PROJECT PLAN

cogARC

Objective:

Minigames for cognitive research using AR cubes

Group members

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AR Cubes

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1. GOALS AND LIMITATIONS

1.1. Project Goals

The goal for this project is to make a framework that our employer can use for his research on cognitive functionality. The framework will enable the user to do basic interactions with objects in augmented reality space. We will implement it as one application with mini-games and we want it to be easy to manipulate, change and add games. The objects within each game will have different behaviours, functions and properties that should be useful for our employer.

The framework will be built around the concept of Augmented Reality. The use of AR was given as a requirement from our employer and it will digitize the games so that measurements for research will be given digitally. This will change the way the games is played and can give useful information that is quite unique for this technology. The interactions in the games happens through square cubes that the user will move around and place in groups.

Result goals

- 7 games
- Adaptable framework
- Viable bachelor thesis
- Combine physical cubes and digital structures

Effect goals

- Supporting research
- Experience with a game engine.
- Experience with a longer development process.
- Experience with digital space linked to reality

1.2. History and Background

Augmented Reality is a quite new discipline in computer science. It uses a real-world environment and augments its perspective with adding digital content[1]. One of the biggest contributors in the field is Steve Mann, who has been working with wearable computing and augmented reality systems since the 1980's[2]. His idéas begun back in the 1970's called mediated reality - a way to alter our perception of reality. He is also the chief scientist at the team working with Meta SpaceGlasses[3]. The term itself was coined at Boeing in 1990 where the technology was proposed to replace a lot of large plywood boards with schematics for planes. They proposed a kind of eyewear that could project the schematics on reusable boards and with this make reconfiguring during the manufacturing process a whole lot easier[4]. Even though most of the AR technology of today happens through screens (like mobile phones and

Google glasses / Meta SpaceGlasses), the idèa of projection is still living. castAR is an example of this technology where digital content is cast on a reflective material[4]. So even though the technology has been around for some decades and is being present in several forms, we will still say it is a quite new discipline in computer science.

The background for the project is that our employer Costas Boletsis is doing a PhD and wanted a set of games that tests the players cognitive condition by completing set tasks. To do this he wants to use a device that implements augmented reality and a set of cubes with markers on them that the user can interact with. When we decided that we wanted to go for the task, we were expecting to use the Meta SpaceGlasses. They were expected to be released in December 2013, but unfortunately the release of these has been pushed forward to July. Because of this we will use mobile phones instead. We will need to create the games given in the task, but we think we can make the project a bit more useful. This can be done by making a platform or an environment where it will be easy to modify and even make games, instead of making only some individual, small games. Such an environment can make it simple for our employer to both change existing games or add new games for his research. The environment will contain predefined objects that can easily be manipulated to do their task and easily be put together to make a simple game.

1.3. Framework and Limiting Factors

To make the games in the project we will use Unity and Vuforia for Augmented Reality. Vuforia is so far the most fitting software development kit for our project as it is made for Android phones and has a plug-in for Unity.

There will not be much time spent on beautifying the games beyond having usable graphics as the group will have a focus on making the framework for the games. Ultimately the look of the game is not as important as the interactivity of the player and the augmented reality of the cubes that the player will be interacting with.

2. SCOPE

2.0 Who we are

We are three students who study game programming at Gjøvik University College.
We have all little experience in both using a engine to make games with and little experience with Augmented Reality.

2.1. Project Description

The focus of our work will be on making a framework that makes it easy to make more mini-games and manipulating the ones that we have in a simple fashion. By focusing on making a framework it will be easy for our employer to add features later that he might find missing or lacking. It will also make it easier to change features that is already implemented, if needed. It will also be relatively easy and quick to add new games or remove mini-games that are no longer wanted.

2.2 Task Description

We will be making an application with a menu, 7 mini-games, scores for the mini-games, a web page, a report and a presentation.

The application:

The work of making the menu will consist of making components and writing code scripts for controlling the scenes / starting the mini-games, possibly also seeing the highscore lists. The mini-games will be as described very briefly below:

Mini-game #1: Shape Match (Working title)
Goal: The player has to match the cubes according to the shape displayed on the surface of each cube.
Cognitive function addressed: flexibility - response inhibition (impulse control).

Mini-game #2: Colour Match (Working title)
Goal: The player has to match the comparing one word's meaning to another word's colour.
Cognitive function addressed: flexibility - response inhibition (impulse control).

Mini-game #3: Total Sum (Working title)
Goal: The player has to place a specific number of cubes on top of each to create a certain total sum.
Cognitive function addressed: problem solving – arithmetic calculation.

Mini-game #4: Find the Answer (Working title)
Goal: The player has to find the correct answer to simple arithmetic calculations.
Cognitive function addressed: problem solving – arithmetic calculation.

Mini-game #5: Memory Cubes (Working title)
Goal: The player has to memorize the image with the highlighted tiles and after it disappears, he has to reminiscent the tiles' formation and display it using the cubes.
Cognitive function addressed: spatial memory recall.

Mini-game #6: Matching Figures (Working title)
Goal: The player has to match the same figures, after turning the cubes.
Cognitive function addressed: spatial memory recall.

Mini-game #7: The Path(Working title)
Goal: The player has to create a path, using the cubes, following the logical order of number-letter.
Cognitive function addressed: visuospatial/executive functions.

We will be making target images and shared assets for all the minigames.
There is few and small differences between the cubes appearances in the different minigames.
Scripts for the tasks, time-taking / scores, cube behavior, controlling the score database and controlling the application will also be shared between mini-games.
In different mini-games the virtual cubes will change appearances from being a single color to displaying text, letters, geometrical shapes, images and numbers. The cubes will interact with each other and report connections to the task script.
In the different minigames there will be some differences to how cubes are connected to fulfill the tasks goal. In some minigames they are to be placed on top of each other, in some they are to be placed besides each other in pairs or in some form of logical readable order and in another they just have to be marked/targeted/touched.
We will save the users score for each mini-game on the device so that we can show the best scores to the user.

3. PROJECT ORGANISATION

3.1. Responsibilities and Roles

The responsibility for being project manager was given to Daniel after a democratic vote.
Per Kristian is responsible for communicating with employer and mentor, and version control tools.
Jakob was delegated the task of writing down a short summary of every weekly meeting we have as a group.
The responsibility of having up to date documents is shared between all members of the group

3.2. Routines in the group

At the end of the week there will be a group meeting for evaluating the last weeks results, achievements and progres. At this time all relevant documents will also be updated or changed to reflect what was discussed during this meeting.
At the beginning of each work day there will be a brief discussion on what should be done that day and by whom to achieve the most satisfactory results. We will work as a group Monday to Thursday every week, leaving Friday to work for other classes and only having a short meeting of about one hour to summarize and bring all relevant documents up to date.

4. PLANNING, FOLLOW-UP AND REPORTING

4.1. System Development Model

We do not want to use a full model of any of the currently defined system development models, since we feel that none of them fits with the way we want to develop the project. We want to use weekly retrospective reviews on progress so that we know where we're at. Additionally we will orally exchange daily progress and problems to keep up with each other and the plan we have set.
At the beginning of the day we will decide what each person will work with, and throughout the day we will update each other on progress and assign new tasks when needed. With this model it will be important to reach the milestones we have set, and we think that will be possible. In case we do not manage, we will assign more hours to the project to finish on time.

4.2. Plan for Status Meetings and Decisions

All decisions taken will be written in a separate document with date of happening, who is writing and what the decision was. Decisions made by employer will also be in this document.
All status meetings will be written in a document as a log for what have happened in the previous week since the last status meeting. To keep track of time we will use a time management program. The log from our external logging system Toggl will be used to give an overview over this.

5. ORGANISATION OF QUALITY ASSURANCE

5.1. Documentation, Standard Usage and Source Code

Documentation of the groups activity is done in a few different ways.
Documentation of time used on the project and what was done is through a program called Toggl, which also is a app for Android that you can use to log hours and what you did.
All decisions taken will be logged in its own document that is shared between all members of the group.
All code will be written after a group chosen code standard.
Documentation of all group status meetings will have its own document, functioning as a log that will be written after the meeting is over.

5.2. Version Control

We have chosen GIT as our version control tool of choice. The reason is that Git is one of the tools we know and have experience with. We were questioning whether we could use it with Unity or not, but some sources claimed it should be possible[6, 7]. Since we have not used Unity before we obviously have not tried this combination, but by reading these sources we have decided to give it a try. We like how Git is centralized and how much control we have with updating and applying our work. Problems that has been pointed out are how to handle assets and exposed media, since these are often in binary

format. Solutions others have used is to only save them in the repository when they are finished. That is something we can also do, even though we can't see that we need too much media content in our project.

5.3. Risk Analysis

Technology risk analysis

Unity3d: None of our members have more than a few hours or weekend experience with Unity3d. We expect this to be an issue at least at first and we have planned spending time on learning to use the tool as it is an extensive tool with many features that we have to learn to use it effectively.

Javascript: Only one member of the group has any decent experience with writing in this language, a second member has used it for a small project and the last member has no previous experience with the language. It is fairly easy to get into so we do not expect too big problems with Javascript. By relying a little on the member with the most experience the other members can get into the new language faster.

Learning the tools: We may be trying to learn too much new technology for this project. We will be using a new programming environment, a programming language with which we have very limited experience and API's that we haven't looked into before. This means we will be spending a lot of time not working on the project, just learning and we will be working less efficiently than if we were working with the tools we are more familiar with.

General lack of documentation for technologies: We need documentation and examples to work out how to do the thing we need to do for this project. Usually we can find workarounds, but any little thing can be crucial. And if documentation on something is lacking it can lead to us spending a lot of time on figuring out something that could have been easily answered if the documentation was not lacking.

Vuforia: If the marker recognition is too bad it will be impossible to complete tasks and play the game even if we managed to finish it, and it will be very difficult for us to do testing. If the documentation is lacking a lot we will spend a lot of time just figuring out the API for Vuforia instead of being productive. We also have to find out if Vuforia has all the functions we need in order to do what we need to do.

Project risk analysis

Lack of motivation	high risk	high chance
Dislike of Unity3d	high risk	medium chance
Internal group disputes	medium risk	medium chance

Dislike of Javascript	high risk	low chance
Not manage to polish product	low risk	high chance

Risk Countermeasures

- To avoid most risks with technology we have done a fair bit of early testing to make sure we can do what we need to and see if the accuracy of the augmented reality technology is sufficient for this application.
- Spending a lot of time on learning the tools before actually starting on the project itself should help improve our impressions of the tools.
- We have established countermeasures for internal group disputes in the group rules.
- The dislike of Javascript has so far not been an issue as there have been time invested early to learn the language.
- Not managing to make a polished product is quite far down on our priority list as our focus is on making the framework that is used to make the games and polishing will be done at the end if there is time for it.

Early Testing

We spent a few days testing the technology of Vuforia. At first it appeared to be a little weak or a little too colour sensitive for what we need it for.

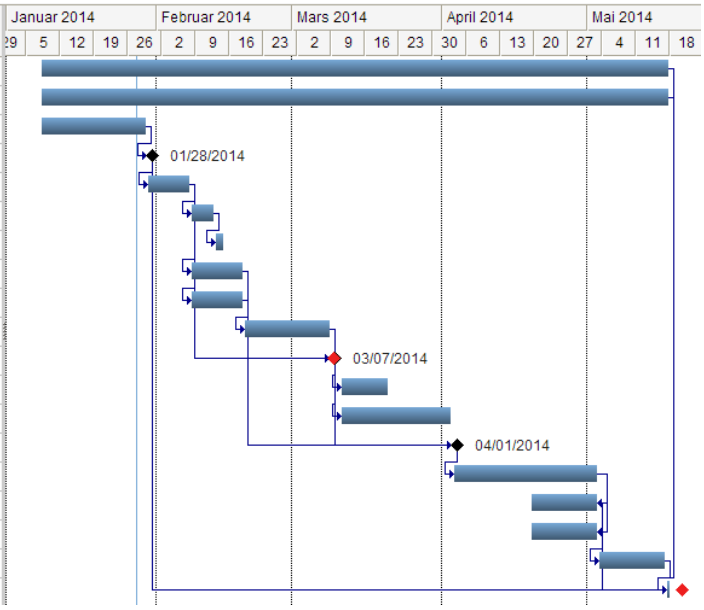
- The lighting will need to be just right, we can only do testing at certain times during certain days or else the sun will make too much glare of the paper on the boxes.
- The active marker(s) cannot be partially covered for the object to be active. This could be annoying for the player when moving the cubes and fatal when the task is to put cubes together in one big group.
- The active marker(s) will have to be at least partially within the screen for the object to be active, depending on how good the tracker is this could be a problem when the task is to line up the cubes or pair them all together.

We later discovered that this was because the markers were too fuzzy or too big. When we then tried with smaller, clearer targets we fairly easily got 8 targets at the same time with at least a meter range. This dispelled most of our fears in this project.

6. SCHEDULE

Gantt chart

	Navn	Varighet	Start	Slutt
1	Report updates	94d?	01/07/2014	05/16/2014
2	Webpage updates	94d?	01/07/2014	05/16/2014
3	Planning	16d?	01/07/2014	01/28/2014
4	Start (Planning approved)	0d?	01/28/2014	01/28/2014
5	Learning tools	7d?	01/29/2014	02/06/2014
6	UI Design	3d?	02/07/2014	02/11/2014
7	UI Creation	2d?	02/12/2014	02/13/2014
8	Create application environment and menu UI	7d?	02/07/2014	02/17/2014
9	Recognice cubes	7d?	02/07/2014	02/17/2014
10	Real world orientation (for besides and upon)	14d?	02/18/2014	03/07/2014
11	Minigame environment prototype finished	21d?	02/07/2014	03/07/2014
12	Testing of minigame environment	8d?	03/10/2014	03/19/2014
13	Implementing and testing the two first minigames	17d?	03/10/2014	04/01/2014
14	Prototype finished	0d?	04/01/2014	04/01/2014
15	Create the rest of the mini-games	22d?	04/02/2014	05/01/2014
16	Polish software	10d?	04/18/2014	05/01/2014
17	Testing software	10d?	04/18/2014	05/01/2014
18	Finalizing report and web-page	10d?	05/02/2014	05/15/2014
19	Delivery of project and report	1d?	05/16/2014	05/16/2014



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