Initial Plan

Video Realistic Facial Modelling and Synthesis

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CM0343 - 40 Credits

1. Project Description

This project builds on recent research to build video realistic statistical models from training data (i.e. video, both 2D and 3D). The models can be used for analysis of new video, in which the model is fitted to the video frames in order to estimate the model parameters. Such models have been used and developed extensively in our lab. These models can then be implemented onto a mobile device with the aim of being able to allow a user to have their facial actions mimicked by a 3D facial representation.

2. Project Aims and Objectives

The aim of this project is to analyse a users face via use of an Active Appearance Model (AAM) and then extract positional data for key features in order to form the ability to map these onto a 3D model that can be moved in real time by the users facial movements. The AAM will be fed an incoming video stream (either live or pre-recorded) for which it will produce a set of model parameters for each frame. These values will then be used to either create a new 3D face, or control a pre-existing one so that it will move in a way that replicates what the face in the initial video stream is doing. This is intended to work in real time so it will be akin to looking into a mirror with the 3D face providing the reflection of the user. The project will be implemented in an iOS environment.

The main aim of this project can be split into two distinct sections, the first will be porting an AAM onto an iOS device whilst the second will be taking the parameters generated by the AAM and using it to control a 3D model of a face so that the users facial movements are mapped to the model.

These aims can be again broken down into a number of sub objectives that will help to make the project more manageable. When tackling the problem of integrating an AAM into an iOS environment it will be necessary to first research and define potential AAMs and decide how to incorporate them into the project. Three potential AAM's have already been identified, these are an AAM developed by Jason Saragihs whose code is freely available and SDK's for iOS provided by Visage Technologies and Image Metrics. All will be able to provide the aspects of an AAM that are important to this project (namely the ability to extract useful model parameters from each frame) but time will need to be taken to understand each one and to decide which is the best to use. Research will also need to be done into the appearance models used by each AAM as currently they come with pre-built ones. It will be necessary to understand whether these models are generic or person specific and there is a possibility that new appearance models could be created but this is a decision that will be made after further research.

The implementation of the AAM will require a knowledge of the iOS environment to be built up as the AAM should be able to make use of the incoming video frames from the device and then output it in a way that is again understandable to the device.

The aim of using the data from the AAM to control the 3D model will be more complicated as this will involve firstly understanding how the AAM stores and uses the parameters that make up the model and then working out how to extract this data for it to be used in the iOS environment. The use of a 3D model will be a challenge as this could involve having to use OpenGL to first portray a 3D environment and then use it to link up with the data acquired from the AAM to animate a 3D model in real time. Further research needs to be carried out to correctly ascertain the best way of achieving this.

There are many potential applications for mapping an AAM output parameters to a 3D model on a device that can be used for communication but this project will be done with the view that anything related to networking and communications is beyond the scope of this project. However, if the project is advancing quicker than expected then it may be necessary to introduce an additional objective which could be based around using the iOS device to communicate the model parameters to another device to be able to reproduce the model. This could then potentially lay the groundwork for the basis of a video realistic, anonymous communication system for use between devices. This extended goal will be based on how fast the project is advancing and will be decided upon at a later date.

With these objectives in mind the two reports will roughly breakdown into describing the following:

Interim Report Contents
- Analysis of project
- Research into potential AAMs
- Research into use of 3D models in an iOS environment
- Research into use of media in the iOS environment.
- Description of basic AAM / iOS implementation

Final Report Contents
- Description of fully implemented AAM to iOS environment.
- Description of 3D model implementation in iOS environment
- Description of interaction between user and model
- Testing and results
- Future work
- Conclusions

3. Work Plan

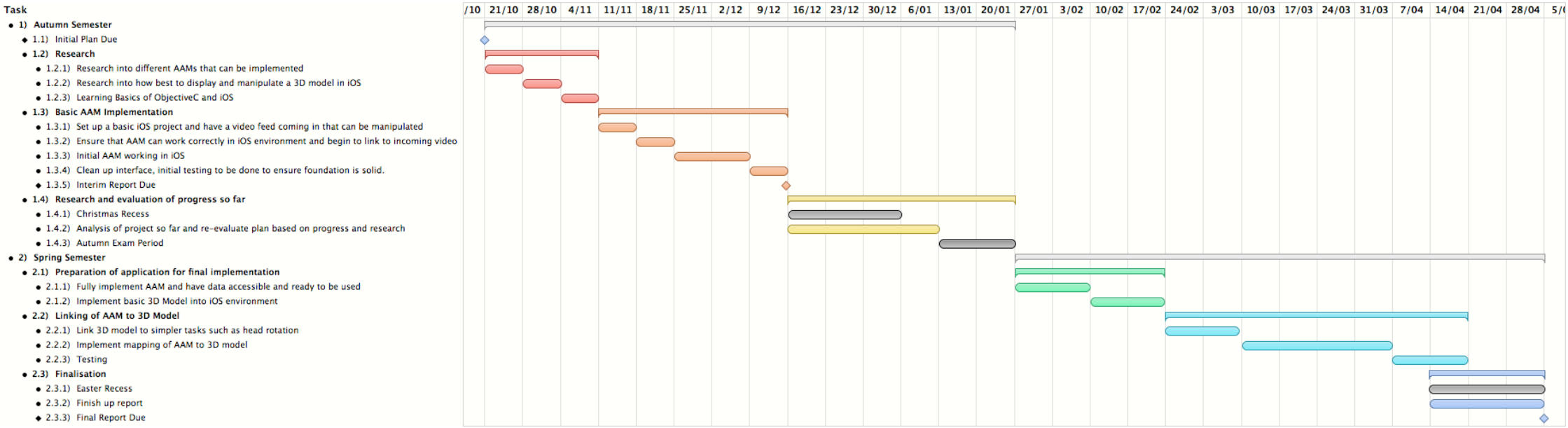
The work plan for this project will commence on the day after this initial plan is due in, however it should be noted that general research is already underway.

The whole project has been broken down into six distinct sectors spread across the two semesters. Each semester should roughly equate to the two high level aims mentioned previously, specifically, by the end of autumn the AAM should be ported to an iOS environment and by the end of spring the device should be able to use facial features as a way of controlling a 3D model.

The chart in appendix 1.1 shows a broken down view of each sector and how the final project aims will be achieved. At this stage the timescales in the Autumn semester stage are likely to change once the challenges are better understood via research done in the initial stage of the spring semester. To this end the period over the Christmas holidays and Autumn exams will be used to take stock of progress and to re-evaluate time scales. This could mean that a new project plan is drawn up for the Spring semester based on these results.

Finally, slots have been allocated in the Autumn timetable that will be dedicated to the project which will hopefully allow a more work like approach to the days. These are shown highlighted in blue in appendix 1.2. Whilst these slots are solely for the project, a considerable amount of work will also take place outside of University time.

Appendix 1.1 - Detailed Work Breakdown



Appendix 1.2 - Timetable With Dedicated Project Slots

School of Computer Science & Informatics **BSc Computer Science Year 3** **Autumn Semester 2012/13**

	9.00 9.50	10.00 10.50	11.10 12.00	12.10 13.00	13.10 14.00	14.10 15.00	15.10 16.00	16.10 17.00	17.10 18.00
Mon	**CM0390** **Rm C/2.07** MWD	**CM0311** **Rm T/2.07** PLR	**CM0311** **Rm T/2.07** PLR		**CM0373** **Rm C/2.07** IMC	**CM0373** **Rm C/2.07** IMC			
Tue	**CM0343** **Rm C/2.07** **Wks 1, 9** FCL			**CM373** **Rm T/2.07** IMC	**CM373** **Rm T/2.07** IMC	**CM0390** **Rm C/2.07** MWD			
Wed	*CM0311 Lab* *Rm C/2.08* *Wks 2-11*								
Thu	**CM373** **Rm C/2.07** IMC	**CM373** **Rm C/2.07** IMC	*CM373 Tut* *Rm T/2.07* *Wks 2-11* SH						
Fri	*CM0390 Lab* *Rm WX/2.09* *Wks 2-11* MWD	*CM0390 Lab* *Rm WX/2.09* *Wks 2-11* MWD							