INFOMMMI (Multimodal Interaction) 2015-2016

Exam questions for part 2

(max. 40 points)

Comments

Some comments on possible solutions. Notice that these are incomplete and for some questions, other answers exist that might give full credit, too.

Question 2-1: Virtual reality definitions (max. 8 points)

In the paper "Defining Virtual Reality: Dimensions Determining Telepresence" by Steuer (1992) the author introduces a "variable-based definition" of VR, in which he describes different systems with respect to their *vividness* and *interactivity*.

Cf. Lecture AR – 2 Technologies, slides 33 & 34

a) What are the two variables contributing to the vividness of a system?

Breadth

Depth

b) Give one example from VR or AR for each of the following variables that further specify the interactivity of a VR (or AR) system.

b1) Speed:

Speed describes the response time, for example …

b2) Range:

Range describes the number of attributes that can be manipulated (and the possible amount), for example …

b3) Mapping:

Mapping describes the types of controllers and how actions with those are mapped to actions in the virtual environment, for example …

Question 2-2: AR-VR comparison (max. 2 points)

AR is often referred to as "harder to create" than VR. Give one concrete example that supports this claim.

Cf. Lecture AR – 2 Technologies, slides 49 & 50

(no sample solution, because various correct answers exist here)

Question 2-3: Augmented reality definitions & non-visual AR (max. 9 points)

The Chewing Jockey system by Koizumi et al. (2011) describes a setup where jaw motions during chewing are translated into sound signals with the purpose of changing your perception or experience during chewing. Although the authors never introduced their approach as an AR system, to some degree it can be seen as type of non-visual AR. Shortly discuss this with respect to the three characteristics introduced in the AR definition by Azuma (1997).

Cf. Lecture AR – 1 Intro, slides 36 & 42

Requirements are:

1. Combines real & virtual
2. Interactive in real time
3. Registered in 3D

No unique solution exists for the discussion of course, but it could be something on the lines of:

1. It combines "real chewing/jaw motions" with virtual chewing sounds
2. It is interactive in real time because the sounds are directly (and immediately) evoked from the related input (= chewing)
3. You can argue in different ways here; as long as the discussion makes sense (and illustrates that you understood what registration in 3D means) you got full credit for it.

Question 2-4: Sensor technology (max. 4 points).

In 3D, orientation can be described by rotations around the three axis.

Cf. Lecture AR – 2 Technologies, slides 55 & 56

a) What are the three technical terms for these rotations?

Pitch, roll, and yaw.

b) Which of these three rotations cannot be measured with an accelerometer and why?

Yaw, because an accelerometer only reports changes with respect to gravity. Because yaw is the axes parallel to gravity, there are no changes when a device is rotated around it.

Question 2-5: Handheld AR (max. 9 points).

The image on the left shows a handheld AR system implemented on a state-of-the-art smartphone, where information that is related to the direction where the phone is pointing at is superimposed onto the live video stream of the phone's away-facing camera.

Cf. Lecture AR – 3 Technologies, slide 14

a) What kind of sensors are needed to realize such a system?

GPS, compass, and accelerometer

(Note: "gyroscope" instead of accelerometer (or in addition to it) is correct, too. The same goes for "camera", but it would not have given a deduction if it is not mentioned (although it is technically a sensor and needed, but it was listed separately on the lecture slides, thus no deduction)).

b) Shortly discuss this type of AR with respect to the three requirements for an AR system specified by Azuma (1997).

Combines real & virtual is fulfilled because …

Interactive in real time seems fulfilled because …

Registered in 3D seems partly fulfilled because …

(Notice that the image only allows you to speculate about real time interactivity, hence the phrasing "seems" above. Likewise, registration is only in 2D, hence, you could also write it is "not fulfilled" (or as above "partly", since 2D is partly 3D. These different phrasings and interpretations have been considered in the grading in your favor).

Question 2-6: Display technology (max. 4 points).

Optical see-throughs (OST) and video-see-throughs (VST) are two types of head-mounted displays (HMD) that can be used to create AR. Write down for which technology the following statements are true (OST, VST, both, or none/it depends).

a) This type of HMD can add and subtract light.

VST

b) It is important that this HMD has very low latency in order to a create a comfortable and convincing AR experience.

Both (note: one could argue that it is "more important" for OSTs, but it is important for VSTs, too; cf. Lecture AR – 3 Technologies, slide 46)

c) Registration in 3D is harder with this type of HMD.

OST

d) This type of HMD creates a better, more realistic type of AR than the other one.

None/it depends

Question 2-7: AR/VR application and comparison of systems (max. 4 points).

The IllumiRoom system from Microsoft Research uses a data projector to project game-related content on the wall surrounding your TV screen when playing a game on that screen. It can be considered as a special type of spatial AR.

Assume you are a game developer or designer who has to create a car racing game with a first person view (i.e., the scene that the player sees is similar to the view of a race car driver during the race) for a company that wants to use this game to entertain people at fairs and other public events. In your team you are now discussing if you should use the IllumiRoom setup to create such a game or a VR setup with an HMD (e.g., the Oculus Rift).

Give one good reason that speaks in favor of using the IllumiRoom setup and against the VR HMD setup, and one good reason that speaks in favor of using the VR HMD setup and against the IllumiRoom setup.

Various correct solutions exist here, of course, so no standard solution here.