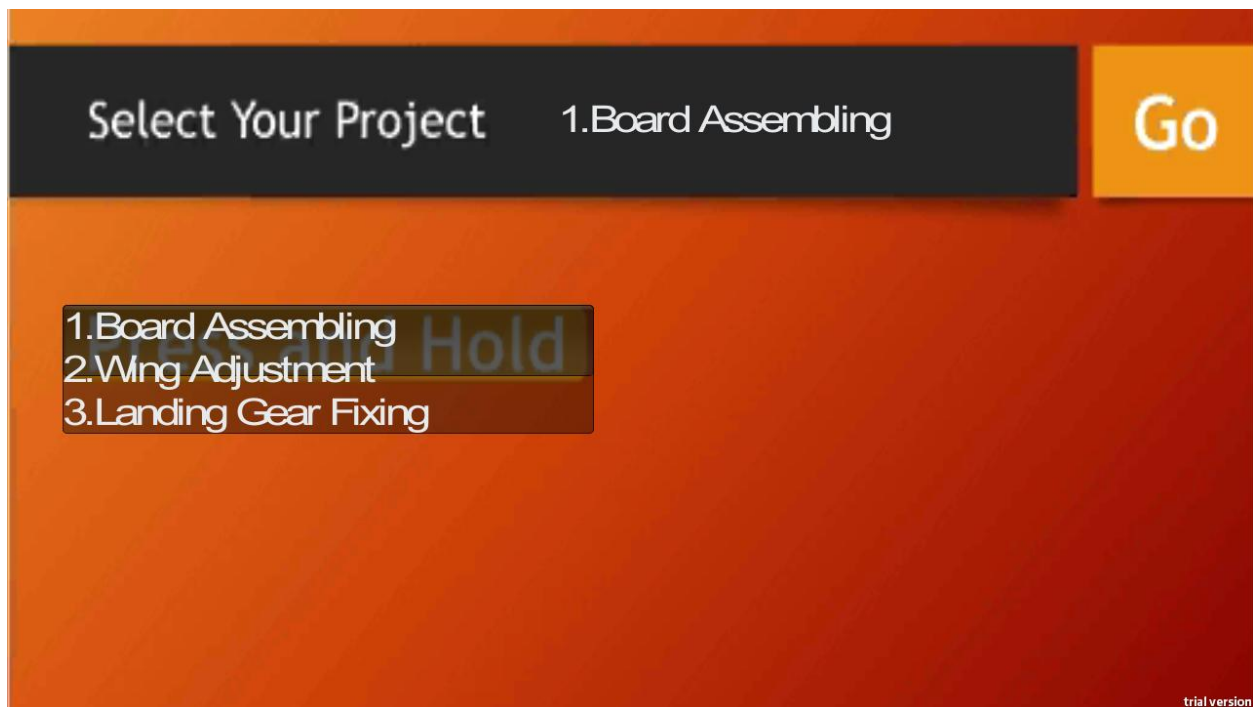


Figure.7 Project Selection Screen

An activity assign to the Unity project will allow it to read the data base in the server side and download the model to the phone.

Press and Hold the button to show all the project available on your device and choose one press "Go"

3.3 Main Screen

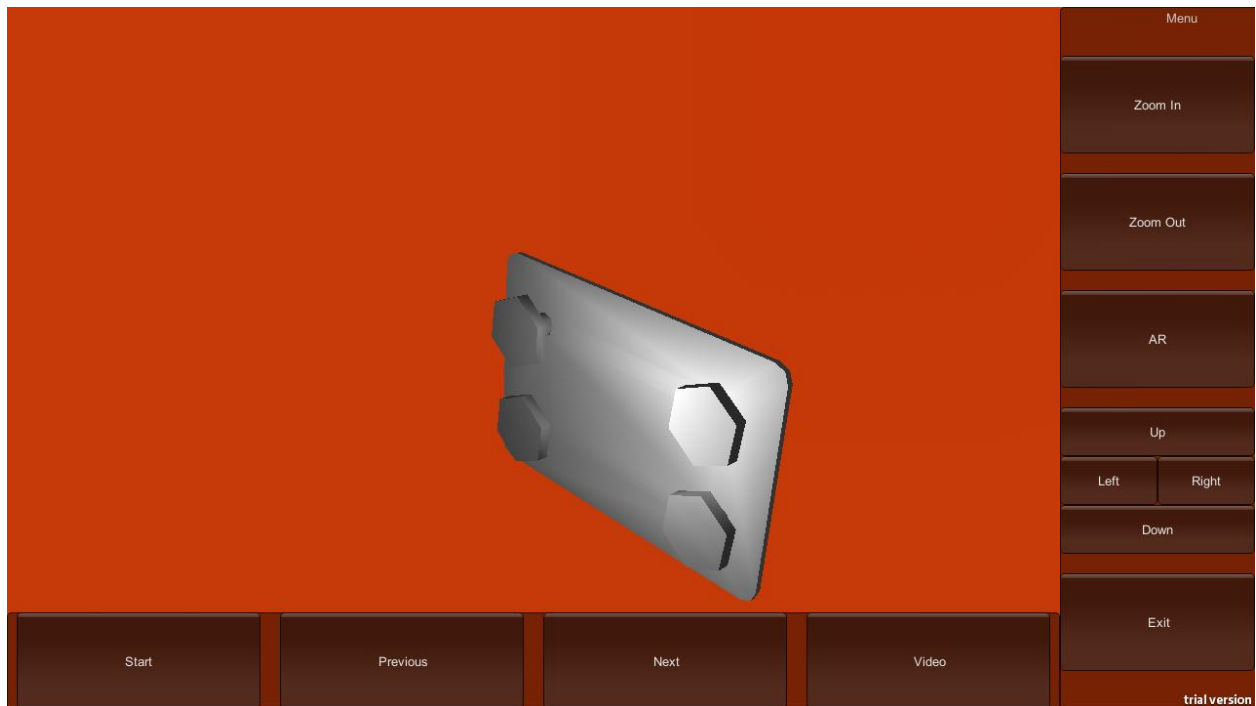


Figure.8 Main Screen

The Main screen display the model and let the user have the ability to zoom, rotate and move the object.

3.4 Tutorial

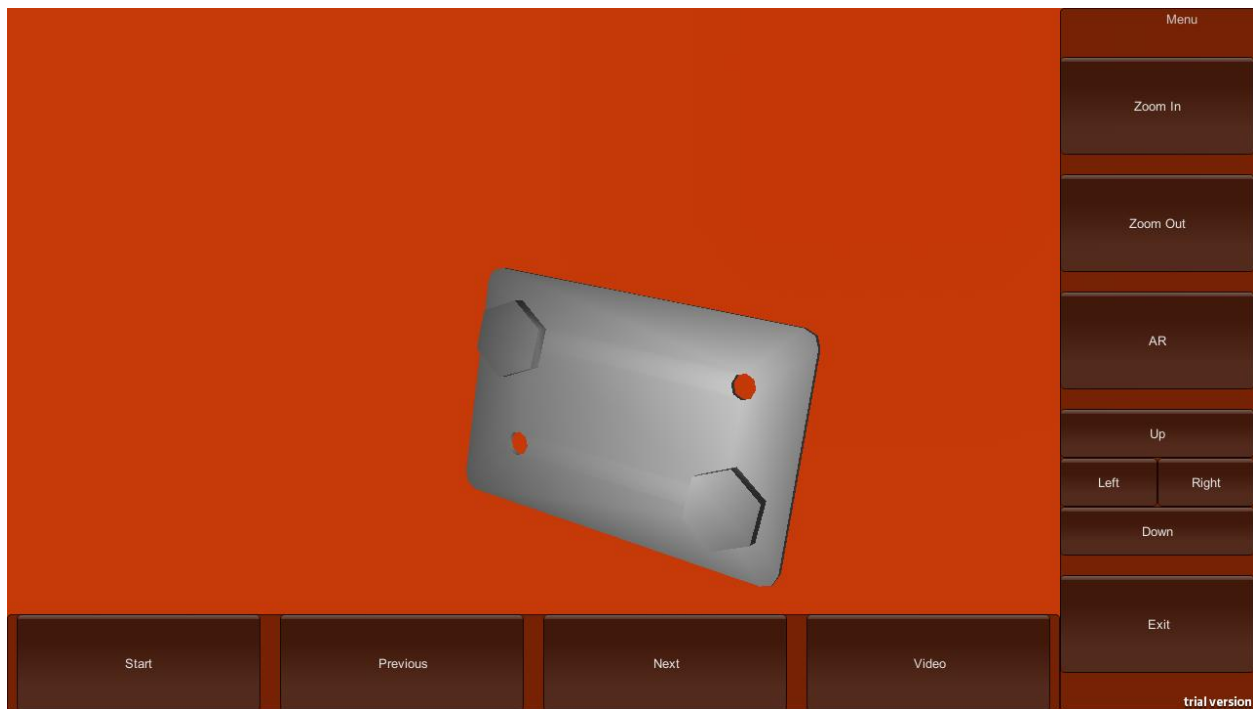


Figure.9 When Tutorial function starts

By pressing the “Start” button in the main screen we enter the tutorial part press “Previous” “Next” to see what to do next or review the step before. If you press “Video” button a tutorial video will show.

3.5 AR Function

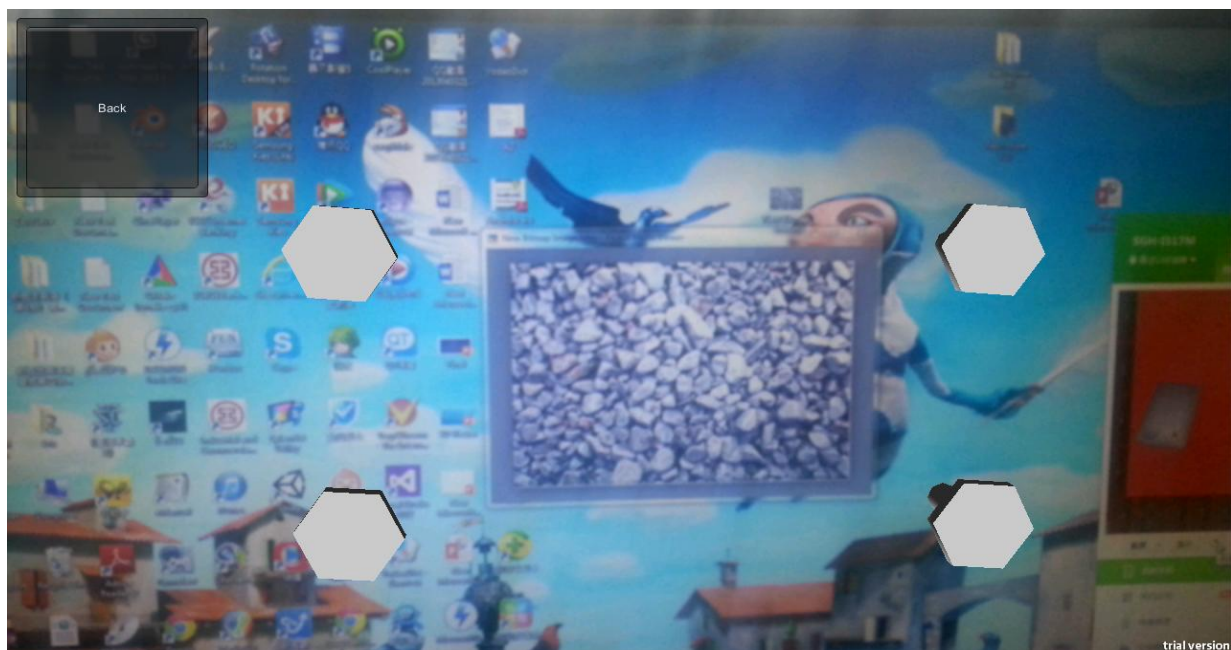


Figure.10 AR function Screen

By pressing the “AR” button we enter the AR mode. In this mode the main part of the project will be hidden, and the thing with the certain tag on it will show by the camera. In this case the screen is the thing with the tag instead of the board in the 3D model.

4. What did you learn

Through the building of this app we’ve learnt many things:

At first we are trying to build this app with OpenGL, but after many times of trying, we found that with OpenGL the interface looks awful, so we tried to use Unity and found it is much better and more effective, we are fresh to Unity so we learnt how to build scenes, writing scripts from the beginning. And we also learnt how to integrate Android activity into Unity. Finally we learnt how to use Qcar in a Unity platform.

As an apper I learnt how to design UI in Unity and how to arrange the life-cycle of a project to make it run. And I have realized some facts:

Make your goal understandable to the programmer: When I said “We should do it this way.” And the programmer said yes. But when he finished the code, it has been far away from your thought. It happens to us many times. When they done the code, the app is not what we thought anymore. I think the Apper and the Programmer should communicate more often to solve this problem.

The tools that used to develop the app should be fixed earlier in the life-cycle of the development: At first we try to use the OpenGL to do the 3D display and the Android layout to do the GUI, later we found it is better to use the Unity IDE to do all these things. But the OpenGL took us a lot of time to learn and code. I think we should first take a wild look at all the tools we could use and then make the decision rather than decided it just by an idea in mind.

Always check the Google Play Store: Recently I found this Store is a good place. By researching it we can find out whether our kind of app is already exist, is it better than what we are doing? Can I use the same idea? How can I make the difference between mine and the one already exists? How many people will download this kind of app? How many paid? These questions are very important for making the goal, and the answers is in the Google Play.

Specify your field: This is a mistake I made in the process as an apper. At the beginning I thought we team should build a software for the assembly of an airplane, but later I found that the user will be very limited so I decide to make the app fits for airplane, toys and furniture, but finally I found

it is impossible to build an app that good at every aspect. For toys the application should provide more interactivity, nicely and friendly UI because toys is for fun, assemble them should also be fun. For furniture the user want to do it more effective rather than look at the beautiful UI ,interact with the device, what they want is just to assemble the furniture A.S.A.P. And for professional area like airplane, we need accuracy. What I learnt here is don't let the App to be all-round, just let it unique.

Use the thing already existed not build them again: We team take several weeks to learn the geometry and programming skills used in AR technology and tried very hard to build the AR library ourselves and we succeeded. But it turns out it is neither accurate nor fast enough to use. Then we find Qcar lib is a very good one already exists. We should use it at first so that we can save a lot of time.

5. Contribution by Group Members

Jingdong Su: As an Apper in the group I design the app structure, created all the UI, 3D models use in our app and design. Find the Unity and Qcar lib and how to integrate.

Jianwei Xu: As an Programmer, he design all the scripts in Unity

Yunan Zhao: As an Programmer, he design the server side DataBase and the

6. Apper Context

I'm an airplane designer, my work is to draw the 3D model of the plane and project them to the 2D drawings and then add some text to make it understandable. So many times the worker using these drawings told me that it is difficult for them to assembly in some certain circumstances. Fortunately in recently years Boeing company start a project to give the worker 3D model instead of 2D drawings. The let the worker bring laptop to the plane to see the model directly , it is a revolution to the manufacturing field

My idea is base on that, since the laptop is somehow a little big for the worker to carry, I think the tablet or smartphone will play the role better. And I think maybe the worker want more than the 3D model, so I add AR function and tutorial part to the app too. This is important because with this app we can let a fresh worker to do the job directly instead of training them year by year to let them remember what to do each step.

Later I think that when people assemble toys and furniture the same problem appears again, and an App for the toys and furniture is much easier to build than the one for he professional area. So then I decide to make the App towards that way.

However, the 3D model will finally take all the place of 2D drawings like what happened in the design field. In the early years we design the plane using pen and rulers and now just the computer. So we are still going to make another App that suit for this case.

7. Future Work

We need to build more GUI into the application, now the menu in the main screen is fixed so it takes a lot of space, we are going to make it a popup menu later. And we are searching for assets in Unity like NGUI to use.

We are using the Qcar package a very limited way. In the future we are going to dig deeper to find what we could do with it. And if we have enough time we may try to build our AR function but it may be a long way.

We think that an app for everything is a bad idea. We need to specify our goal, first we are going to make the software available for the toys then furniture and finally to the professional users. This is specially in airplane manufacturing field, our company is already to start the process to cancel the 2D paper drawings and let the workers take a laptop with them. However, after I told my company that this job is well done by the tablet that is much cheaper and less weight than the laptop they accept this idea

8. Business School

We team do not want to have a business school.

9. Useful Assets

9.1 First I think if you are making a 3D application it is better to use some 3D engine rather than using the OpenGL directly. Here is the link to Unity: <http://unity3d.com/>. (This software has a free version.)

9.2 If you want to make you GUI beautiful you can use NGUI:
http://www.tasharen.com/?page_id=140

9.3 If you have any problem when writing script in Unity, go to forum:
<http://forum.unity3d.com/forum.php> looking for help.

9.4 Always check the asset store before you do something, maybe they are already there: <http://unity3d.com/asset-store/>

9.5 If you are going to use AR :
<http://www.qualcomm.com/solutions/augmented-reality>