1. How can a VR HMD be integrated with different tracking devices to create a rich VR experience and how can it be evaluated?

相关材料：

1. Surround-Screen Projection-Based Virtual Reality: The Design and Implementation of the CAVE
中的Introduction 1.1对VR有一个综述，可适当挑选部分内容对VR进行介绍。

2. Surround-Screen Projection-Based Virtual Reality: The Design and Implementation of the CAVE
中的Abstract和Conclusion，对CAVE沉浸式系统有一个简介，可以用来写如何搭建VR的环境。

3. The LAIR: Lightweight Affordable Immersion Room中的Introduction和previous work也有对CAVE的一些介绍，可以进行补充。

4. A Survey of Augmented Reality Technologies, Applications and Limitations中的II.2 Tracking sensors and approaches往后，介绍了多种tracking的方法，虽然说的是AR的，不过我觉得是和VR同理，可以套用的。

5. A Survey of Augmented Reality Technologies, Applications and Limitations中的II.1.3.1 和 II.1.3.2介绍了两种device, 可以简要的提一下。

6. Human Pacman: a mobile, wide-area entertainment system based on physical, social, and ubiquitous computing中的4,1 Discussion中有个statistical method，之后的部分都可以引用来说evaluate（这块我也不是特别确定，可以节选着抄）

2. Why are Augmented Reality Headsets still uncommon and what is the difference between video and optical see through displays?

相关材料：

1. Augmented Reality: A class of displays on the reality-virtuality continuum中的section3，的第三段话，说的是用“video see-through”的好处。

2. A Survey of Augmented Reality Technologies, Applications and Limitations中的II.1.2.1 和II.1.2.2，分别介绍了video see through和optical see through。

3. A Survey of Augmented Reality Technologies, Applications and Limitations中的IV, 说的是AR的limitation

3.4题How can you create a Non-Headset based immersive Virtual Reality Environment? What techniques could you use to reduce costs of its development?

Abstract 自己总结自己的吧。

1 Introduction 抄LAIR这篇吧对于第三小题（没有后面这个减少开销）。至于后面减少开销的introduction可以抄Low cost这篇的introduction的第三段。A Design of Low Cost Head-Mounted Display Using Android Smartphone

2 affordable immersion room

直接抄The LAIR: Lightweight Affordable Immersion Room第三部分LAIR的所有。

第三部分 完全抄上

3 CAVE （Surround-Screen Projection-Based Virtual Reality: The Design and Implementation of the CAVE.）这篇的的1.3

4 power wall

LAIR的introduction第三段和previous最后一段

5 conclusion自己写

5. Why did inexpensive Virtual Reality headsets take so long to arrive and what factors are important in a Virtual Reality Headset?

相关材料：

1. A Design for a Smartphone-Based Head Mounted Display中的Introduction，介绍为啥简易VR头戴设备发展有点慢。

2. A Design of Low Cost Head-Mounted Display Using Android Smartphone中的introduction中的第二段话和第三段话，介绍了Google推出的VR low cast HMD 的一个实例以及原理。

3. A Design of Low Cost Head-Mounted Display Using Android Smartphone中的III. DESIGN OF LOW COST HMD介绍了做一个简易的在手机上运行的HMD的主要几个部分。

4. A Design of Low Cost Head-Mounted Display Using Android Smartphone中的IV ANDROID APPLICATION中的“We can calculate the required power…”的连续两段话可以说是VR headset的important factor。

5. A Design of Low Cost Head-Mounted Display Using Android Smartphone中的IV ANDROID APPLICATION中的”Our motivation behind building the LCHMD is…”那一句话可以是我们开发low cost hmd的动力。

6. A Design of Low Cost Head-Mounted Display Using Android Smartphone中的V Conclusion&Future Scope中可以写一些未来的发展和改进方向。

6. What techniques and technologies could you use to create Mobile Augmented Reality applications?

Technologies: 1.可以从*A Survey of Augmented Reality Technologies, Applications and Limitations* **的第二部分ENABLING TECHNOLOGIES 完全抄。这里全部都是technologies，随便抄。注意字数。这篇中可以提出来5-6个也很全。**

2. *Location-based Mobile Augmented Reality Applications Challenges, Examples, Lessons Learned*

这篇的3.1 ios mobile os 下sensor controller也是technology 3.2 中的安卓os 下也有相同的解释，可以写不同os下的对比。

Reference 文章中有 直接抄吧。

789；问题主要围绕AR和VR的User experience（VR比较多，没有单独问过AR）

Mixed Reality Questions

- “How would evaluate a Mixed Reality user experience?”
  - Use **Milgram** to define problem
  - Use **Cheok et al** to cite user studies
  - Reference any other paper to cite components like sensors / displays to test.

PPT中提过这个问题，但是我觉得他给的答案不好，Milgram和Cheok其实和这问题关系不大，尤其是Cheok基本没啥关系。Milgram这篇文章如果想用的话就是用来define problem，意思就是用这篇文章解释什么是VR和AR，可以直接抄Milgram的conclusion，篇幅不用很大。

主要的内容是外源的论文提供的。

基本思路是：1. AR/VR是什么（Milgram）

2. 影响用户体验的因素 （只看到了VR的，如果问到了AR可以直接写3，这个不重要）

3. 如何收集用户体验（重要）

4. 如何评估用户体验（重要）

5. AR/VR评估用户体验的区别（如果问了的话）

Caglar Yildirim, Michael Carroll, Daniel Hufnal, Theodore Johnson and Sylvia Pericles. (Aug. 2018). Video Game User Experience: To VR, or Not to VR? IEEE Games, Entertainment, Media Conference (GEM), DOI: 10.1109/GEM.2018.8516542.

W. J. Shelstad, D. C. Smith, and B. S. Chaparro. (2017), “Gaming on the Rift: How Virtual Reality Affects Game User Satisfaction,” in Proceedings of the Human Factors and Ergonomics Society Annual Meeting, 61(1), 2017, pp. 2072-2076.

B. G. Witmer and M. J. Singer. (1998). Measuring presence in virtual environments: A presence questionnaire. Presence, 7(3), pp.225-240.

M. Slater, V. Linakis, M. Usoh, R. Kooper, and G. Street. (1996, July). Immersion, presence, and performance in virtual environments: An experiment with tri-dimensional chess. ACM Virtual Reality Software and Technology, 163, pp. 72-85.

D. Murphy. (2017), “Virtual Reality is 'Finally Here': A Qualitative Exploration of Formal Determinants of Player Experience in VR,” in Proceedings of the 2017 DiGRA International Conference. Melbourne, Australia.

J. Q. Coburn, I. Freeman, and J. L. Salmon. (2017). A Review of the Capabilities of Current Low-Cost Virtual Reality Technology and Its Potential to Enhance the Design Process. Journal of Computing and Information Science in Engineering, 17(3), pp. 1-15. doi:10.1115/1.4036921

S. Persky and J. Blascovich. (2008). Immersive virtual video game play and presence: Influences on aggressive feelings and behavior. Presence: Teleoperators and Virtual Environments, 17(1), pp. 57-72.

M. H. Phan, J. R. Keebler, and B. S. Chaparro, B. S. (2016). The development and validation of the Game User Experience Satisfaction Scale (GUESS). Human Factors, 58(8), 1217-1247.

这几篇是VR相关的，第一篇比较关键，其他的都是第一篇的引用。

- 第一篇文中Introduction的A部分介绍了影响VR用户体验的3个主要因素（Factors affect VR user experience）
- Method的A部分是如何收集用户体验
- Method的C部分中的1和2介绍了两种用户体验的评估标准（Evaluation and Analysis Techniques）

Huang, Yazhou & Churches, Lloyd & Reilly, Brendan. (2015). A Case Study on Virtual Reality American Football Training. 1-5. 10.1145/2806173.2806178.

Q. Lhemedu-Steinke, G. Meixner and M. Weber, "Comparing VR Display with Conventional Displays for User Evaluation Experiences," 2018 IEEE Conference on Virtual Reality and 3D User Interfaces (VR), Reutlingen, 2018, pp. 583-584.

这两篇论文在选取实验人员上形成对比，在收集用户体验时可以用，主要思路是如果应用的专业性较强，选取的实验人员应该是专业人员（第一篇），而如果应用泛用性广，实验人员最好是各个职业的人（第二篇）。

J. Martinez, D. Griffiths, V. Biscione, O. Georgiou and T. Carter, "Touchless Haptic Feedback for Supernatural VR Experiences," *2018 IEEE Conference on Virtual Reality and 3D User Interfaces (VR)*, Reutlingen, 2018, pp. 629-630.

这篇讲了一个叫做Haptic Feedback的评估方法

Huang, Yazhou & Churches, Lloyd & Reilly, Brendan. (2015). A Case Study on Virtual Reality American Football Training. 1-5. 10.1145/2806173.2806178.

这篇讲了一个叫做 Optical Feedback 的评估方法

LI Xiao, XU Bo, TENG Yue, REN Yi-tian, HU Zhu-min. (2014). Comparative Research of AR and VR Technology Based on User Experience. International Conference on Management Science & Engineering

这篇论文提到了ARVR在评估用户体验时的不同，这段话总结性较强：

The most significant difference between VR and AR technology is the requirement on immersion, and AR system emphasizes the existence of users in real world. At the same time, AR technology requires more on the registration accuracy, larger registration error cannot let the users imagine the existence and integrity of virtual objects in real environment, while the AR technology can ease the strict requirement on system calculating capability when establishing realistic virtual environment[i31. Currently, the research in AR and user experience mainly focus on the availability evaluation[i41, the human factor analysis in AR[151, the design and evaluation method of AR[161. Meanwhile some scholars put forward the idea that AR can be applied in real estate fully furnished room, by which we can promote the user experience.

10. How can you program and design a Virtual Reality application?

1. 先introduction说一下VR 第一篇Use Milgram for definition

2. week 10 (a design of low cost HMD using Android Smartphone)section 2 可以用来写VR display也可以结合前面一篇(A design for a Smartphone-based HMD)一起写

3. week 8 Surround-Screen Projection-based…(前面可以做introduction,后面可以做例子,也可以加上后面一篇说CAVE的the LAIR)

4. week 13 Future mixed Reality Educational Spaces(只能用introduction和background第一段)

5.week7 Use of game engines to create a environment Lewis and Jacobson (scientific use of game engines&what are game engines?两部分适当引用)

11. Explain and discuss how you can create an Educational Augmented Reality application.

1. 先introduction说一下AR 第一篇Use Milgram for definition引入一下话题

2. Future space creation(week 13) ,可以用introduction和background部分引入话题，然后用第三部分说到的unity, openGL一类的来简单说明可用的开发环境

3. Use of game engines to create a environment Lewis and Jacobson (scientific use of game engines部分可以引用)

4.Examples for education at the end of Krevelen and Poelman paper (第二篇A survey of Augmented Reality Technologies, Applications and Limitations)

5.week 13 AuRAs(3 why use AuRAs and 4.1 Simulated AR)

12. How can you program and design an Augmented Reality application?

1. 先introduction说一下AR 第一篇Use Milgram for definition 2week 3.Krevelen and Poelman paper (第二篇A survey of Augmented Reality Technologies, Applications and Limitations 可以用section two开始的部分)

3.week 7 ARQuake(week 7) Piekarski & Thomas(可以用做例子)

4.Geiger et al (week 9) Location-based Mobile Augmented Reality Application(最好抄summary & outlook)

5.week 6 也是定位相关的，可以结合上面一条(抄一抄abstract&introduction就行了)

6.week13 Why, when and how to use AuRAs(可以用一下abstract&introduction)

13. What techniques and technologies could you use to visualise 3D data?
你可以使用什么技术和科技来**可视化3D数据**?

• Use **Milgram** to explain different displays **[1]**

第一篇论文中3.1, 3.2 介绍了两种AR display的技术方法

• **Rangier et al** to mention 3D printing and medical imagery. **[10]**

Week11 3D打印医疗app的论文中 Generation of 3D objects一段讲了如何三维快速建模

Source data acquired with any imaging modality typically is visualized in two dimensions. With post-processing tools and algorithms, it is possible to produce multiplanar reformations and three-dimensional views of the anatomy. The process chain involved from image acquisition to productionof a three-dimensional rapid prototype model consists of the following three steps and will be discussed in detail in the next sections: “Image acquisition”, “Image post-processing” and “3D printing”. (Rengier,2010,)

• **Krevelen** and **Poelman** for more examples from AR and VR **[2]**

第二篇论文第三节Applications有很多ARVR的应用，可以抄几个说明如何实现的

• **Cruiz-Neira et al** and **Campbell et al** for CAVE designs **[6]**

Week 7 CAVE的第一篇论文中 1.3 CAVE Design

14. What is Mixed Reality environment and what are the current limitations in creating such an environment?
什么是**混合现实**环境?目前在创建这种环境方面存在哪些限制?

第一篇论文中section4 讲了啥是Mixed Reality environment以及如何分类不同的MR

第二篇论文第四节讲了AR技术的limitation，可以选几个抄

如果索引不够可以写下面这俩 不过感觉没那么切题

Week9的两篇论文讲了HMD的一些问题可以写写

Week10的论文最后一段limitation也写了一些问题

15. Explain and discuss how you can create a gaming Augmented Reality application
解释并讨论如何创建一个**增强现实游戏**程序

开头可以用第一篇论文中section2的前8行说下AR的定义混混字数

• **Piekarski & Thomas [5.2]**

Week5关于game engine的几篇文章可以重点写，ARQUAKE这篇的说了an approach to create an AR game using a VR game engine. 举了一个游戏做例子

第三段AR is the process of…可以抄 最后的conclusion也是

• **Krevelen & Poelman [2]**

第二篇论文section2 讨论了实现AR所需要的各种技术 包括2.1.2中的各种display设备 可以挑几个抄

• **Geiger et al [7]**

Week8 的论文的introduction讨论了移动AR的开发 3.1 3.2写了IOS以及Android不同的开发过程

16. What sensors would be needed to create an outdoor Augmented Reality application and how would you create such an application? 创建室外增强现实应用程序需要哪些传感器，您如何创建此类应用程序?

Introduction

week 2, 2.2 先说需要方位追踪的传感器

week 2, 2.2.1 环境模拟的技术及限制+ week4 Affine Structure from motion theorem模拟环境方法

week6 2.1.1监测不同位置的方法 2.2场景分析的方法 2.3 邻近物体分析的方法

week2 2,2,2 2.2.2 User movement tracking 移动监测方法，限制+ week8 3.1.1Sensor Controller IOS应用控制传感器的方法 3.2.1安卓的Sensor Controller

week6. 6.1 sensor fusion新的技术

17. Explain and discuss how you can create a Tele-presence environment in both Virtual and Augmented Reality.

解释并讨论如何在虚拟现实和增强现实中创建远程呈现环境。

reference week3 文章中第46个ref直接抄，并随便说两句这种支持远程显示的系统

reference week8 可以讲下cave是什么，cave如何应用: CAVE designs that allow telepresence

reference week10 查看tele-presence的其他方法，week10三篇都很短，有图的都讲的是实现这个技术方法，可以介绍两个查看VR的工具顺便抄点ref

reference week7 game engines 前两段，搜environment: Use of game engines to create an environment

18. What is Mixed Reality environment and what are the current limitations in creating such an environment?

什么是混合现实环境？目前在创造这样的环境方面有哪些限制?

week2 第四部分

week3 1.2讲了是什么 第四部分讲了限制

week6 第八部分--限制

19. How would you bring real world objects into a Virtual Reality applications?

如何将现实世界中的对象引入虚拟现实应用程序?

1. *Surround-Screen Projection-Based Virtual Reality: The Design and Implementation of the CAVE*
   - *Virtual Reality Overview (*定义
2. *A Survey and Taxonomy of Location Systems for Ubiquitous Computing*（位置信息
   - *Introduction*第一段
   - *Technologies*技术分类
3. *GAME ENGINES IN SCIENTIFIC RESEARCH By Lewis and Jacobson 2002*（渲染
   - *What are Game Engines?*
   - *Scientific Use of Game Engines*
4. *Alice: A Rapid Prototyping System for Building Virtual Environments*（*Alice*系统
   - *Abstract*
   - *THE ALICE SIMULATION LOOP* 第一二段

20. Explain and discuss how you can create a Tele-presence environment in both Virtual and Augmented Reality.

解释并讨论如何在虚拟现实和增强现实中创建远程呈现环境。

1. *Surround-Screen Projection-Based Virtual Reality: The Design and Implementation of the CAVE*
   - *Virtual Reality Overview (*定义
   - *CAVE Motivation*
2. *A Survey of Augmented Reality 2010*
   - *AR* 定义
3. Future Mixed Reality Educational Spaces
   - BACKGROUND第一句
   - THE FUTURE LEARNING SPACE （UNITY3D等

21. How would you create an application where I would feel like I was in the same room as someone else even if they were on the other side of the world?
你如何创建一个应用程序，让我觉得我和其他人在同一个房间，即使他们在世界的另一边?

1. *3D LIVE HUMANS IN MIXED REALITY ENTERTAINMENT*
    - *ALGORITHM OVERVIEW*
    - *ENTERTAINMENT APPLICATIONS*
2. Future Mixed Reality Educational Spaces
    - BACKGROUND第一句
    - THE FUTURE LEARNING SPACE （UNITY3D等工具