Software Engineering Project

Description of the project:

General overview:

High quality and affordable 3D scanners have now become very familiar in many aspects of our everyday lives and are no longer restricted to industrial or academic applications. It is now well understood that 3D printing, augmented and virtual reality are much more than promising technologies and that affordable and meaningful 3D content is urgently needed.

One way to produce content is 3D scanning of real life objects. More precisely, 3D scanning of people is one of the most interesting applications. However, 3D scanning of people is very challenging if you want to achieve a repeatable level of quality at a certain speed, except for when you have a 3D scanning rig, which combines point-and-shoot functionality with portability

Context:

This project is a joint project with Alexander Hermanns who has developed a scanner rig composed of a turning table and a mobile sensor (Kinect v1) that allows for the 3D scanning (geometry and texture) of people. The acquisition and the processing are performed with a software called Skanect (http://skanect.occipital.com/).

Objective

The main objective of this project is to replace the skanect software by our own, home-made acquisition and processing software so that we no longer depend on proprietary software. Material resources will also be made available so that functional prototypes can be constructed by the students.

Practical organization

Students can be spread within **groups of 4 students at most.**

The project is designed to be completed over 10 weeks and is supposed to start on October the 15th to be finished during Christmas vacations. Defense and presentation will be held in January.

Tutors (CJ and DS) will also be members of all the groups, namely Cansen Jiang and David Strubel. Please, pay attention to the fact that Cansen is heavily loaded with work since he is currently writing his thesis. Consequently, please do not contact him before November.

Some time slots for discussion with David and/or Cansen can also be arranged on a bi-weekly basis or upon groups' request. You can also use parts of the Labs and classes with David ("TD and TP" in French) to organize project sessions.

Evaluation and grading

All the students within a group shall be graded equally. If all the students in a group agree, some adjustments can be done to reward extra points for outstanding commitment (or inversely, some points might be substracted in case of lack of commitment).

The group will be evaluated as follows:

1. Technical quality of the project (50%). This includes the quality of the implementation (including a critical analysis of the provided sources, comments and explanations on the developed solutions), level of functionality achieved by the software, the easiness of use, the quality of the user interface, etc.
2. Project Management (25%). This includes the proper planning of the project, its realistic implementation and timely reach of the project milestones, the respect of all the deadlines, and the **equal share** of the workload between the students. In case of unsolvable conflicts that require the tutors to take actions (such as swapping students or rearranging groups), some points will be deduced from the final mark.
3. Reporting and Defense (25%). **Report must be written using LaTeX and present in detail all the technical aspects of the implementation.** The defense will be held on January. Each group will have an equal duration (to be adjusted depending on your needs) to present their software, implementations, and any other aspect deemed as important.

The detailed evalutation spreadsheet is also provided for your information.

Required features and guidelines

Each group will have the opportunity to propose, then develop (if accepted), any functionalities deemed necessary to the software. This year, the novelty comes from the fact that you will not start your implementation from scratch since you will be provided all the sources developed last year. However, if many aspects are very well done, the quality final output (the reconstructed mesh) is still rather poor. Consequently, many aspects can be improved, and this is exactly the purpose of this software engineering project.

As a recall of last year, the project must respect the following criteria:

- Acquisition duration must not exceed 90 seconds in total
- Various processing of the data can be performed offline
- The system must provide watertight triangular meshes
- The system must allow for the import and the export of 3D textured meshes
- The user interface must allow for the visualization (or preview), even roughly, of the scan and individual acquisitions. Some additional processing and edition (remove parts, smoothing, do/undo, etc.) can be implemented once agreed by the tutors (CJ, DS)
- All the groups have agreed on the same sensors for the project. You

can use either Kinect V2 or Intel R200 sensors (or both).
- Implementation must be in C++ only. IDE can be Qt or Visual studio (whatever you choose, please make sure you can recompile your code interface in both IDEs). **OS will be Windows only.**
- The usage of extra libraries such as Point Cloud library, Eigen, etc. Is allowed but it must be discussed with the tutors beforehand (to avoid exotic libraries).

Advices and other information

All the groups are allowed to collaborate, and some parts of the project can be developed jointly (once agreed with tutors). Collaborative work and active attitude toward the exchange of knowledge (seminars, tutorials, code examples, group discussion) will also be awarded extra points.

However, working together does not mean that all the groups shall have identical outputs...

Please **learn to listen to each others**, and accept that people might work differently from you. This is very important, and you will soon realize that there exist strong differences (temper, culture, etc.), so always take the time to discuss rather than argue.

This is a very ambitious project and all of your soft skills (communication, ability to work in group, ability to listen to the other, planning, etc.) will be crucial. If you want to hear about funny stories about this, simply ask to the former BsCV students... **Pay a special attention to the project management and the spread of the workload**. Be sure that you are comfortable in your role within the group.

Do not hesitate to seek for help. Do not hesitate to learn from your teammates: it's not because you do not feel skilled in one field that you cannot try something within this project. Try your approach and simply team up with someone else in your group who can show you how to progress.

Pay also attention to over-commitment, exhaustion and health issues. Soon, you will have to work on many other projects, courses level will raise, weather will become cold, and you can quickly get a cold which will make the whole much more difficult. Manage your time, spare your efforts, avoid coding late at night, etc. Oblige yourself to sleep at least 6 hours by night, rather than in class...

Never hesitate to ask for feedback and guidance, but avoid seeking for ready-to-go solutions. Please use our Edmodo platform for question so that all of us (including tutors) can benefit from the answers.

The sensors will be made available in the robotics room in Condorcet. You can use them in this room, but you cannot bring them at home.

Most importantly, enjoy!

At last, the sources, reports and documentation are available at :

Group 1: https://github.com/umaatgithub/3D-KORN
Group2 : https://github.com/WajahatAkhtar/Project-S.E
Group 3 : https://github.com/AnirudhPuligandla/3D_scanner
Group 4 : https://github.com/tazleef/Software-Engineering-Project