

# VR UI Design for Engineering Applications Project plan

**Team Number:** o8

**Client:** Tsung-Pin Yeh

**Adviser:** Chris Chu

**Team members/Roles:**

Yuwen Xia - Project Manager

XueyuanChen - Web Manager

ZhengFang - Testing Engineer

Hongji Luo -Meeting Scribe

Jiancheng Zhang - Report Manager

Ziming Liu - Meeting Facilitator

**Team Email:** [yuwenx@iastate.edu](mailto:yuwenx@iastate.edu)

**Team Website:**

<http://sdmay18-o8.sd.ece.iastate.edu/>

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# 1 Introductory Material

## 1.1 ACKNOWLEDGEMENT

Mr. Tsung-Pin support us a oculus development kit<sup>2</sup> and two razer controllers. Also, Mr. Tsung-Pin provide us some resources about the VR interface design. Tsung-Pin also lead us to his company to show the sample VR interface.

## 1.2 PROBLEM STATEMENT

VR technology is widely used in not only gaming field, but also industry to demonstrate and create the final products for both customers and engineers. Comparing to the traditional computer applications, VR can display the products in real size and change the detail dynamically. What the people observe through the VR device is almost the same with real life.

However, different from the computer applications, which use keyboard and mouse as input devices, the only widely used input device for VR technology is two handle controller; which will be problems when operating or change the product model. For example, if we want to select an item and get its cross section area. In traditional computer applications, we can do so by using mouse to click items and menu; or more conveniently, we can use the shortcut in the keyboard to achieve this function. However, in VR environment, we do not have mouse to select items, and we even do not have menu bars listed on the side or top, so, in order to do this simple operation, we need to cost lots of time.

In order to let the engineers or the customers to do those editing operation efficiently, our team is plan to create an VR UI for the engineering application. By creating the unique menu bars in the VR environment, people can editing the models easily.

## 1.3 OPERATING ENVIRONMENT

We start our design from drawing system such as scratch, then implement our design with softwares such like Unity and Oculus. During the developing process, SDK from OD providers(like C#) will also be included.

Another aspect of operating environment is from user's aspect, and from this perspective the environment is very strict. Since it's VR application, it must be applied indoors and a relatively open wide area. There shouldn't be any other objects but camera and monitor in the room otherwise which could possibly affect user's using experience and even potential hurt users.

#### 1.4 INTENDED USERS AND INTENDED USES

We are designing user interface in VR environment for engineering usage, but our potential users are not strictly narrow to engineers. We try to make the interface as simple as possible and make every user are able to use even first time to VR usage. However, engineers with VR experience can definitely easier to use.

What we are designing for is a software that designing a car in VR environment. Since designing in real material is much more difficult and costly, this new technology makes it easier and more convenient. But designing a car is a difficult process and there are a great number of functions need to be performed. We are trying to make a user interface that could this complicated process as simple and straightforward as possible, even first time user could find it easy to use.

#### 1.5 ASSUMPTIONS AND LIMITATIONS

Assumption:

- Even first time user should find it easy to use.

- People with VR experience should find it effective and not hard to perform.

- The interface should be well matched car design application.

- Interface should be fully functionalized by the devices that we already have.

Limitations:

- Indoor environment with at least one camera and a computer to support running.(with VR required devices)

- No limitations on user but recommended VR experienced person.

- No hardware design.

- Support most common household voltage.

- Cost won't exceed one hundred dollars as long as you have the required devices.

- No geographical constraints.

#### 1.6 EXPECTED END PRODUCT AND OTHER DELIVERABLES

The expected end product will be a User Interface for VR engineering applications. The specific engineering function will be excluded; however, the transaction between UI, such as menu to menu, button to button would be necessary. The key point is this UI should be

accepted and acknowledged by both engineers and non-engineering customers. The literature survey, project progress, project report and informal survey should be delivered.

### 1.7 GOALS

The main goal of this project is to build VR Interface. According to the client's demand, our team will focus on the VR Interface design and will make sure the interface is easy to use.

The current goal of our team is to design an VR interface. This interface should easily for people to use and compile with different functions, such as measuring the size of the part in VR environment.

## 2 Deliverables

1. **Literature review:** VR-related technical papers and patents on VR UI designs.
2. **User study:** to evaluate whether a VR UI can be more intuitive to use than a traditional desktop UI when performing complicated engineering tasks.
3. **a Unity program to demonstrate VR UI:** design and which allows users to perform multiple engineering tasks.

## 3. Design

As primary purpose of our project is simplifying the control of the application, we will design a user interface that can combine some of the functions and let the users can using the application with less operating. The specific design progress will be modified as the function of the application will be modified.

### 3.1 PREVIOUS WORK AND LITERATURE

As the beginning of our project, we did not pay attention on how other people and company deal with the VR UI design, and we are doing our UI without learning others UI as examples. And we made lots of basic problems as result. We realize that learning from others' experience is important and fundamental task that we need to complete, therefore, we have started to rework on the literature review part.

For now we are looked through several companies as examples, including Tilt Brush from Google, VRED from Autodesk, ICIDO from ESI and many VR video games from PlayStation and PC. Considering the VR environment is wilder than 2D environment, and the body language can also be considered as one of the input method through camera, the varieties of users interface design style for VR environment is much larger than the its in traditional 2D environment. Specifically, the user interface design style might be different

due to the application audience, the space needed and the functions that we want to achieve.

For example, in Tilt Brush, people will have large space to perform the painting, so the interface can stick with the left controller, which is held by user all the time. By contrasting, people will have limited space for visiting automotive interior in car experience VR application VRED made by Autodesk. In this case, the user cannot have large menu besides hand, instead, a smaller interface will be more appropriate.

Besides, VR technology has been improved a lot in this decade. There are lots of new concepts and ideas that have been used in this technology, which increase its usability and functionality. It will be more efficient to do our work by studying and getting inspiring from those new concepts and ideas.

## 4 Project Requirements

The goal of this project is to develop a user interface for industry engineers to create or modify product models. This UI should handle complicated engineering tasks. In the meantime, this UI should accept various VR input devices.

Hardware requirement: Oculus development kit with two controllers, PC is capable with VR.

Overall, design a VR UI with creative operation approach, as well as user friendly and new look.

### 4.1 FUNCTIONAL REQUIREMENTS

#### 4.1.1 Interface requirements

As a virtual environment application, this user interface should solve the most common issue - occlusion problems[2]. Occlusion means how to manage the UI layers depth. ie. if we are very close to a non-transparent object A, and then we pop up a menu, can we look through the object A and see our brain? if we can, it is occlusion problem and our brain will be confusing.

#### 4.1.2 Usability requirements

This design should be better than the other designs from the ease of use perspective. In other words, this UI should be used easily by users.

#### 4.1.3 Performance requirements

This UI should be able to handle some complicated tasks for industry engineers. However, we do not need to achieve the specific function. We need to create an interface which can include those functions and the transaction between menus.

#### 4.1.4 Supportability requirements

We will use Unity and javascript to program. All of us did not know much about Unity and C# before. Therefore, four of group members have learned Unity and C#, and the other two members work on research about VR and VR UI.

#### 4.2 RISKS

As developers, we don't have much VR experience and it is inevitable that somebody may feel uncomfortable when using VR devices. We are afraid that our work will make user feeling not comfortable and dizzy. We try to make the user interface as simple as possible and in our draft design we didn't take object collision and block into consideration, client told us a potential risk which is menu will get blocked by object or suddenly showed up in front of users' sight and scare users. We have been worked a lot to get rid of such potential danger and we decide to sacrifice a little bit convenience and make the menu moveable and assimilating into environment.

Another potential risk is a common problem when using VR equipment that the users' sight are blocked and are not able to see objects from real world and potentially hurt themselves by bumping against objects from real world.

#### 4.3 STANDARD

Our group plan use Capability Maturity Model (CMM) from the Software Engineering Institute to develop our standard. By following software processes of CMM, the software process capabilities can provide us the expected outcomes that we predict to achieve. Our process performances of the project may not show all process capability of project due to the difference between reality and prediction. But if our team continues using software process, our productivity and quality will be improved. Now we are at the third level of process maturity -- defined level. Based on the foundation of second level of process maturity, we have done some software projects in other courses. We understand how to be responsible for our roles and work. Thus, we ensure that team members have the required knowledge and skills to fulfill our assigned roles. We want to improve our maturity level to fourth level. For improving our team's maturity level, we need to learn how to measure progress and problems. When we make plan, we have to think about the potential interferences which could affect our progress. Then we need to predict the influence of interference as much as we can. With considering the potential conflict and figuring out solution in our process, our software process could be more stable later on.

#### 4.4 CONSTRAINTS CONSIDERATIONS

Currently, our team face the collision problem in design. This collision means that objects in the VR environment will be crash with VR interface. Also, this problem is the primary problem that the client want us to solve. According to the client's demand, we need to focus on the design rather than focus on the coding. Solving this collision problem is our challenge right now.

#### 4.5 TECHNOLOGY CONSIDERATIONS

1. Supported browsers  
Doing research and google drive documentation sharing use following browsers: Google Chrome, Firefox, Microsoft Edge, and Safari. If you use an unsupported browser, you may encounter more bugs.
2. Application for VR UI design  
Unity to build UI; Word, ppt or any drawing app for UI design.
3. Electronic equipment  
Oculus development kitz and two razer controllers; PC or laptop with high performance GPU
4. VR UI experience learning  
Sony Playstation VR Headset Core System and VR game; Any other VR devices from ISU IT department.
5. Technology setup and maintenance  
Troubleshooting; Technology maintenance; Equipment maintenance

#### 4.6 SAFETY CONSIDERATIONS

In most cases, there is no potential danger in using our product. But is always an exception, people who are not comfortable with immersive environment may feel dizzy when using VR gears. Since there is no best solution so what we can do is try our best to make the interface clear and not confusing.

The second thing is that user need be in a clear environment when means the room that users are wearing VR glasses should be wide and no sharp objects that will hurt or cut users since they cannot see their surroundings.

#### 4.7 PROJECT PROPOSED MILESTONES AND EVALUATION CRITERIA

Our project is designing a user interface for the virtual reality environment. The most important part for this project is design a convenient user interface. The client indicates that we should focus on the design part instead of the coding part. The milestone for this project is creating a innovative and convenient user interface in the virtual reality environment. The evaluation criteria will be whether the user interface we are designed is easy for users to use and the innovation of the design.

## 5 Challenges

1. In this project. the first challenge for us is coding skills. Since none of us learned Unity and C#, it will be challenges for us to catch up in short time.
2. The second challenge for us is to design an VR interface, which should compile different functions in different engineering field. Also, the VR interface should be convenient to help user to use it.



3. while experimenting with virtual reality, has figured out two factors which have an immense influence on virtual reality UI design: occlusion and convergence. Occlusion means how to manage the UI layers depth i.e the Z order. i.e. what is in front of what? Convergence means the point to which the focus of our eyes meet, also called gaze.  
(reference: <https://devcrew.io/2017/03/10/ui-design-for-virtual-reality/>)

## 5.1 FINANCIAL REQUIREMENT

We do not have any financial requirement. The softwares we use to program are free. The researches are free. The online tutorials of Unity and C# are free. The Oculus development kit2 and two Razer controllers for test are provided by our client, and we do not have other requirement of hardware. Therefore, we do not have financial requirement.

## 6 Project Timeline

**September:** Learn basic coding application and get know about what is VR UI.

**October:** Do literature review, search VR technical papers. Learn other companies' idea of VR UI design

**November:** Get know about the common issue of VR UI design, then find our own answers to solve them. Have a our own idea of VR UI in the end of November.

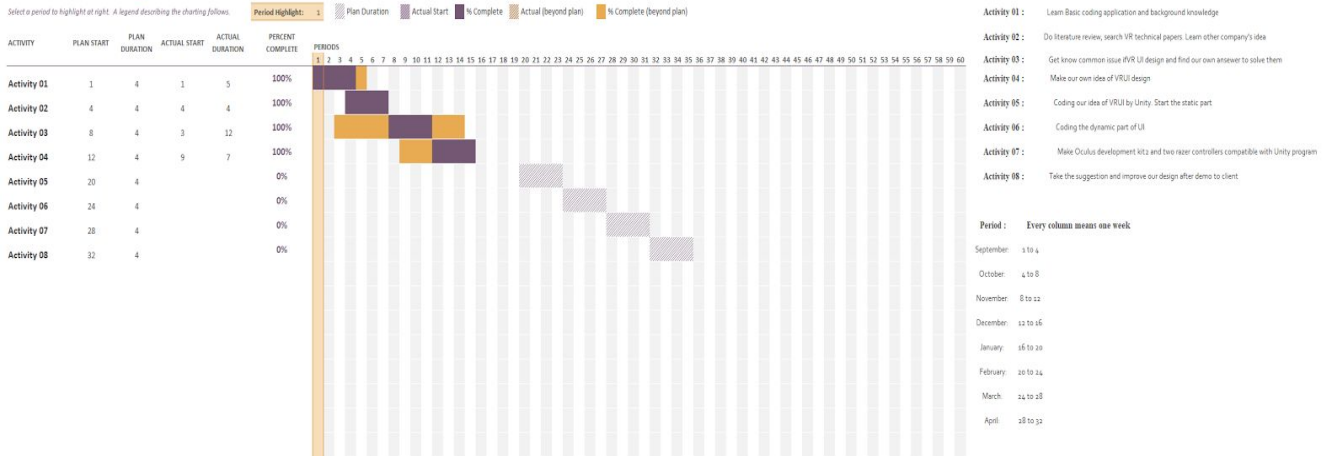
**January:** coding our idea of VR UI by unity program. Coding the static part of our VR UI. (eg. image, icon, background).

**February:** Coding the dynamic part of the UI. (eg. transaction, sounds)

**March:** Make Oculus development kit2 and two Razer controllers compatible with Unity program

**April:** Take the suggestion and improve our design after demo to client.

## VR UI Design Timeline



## 7 conclusion

The goal of our project is designing a easier and more convenient user interface in VR environment. The current user interface in the VR environment is too complicated and is difficult for the users to control the application. Our project will combine lots of functions in the application so that the users can control the application easier. With our project, the users can achieve their goal easier and faster which can reduce the time spend on their work.

## 8 References

This website helps us learning the use of the application Unity which will use in our project:

### MLA 8th

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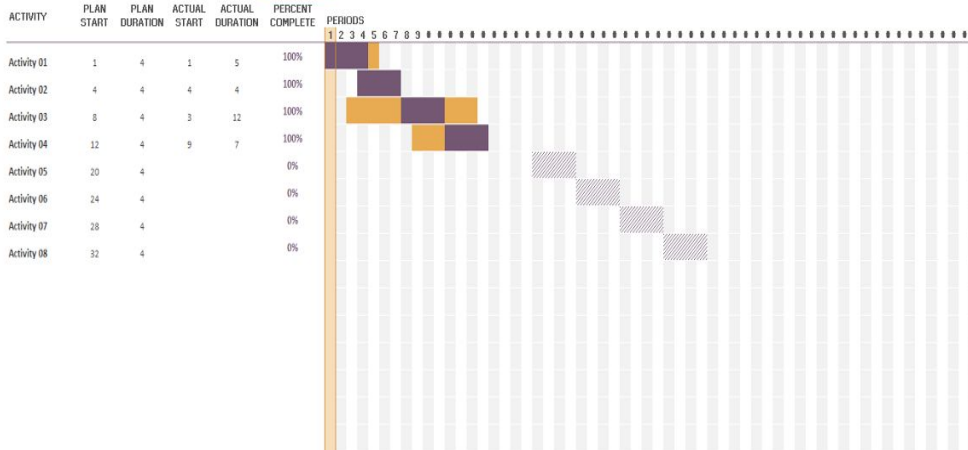
## 9 Appendices

Gantt Chart:

### VR UI Design Timeline

Select a period to highlight on right. A legend describing the charting follows:

Period Highlight: Plan Duration Actual Start % Complete Actual (beyond plan) % Complete (beyond plan)



Activity 01 : Learn Basic coding application and background knowledge  
 Activity 02 : Do literature review, search VR technical papers. Learn other company's idea  
 Activity 03 : Get know common issue of VR UI design and find our own answer to solve them  
 Activity 04 : Make our own idea of VR UI design  
 Activity 05 : Coding our idea of VR UI by Unity. Start the static part  
 Activity 06 : Coding the dynamic part of UI  
 Activity 07 : Make Oculus development kit2 and two razor controllers compatible with Unity program  
 Activity 08 : Take the suggestion and improve our design after demo to client

Period : Every column means one week

September: 1 to 4

October: 4 to 8

November: 8 to 12

December: 12 to 16

January: 16 to 20

February: 20 to 24

March: 24 to 28

April: 28 to 32