Indian Institute of Technology Guwahati

Department of Computer Science & Engineering

Software Engineering Lab (CS243) Assignment, January – April (2017) Session

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1. **Each group will be assigned one project; the group is expected to implement all the stages of SDLC for the project throughout the semester, along with the progression of the class lectures.**
2. **Each group has to submit a formal report after completion of each phase of the development.**
3. **Proper documentation and final report of the entire work are mandatory.**
4. **For projects 1-3, system implementation is mandatory though the user evaluation stage may be scaled down. For the remaining projects, you may implement hi-fidelity prototypes if you are not comfortable with coding (full system implementation may not be necessary). However, the prototype (s) must have to go-through rigorous user evaluation phase, to earn credit. If you chose to focus more on implementation, scaled down user evaluation will be acceptable.**

Useful Software/Tools:

- Android Studio
- OpenGL library
- OpenCV library
- 3D Studio Max, version 2014 for modelling 3D object and partition of an object into different parts.
- SDK Vuforia with Unity3D software.

In order to do the following TWO projects (project 1 & 2), we'll assume an IT-enabled large classroom environment as follows: both the students and the instructor carry mobile devices (smartphones, tabs or laptops). Instructor plays the lecture slideshow on his/her device. These slides are automatically shared with the students (on their devices), including the slide transitions. Thus, there is no need for projectors. Students can also hear the talk delivered by the instructor using earphones plugged into their devices.

(We have already developed such a system. You may contact head TA Mr Subrata Tikadar for a demo, if interested).

Due to the large number of students present in the classroom, it may not always be possible for the instructor to observe all the students whether they are attentive or not. Instead of attending the lecture, some students may play games with the smartphone, some students may just put the phone on the desk and gossip/whisper with her/his classmates. We want to make the IT-enabled large classroom system "smart", which can automatically detect the attentiveness of the students and alert the instructor accordingly.

As we know, smartphones are called "smart" because of the various sensors present in them. These include accelerometer, gyroscope, proximity and the like. We want to utilize the power of these sensors to identify the activity of the users of the device. That is the objective of the projects.

Project 1: An app to detect student activity and alert generation for the instructor

In this project, you are asked to use the three features (which can be obtained from the relevant sensors): *orientation of the device, distance between user and device* and *movement/shaking frequency of the device*. Using these features as input, develop the app by which the instructor

a) Can get an alert whether a particular student is engaged with the lecture or doing something else,
b) Is able to know how many students are engaged and how many students are not.

Assume the ideal condition of engagement is as follows:

a) distance between user and device = 25 cm
b) movement/shaking frequency of the smartphone <= 2 per minute
c) orientation of the device: (x-axis = 45°, y-axis = 0°, z = 0°)

You can make use of other sensors (excluding camera) if required.

Project 2: An app to detect student activity and alert generation for the instructor (camera-based)

All the smartphones come with front-camera. It is possible to detect the movement/position of the eye/face by this important sensor. By detecting the eye/face movement/position, it is possible to identify whether a student is watching the lecture slide or sleeping (or looking at somewhere else). Using the eye/face movement/position data as the input features, develop a system by which the instructor

a) Can get an alert whether a particular student is engaged with the lecture doing something else,
b) Is able to know how many students are engaged and how many students are not.

Assume the ideal condition of engagement is follows:

a) head/eye movement frequency of the user <= 2 per minute
b) distance between user and device = 25 cm

You may determine the distance between user and device by using the proximity sensor. Also, you can make use of other sensors, if required.

Project 3: a mobile app to tell your mental state

Here's a look at how your eyes speak volumes and how you can learn to read other's mental states through their eyes [1]. Although it is considered unreliable or controversial by some, eye movement analysis might have some truth to it.

1. **Stress**: When someone blinks fast it is often a sign that they are under stress. At rest, the normal blink rate ranges between 8 and 21 blinks per minute. If a person blinks more frequently, such as when asked a challenging question, it is usually because he is stressed. But this isn't always the case. Blink rates can also increase as result of dry air, dry eyes and allergens in the air that irritate the eyes.

2. **Disgust / Distaste**: If you see someone narrow his eyes when you are speaking to him, this is usually a negative response showing you that he finds what you are saying to be offensive. When it comes to showing distaste with the eyes, the narrower the eyes are, the more unpleasant you find what is being said. However, the best way to decipher a person's true emotions is by looking at the rest of his face. For example, narrow eyes and tight lips indicate anger.

3. **Happiness**: Happiness is conveyed through the eyes in a number of ways. Arched eyebrows accompanied with a smile indicate you are happy to see someone. Mothers do this naturally with their babies across all cultures.

   Another way that happiness can be detected is through the size of the pupils, which is of course an involuntary reflex. Large pupils let others know that you like what you see. Studies have shown that when you look at an object or person you love, your pupil size increases.

4. **Fear or Surprise:** Fear is usually indicated by wide open eyes not accompanied with a smile but often an "O" shaped mouth. Surprise on the other hand is also usually shown by wide open eyes along with a fleeting look. Additionally, the pupils will dilate if a person is frightened or excited due to the natural adrenalin response of the body.

5. **Focus**: When someone is focused on something, particularly a near object and the pupils will constrict. Alternatively, they will dilate when someone is looking at a far distance.

Based on the above information, develop an android app through which it is possible to detect the above states of a mobile user. Take the advantage of the front camera of the smartphone.

Project 4: Game based learning

In this virtual game based learning system, students learn through a gaming environment. The application is a fully mobile based application. The system provides touch based user interface which will guide student to learn different sorting algorithms. The student can play and learn during the lecture or outside of the college hours. A teacher also can use this application as a supplementary for teaching sorting algorithm.

Initial interface will contains menu like play game, restart, quit, user helps etc. Rest part of the screen should contain the rules for playing the game. Under the **play the sorting game** player will select any sorting from the list (The app should contain at least 3 options in the menu for 3 different shorting algorithms). Based on the selection of the sorting algorithm from the menu, the algorithm in pseudo code should be displayed first. Student should learn the working principle of the algorithm from there. After pressing the "Start Playing" button, some 3D cubes labeled with some 2-digit numbers in unsorted order will appear on the screen. The cubes on the screen are swappable. The student should swap the cubes correctly as per his/her understanding of the algorithm. Every correct swap adds a score of +10 and every wrong swap -10. If a student perform three conjugative incorrect swaps, a message will be displayed requesting to restart the game. If a player successfully performs all swaps, it will report the score as per total correct and incorrect swaps and time taken to complete the sorting. The system also generates game statistic report that include name of the player, max score (without mistake), number of restarting the game etc.

Project 5: Mobile based virtual museum explorer (virtual tour)

The objective of the project is to develop an app to perform a virtual tour of a museum. The virtual tour will help the system user to explore the museum, providing a 3D visualization of the museum building (with different sections such as Archaeology, Art, Anthropology, Botany etc., properly labelled). Your app should support

a) Overview of the museum (auto-tour)
b) Interactive tour (i.e., moving to a section based on touch interaction)
c) Section labelling
d) Different viewpoints at each section

You may choose any number of sections (at least 3) on any topic.

Project 6: Mobile based virtual museum explorer (virtual guide)

Unlike the previous one, here you are expected to use the concept of *augmented reality*. In the **virtual guide**, the visitor points his/her (phone) camera to an artefact kept in the museum (say, a mask). On the mobile screen, the image of the mask along with its details such as the historical background, time of the mask use, from where it was discovered, size, material used for making the mask and so on, are displayed.

You may choose any number of artefacts, of any shape and size (at least 3).

Project 7: learning through interactive visualization

Assume that a teacher is delivering lecture on the basics of a computer system. You want a virtual experience for better understanding on that topic. Develop an application for the purpose. The system also acts as a virtual tutor, telling relevant concepts about different components. Your system should contain

1. 3D representations for individual components (e.g. processor, RAM etc)
2. Mouse-based interaction (zoom, rotation, scaling).

Project 8: virtual ad-space

Consider a real world object (say a building). You point your smartphone camera towards the building. What you see on your smartphone screen is the "virtual space" occupied by the building. A company is interested in advertising its product in the "virtual space". For that, it has chosen the IIT G virtual space. That means, whenever anyone points his/her camera to the buildings in the IIT G campus, the building along with the ad is shown on the screen. Design an app for the company (you may choose a very simplified representation of the IIT G virtual space).

Project 9: 3D news-reading experience

When we read newspapers on the screen, it appears in 2D. We access the pages/news items through scrolling and clicks. However, the real-world newspapers are 3D entities with 3D manipulation of pages. Systems like Kindle attempts to make the reading experience closer to reality. In this project, we try to explore somewhat different on-screen news reading experiencing by making the following changes:

1. Show the digital newspaper in the form of a polyhedron. The number of surfaces may be equal to the number of headlines.
2. The polyhedron should be manipulated interactively (through mouse gestures).
3. The reader should be able to interactive access the surfaces of the polyhedron (i.e., the headlines) and zoom in/out the news under each headline.

Project 10: Online examination system (mobile based)

As we know, now-a-days many exams are conducted online. In this project, you are expected to build a system (including interfaces) for conducting MCQ-type online exam system (for demonstration, you can use your desktop as server and mobile as client). The system should have the following facilities.

a) Creating of question bank by the examiner.
b) Starting and ending of the exam by the administrator.
c) Setting of exam duration by the administrator.
d) Question answering by the student.
e) Facility for the student to see and pick questions to answer.
f) Timer displayed to the student (time remaining).
g) Auto-closure of the exam (after the timer runs out).

Useful references and links:

For Android Studio Tutorial the following links may help you.

1. https://developer.android.com/training/index.html
2. http://www.androidauthority.com/android-studio-tutorial-beginners-637572/
3. https://www.tutorialspoint.com/android/android_studio.htm

Reference:

[1] http://www.ssfeyecare.com/2014/03/31/how-your-eyes-convey-emotion/