Capstone Design(1)

Proposal

Subjects   **: Capstone Design(1)**
Prof.   **: Sang Oh Park**
Team Name   **: TriStar**
Members   **: 20165729 Park SangWoo**
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                 20161090 Lee ChaeMin

1. Project Title

3D room reconstruction using a smartphone's RGB-D camera.

2. Introduction & Motivation

Abstract: Reduced user convenience due to many false sales and hype of real estate brokerage apps. As a result, the number of users using the app is decreasing, and as an alternative to this, 3D scanning of sales is mandatory using smartphone Tof Sensor.

If we need to move to another area, find a room that I want is very difficult. You need time to travel between regions, and if you don't have room to stay, you must look around every room in a day.

In this case, it's hard to look around all the properties in the neighborhood in a day and choose the room you want. So, we find the room we want through an application like '직방', '다방' etc.

But we cannot see photo or 360 surround-view about the room all the time. Even if you've seen the room through the photos or 360 surround view, it's hard to estimate the size of the room. So even if the room looked good in the photos, you can be very disappointed when you see it in person.

Next, I do not know if the furniture I want will fit into the room with just photos or a 360-surround view. So only the tape measure can be taken and compared to the size of the room.

Finally, because of COVID-19, it's hard to go out comfortably and meet many people.

While we were looking for efforts to solve these problems, we can find 'VR Modelhouse'. "VR Modelhouse" is a way to see the existing model house through VR, and it is a realistic way to see the room provided by apartment construction companies to prevent people from flocking to the model house.

But this is for only recently built apartments are available, and no individual buildings such as old apartments or studio villas are provided.

We thought it would be nice if this technology could become universal in an accessible way. In the case of the VR model house, experts make 3D models, but we are going to make them through mobile phone video. So, existing tenants can share one 3D model by simply taking a video through an application. Those who visit the room can check the 3D model of the room on their smartphone without a separate device.

Also, you can see rooms if you want to use a VR device such as 'Google Cardboard', 'Samsung Gear VR'. And you can make your avatar using your height and weight. So, you can feel like you're really in the room.

3. Market Research

Mobile real estate Brokerage Application: An apt example of these are Jik-bang(직방), Da-bang(다방), and Han-bang(한방).

SWOT Research

Strength
- You can check the apartment sales reviews in the application
  Categorized according to age, gender, rent-based, etc.
- Convenience and Speed of Real Estate Exploration
  24-hour service via the Internet.
  You can easily check for sale without having to go to a brokerage house.
  Explore things beyond time and space with real-time feedback.

Weakness
- There are many false offerings.
- Difficult to know the exact information about the house.

Opportunity

-An increase in the share of monthly rent, and leaseholds.

-Real estate agent's interest

  Meditation through mobile services can save both tenants and brokers time and money in real estate sales transactions.

Threat

-Multiple Competitors increase.

  According to the user survey and the analysis above, the biggest drawbacks are that it is difficult to obtain accurate information about the house only through writings and photographs and a lot of false sales.

  Therefore, by requiring 3D Scanning of the house when registering a sale, users can expect accurate information and a decrease in false sales.

4. Development & Implementation Contents

- Scanning room using RGB-D Camera on smartphone
  RGB-D camera is consisting of an RGB sensor and a depth sensor. Using a depth sensor, you can get a distance between the object and camera. So, we can reconstruct a place using depth only. But for accuracy, we get RGB value from the RGB sensor. For this, we need to get RGB and Depth value simultaneously and we need to implement this application. We can use some smartphones that have a depth sensor like S20+, S20Ultra, S10+, Note10+, iPad pro 4th.

- 3D reconstructs a place using depth & RGB value
  Based on the RGB and depth values previously obtained, we need to reconstruct a place. For this, we will use 'Unity 3D' because of the application. In this step, we need to study Unity 3D, so implementation is likely to take a long time.

- UI for control avatar & furniture
  If the user does not want to use a VR device, we need to show 3D place on the smartphone screen.

- Recognize direction & walk using Smartphone's sensor
  If the user uses a VR device, the user cannot control the avatar through touch. So, we need to recognize the direction and walk. And the space in which users use this application is very limited, so this application necessary to recognize the user's walk in a place

- Furniture arrangement using Hand Tracking
  If the user uses a VR device, the user cannot control furniture through touch. But an additional device is inefficient. So, we are tracking a hand and using a hand as a controller.

5. Goal

There are three key functions that this application provides.
1. Scanning a room and reconstruct to 3D model using an only a smartphone camera
2. Look around the room using a VR device or using a screen touch
3. Furniture arrangement

5. Project Schedules

Development Contents	September				October				November				December		
	9	16	23	30	7	14	21	28	4	11	18	25	2	9	16
Content Acquisition & Data Survey	■	■						Midterm Demonstration and Presentation					Final Demonstration and Presentation		
Study android API for camera		■	■	■											
Implementing 3D reconstruction using unity					■	■	■		■	■	■				
Implementing RGB-D camera scanning			■	■	■	■									
Implementing application UI		■	■	■	■	■	■		■	■	■				
Study Unity3D and AR Core		■	■	■											
Implementing Sensor tracking						■	■		■	■	■				
Preparing Midterm Demonstration and Presentation							■								
Test and Debugging										■	■	■			
Preparing Final Demonstration and Presentation												■			
Writing manuals and reports														■	■

1. Heo Jeong-woo

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	9	16	23	30	7	14	21	28	4	11	18	25	2	9	16
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Implementing RGB-D camera scanning				■	■	■									
Implementing application UI			■	■	■	■	■		■	■	■				
Implementing Sensor tracking							■		■	■	■				
Preparing Midterm Demonstration and Presentation							■								
Test and Debugging										■	■	■			
Preparing Final Demonstration and Presentation												■			
Writing manuals and reports														■	■

2. Lee Chae-min

Development Contents	September 9	16	23	30	October 7	14	21	28	November 4	11	18	25	December 2	9	16
Content Acquisition & Data Survey	█	█						Midterm Demonstration and Presentation					Final Demonstration and Presentation		
Study android API for camera		█	█	█											
Implementing 3D reconstruction using unity					█	█	█		█	█	█				
Implementing application UI			█	█	█	█	█		█	█	█				
Study Unity3D and AR Core			█	█	█										
Preparing Midterm Demonstration and Presentation							█								
Test and Debugging										█	█	█			
Preparing Final Demonstration and Presentation												█			
Writing manuals and reports														█	█

3. Park Sang-woo

Development Contents	September				October				November				December		
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Implementing 3D reconstruction using unity					■	■	■		■	■	■				
Implementing application UI			■	■	■	■	■		■	■	■				
Study Unity3D and AR Core			■	■	■										
Preparing Midterm Demonstration and Presentation							■								
Test and Debugging										■	■	■			
Preparing Final Demonstration and Presentation												■			
Writing manuals and reports														■	■