Bidding Document
Project 21

Face Capturing
with Decoration

Preference 2nd

Team 2018-10

COMP 2043.GRP

Software Engineering Group Project

University of Nottingham

Developer Group
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Huixing REN
Zeyu ZHANG
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Preface

These Standard Bidding Documents for Face Capturing with Decoration (P021) have been prepared by Team 10 of COMP 2043.GRP, and are based on the project briefs on Moodle.

The developer group consisted of six people, Runyu ZHANG, Qichen ZHANG, Yinglun LI, Huixing ZHANG, Zeyu ZHANG, and Yundan WANG, whom are from University of Nottingham, Ningbo, China.

This Project is the second choice of all available projects. It is aimed to build a mobile app to detect the face, detect the facial landmark, and then decorate the face accordingly.

The definition of face detection refers to a subset of computer technology that is able to identify people's faces within digital images and videos.

The developer group will work together to complete a full cycle of software engineering process, aiming at building a mobile app for face capturing with decoration. The app will use JAVA language based on Android studio. The app can be used on mobile phones. It is expected to recognize different faces with their landmarks and decorate with the chosen masks, besides, the photo with masks can be stored in photo gallery.

This software engineering project will include requirements, SE approaches and methods, the face capturing with decoration program design, coding, debugging, testing, and etc.

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Chapter 1
Introduction

1.1 Document Outline

The document bid is structured in the following way:

Chapter 1 is the overview of the development team, and the background of face capturing.

Chapter 2 will introduce some important concepts in our project and give a basic plan of how we would implement them.

Chapter 3 describes the development process of our project which is by discussing the software requirements, software approaches and methods, the design of serious game, together with coding, debugging and testing, etc.

Chapter 4 presents the schedule of the process of the project development, including the important dates during the year, and the detailed timeline of the project.

1.2 The Developer Team: *why choose us?*

Members of our team generally have the ability and experience of using programming languages such as Java, C, C++, python and have a strong interest in machine learning, artificial intelligence, hardware and software development. Some of the team members have participated in computer competitions and won awards. There are six members in the team, including a team leader. Everyone has unique advantages as well as clear logic, good understanding and expression skills. When work arrangements are needed, it is generally up to each member to come up with their own ideas, and then analyze them together. The final choice will made by group leader and the tasks will be assigned reasonably to everyone according to their interests and abilities. Therefore, our group is able to complete the project correctly and efficiently.

1.3 CVs of Team Members

The following is a brief introduction of our team members.

Runyu ZHANG (Team leader)

Familiar with C, C++, Python, Java and have experience of writing programs in these languages.
Participated in robot competitions.
-Third prize in national robot competitions in high school and university.
-Second place in the Hong Kong Robot Track Obstacle Race.
Excellent decision making and leadership.
Interested in artificial intelligence and machine learning fields.

Yinglun LI

Skilled in using C and Java and have studied Python and Swift.
Have experience in program development.
-Participated in a smart medical system development.
-Participated in the design and production of some web multimedia.
Second Prize in the Computer and Multimedia Design Competition of the city.
Great understanding in code specification.
Strong aesthetic and design skills.

Zeyu ZHANG

Familiar with C, Java and Database establishment. Self-learned Python foundation.
Worked as an IT intern at an educational institution.
Interested in machine learning, robot programming and AI.
Good understanding and communication ability.
Strong sense of responsibility.

Qichen ZHANG

Familiar with C, Java, Haskell and Database establishment.
Having experience in summer research in Neural networks.
Interested in machine learning, robot programming and AI.
Good understanding and communication ability.
Strong sense of responsibility.

Huixing REN

Familiar with C, Java and Haskell.
Have teaching experience in C language.
Have good program skills and motivated to learn new knowledge
Great understanding and learning ability.

Danyun WANG

Familiar with C, Java and Database establishment.
Worked as an assistant of customer manager at the Bank of Communication.
Interested in machine learning and AI field.
Good understanding and learning ability.
Strong aesthetic and design skills.

1.4 Background of Face Capturing

In recent year, face recognition techniques have become more and more popular. For example, the face unlock feature and automatic beautify feature which are based on face capturing is almost standard on all smartphones. Many people choose mobile phones for beauty features, and these features do meet the daily needs of people.

As these demands increase, automatic beautify or decorative features are becoming more mainstream. To this end, we want to develop an app that can implement those features with face capturing.

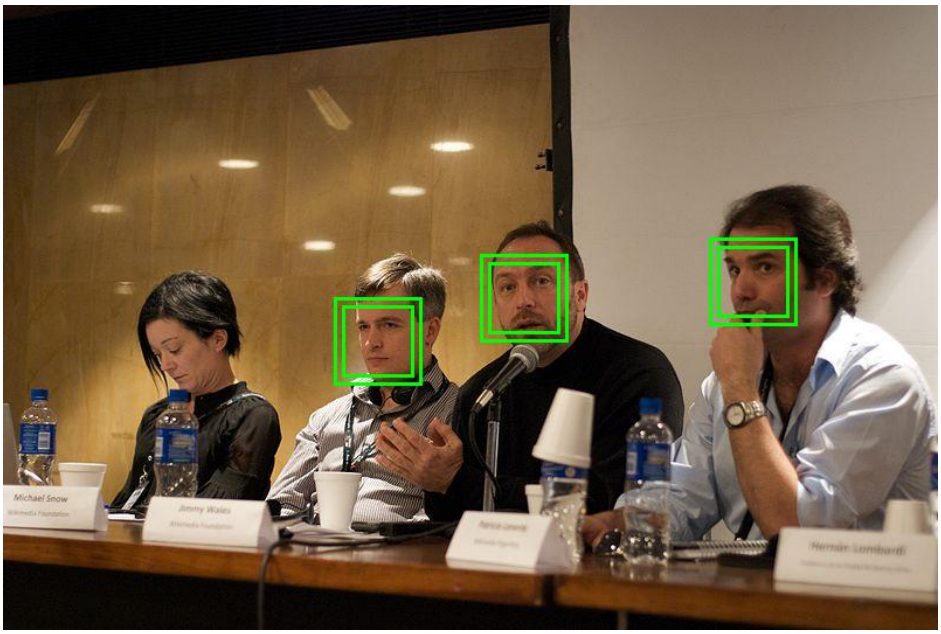
Chapter 2
Face Capturing with Decoration

Since this project has brought us to a new field, we have done some research on the key concepts in order to better understand and implement the project.

2.1 Important concepts

In this part we will introduce three concepts. Understanding their principles is very helpful for us to build the software later.

2.1.1. Face Detection



Face detection is a computer technology being used in a variety of applications that identifies human faces in digital images. It's algorithms focus on the detection of frontal

human faces and can be regarded as a specific case of object-class detection. Face detection can be used in many fields. For example, some recent digital cameras use face detection for autofocus.

2.1.2 Facial landmark detection

When we detect the face, further, we can identify different parts of the face such as the eyes, nose and mouth. This recognition technique is facial landmark detection, which is also called as face feature detection or facial keypoint detection. In this way, we can know the precise position of the facial features, which is very beneficial for us to add decoration to the face.

2.1.3 Image Processing

In computer science, digital image processing is the use of

computer algorithms to perform image processing on digital images. For our project, it's a useful technique to add decoration to the face after we detected the position of the face and facial features.

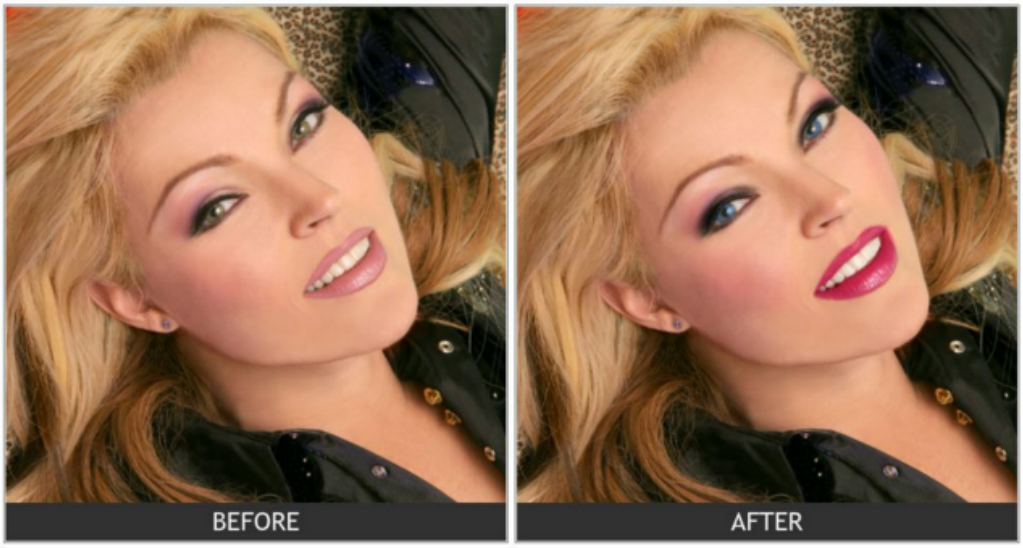


Figure 2. Landmark detection for virtual makeover.

2.2 Implementation

We find some useful library that may helpful for us to implement face capturing.

Dlib is an open source library that contains many algorithms in machine learning, computer vision, image processing, and linear algebra. We can use it to achieve face detection and facial landmark detection.

Chapter 3
Program Development

Requirements：

The app is used to shoot video with entertainment. The users want to decorate their faces with different masks and have a funny effect in their videos. In this way, We need to implement these functions as required by the teacher:

1. Automatic face detection: detect a few faces (at most 4) from the video stream, mostly selfies,using face detection algorithms.
2. Automatic facial landmark detection: detect the major facial landmarks from the video stream,e.g. eyes, nose and mouth, using facial landmark detection algorithms.
3. Face capturing with decoration.

And the app should implements those functions:

a. Create a list of face decorations, e.g. cartoon mask, crowns and etc.
b. Choose a decoration from the list, and overlay it on top of the video stream.
c. Press the capture button to capture the face image, with the selected face decoration.
d. Preview the captured image, and save it to the photo gallery.
e. Optional functionalities includes: classify the gender and age

using faces, and suggest the face decoration accordingly. Or any other fun functionalities that could promote the usage of the app.

Software Approaches and Methods

We will apply agile development. We have six students who are in the small teams, with small budgets. Agile methods exist to be flexible about the SE stages, there are times when it is good to plan, which gives us possibilities to fix our problem.

Design

In the game design stage, we will make an Object-Oriented design. Produce a class diagram which contains the elements of this project and make component design in UML. Then, we will create a preliminary prototype. With the development of our project, the prototype will be improved.

Coding

Coding is very important. Well coding means “easy to maintain”. In order to code to certain standards, we will coding according to certain strategies. One student will be the manager and other five students will be in charge of different developing parts, but all of

us will have enough ideas of the whole situation. We will communicate frequently, and be sure that all of people meet the requirements.

Debugging

Debugging is a social, multi-faceted skill. So, we should first find bugs, try and reproduce it. We may use some debugging strategy such as binary search and hypothesis testing. Also, we may use a bug tracker which records data to help us judge the defect. Our group will print out the code and do a group code inspection twice a week or once a month.

Testing

First, we will build a test plan that developers can use it to test code before delivering it and managers can use it to estimate testing workload, and schedule it and include it in the budget. We may use Unit Testing to test the individual pieces and Integration Testing when we test combinations of pieces. Following are the Release Testing and Acceptance Testing. We will consider the result and may need to change our framework until the acceptance goes very successfully.

Chapter 4
Schedule

4.1 Important Dates

The facial detection and decoration development project will be assessed through a number of tasks to be completed at specific times during the project. There are also other important deadlines that must be met. The tentative key dates and deadlines during the process of development are given in Table 4.1.1.

Task	**Date or Deadline**
Equipment requests	From 15 October 2018
Group project site up and running	Thursday, 31 October 2018
Interim reports due	Thursday, 13 December 2018
Final reports and software due	Thursday, 11 April 2019
Open Day (TBC)	Presentation Day (TBC)
Presentation Day (TBC)	Wednesday, 24 April 2019

Table 4.4.1 Important Dates (Tentative)

Chapter 5
Appendix

Appendix i. References

https://docs.opencv.org/3.4.0/d2/d42/tutorial_face_landmark_detection_in_an_image.html

https://yq.aliyun.com/ziliao/295287

https://en.wikipedia.org/wiki/Face_detection

https://en.wikipedia.org/wiki/Digital_image_processing