

# Bi-Weekly Report

12 November 2014

## Team Information

This document contains a summary of all that has been achieved over the last two weeks by team 19 on the CTSNet Robotics project as a part of the module Systems Engineering I of the University College London Computer Science course. Team 19 is formed of three students, Edward Collins (team leader), Kirthi Muralikrishnan (website and documentation lead) and Tom Page (research and programming lead).

## Client Information

Team 19 has three clients:

- ~Dr Shabnam Parkar, a paediatric surgeon at Great Ormond Street Hospital.
- ~Dr Joel Dunning, cardiothoracic surgeon at James Cook University Hospital.
- ~Dr Lourdes Agapito, computer graphics and vision expert at UCL and primary supervisor.

## Summary of Progress

As the first term draws to a close so does this first module of Systems Engineering. Two weeks ago it was thought that the deadline for submission of work from this term would be Friday 12 December, however this deadline has since been extended to Wednesday 17 December.

The past two weeks have involved a significant amount of work on behalf of all members of the team, with our goals being to have finished the team website, created a video presentation and created prototype programs by 12 December. A significant amount of this work has been achieved, but it is by no means finished.

These two weeks saw the creation of prototype programs that make use of the Kinect sensor, and will make up the software layer that provides the functionality behind the depth sensing endoscope. Our original goal was to have the program output numeric values of the distance of objects from the sensor and if this goal was realised, to work on distinguishing foreground from background. As it turned out, getting numeric values of the depth of objects proved to be too complex to complete in two weeks. The team rather focused on determining foreground from background - an essential ability to have in order to ascertain which objects in the camera's view are surgical tools and which are part of the body.

To this end, a program was designed that removes any object that is coloured red from the camera feed. As the interior of the body is all a certain shade of red, this would mean that the software would be able to recognise tools (parts of the camera feed that are not red) from the body (parts that are red). In addition, a basic depth sensing program was created that will be refined next term to determine exact measures of depth. This is a starting point for more advanced development of the system, which could involve using techniques such as active shape modelling to track tools, or other statistical models that should allow the system to intelligently recognise whether an individual pixel of the feed belongs to a tool or to the body based on its colour.

In addition to this prototype creation, the team has worked on documentation of the project including editing the team website, finalising UI designs and creating other documents associated with the project such as requirements listings. All of this content shall be present on the website by Wednesday 17 December. Also present at this date shall be the team's video presentation which the team has begun to create.

## Summary of Team Meetings

Date	Topics Discussed	Time
5 December 2014	Discussion and assignment of remaining work and prototype.	2 hours
9 December 2014	Discussion of structure and content of team website.	45 minutes
12 December 2014	Discussion of website content and structure and video presentation.	2 hours

### Difficulties Encountered

When creating the prototype, the team ideally wanted to create a program that could identify foreground from background and then print numeric values of the distances away of objects in the foreground from the sensor. It turned out that this was more complex to implement than initially thought, and would require longer than two weeks. The team instead changed its focus to identifying foreground from background.

Furthermore the team has encountered some difficulty with creating the website, requiring the use of new tools such as Bootstrap in order to make the website look professional while containing a large amount of content.

### Progress Target

By Wednesday 17 December, the team needs to have:

- ~The team website fully created and functional with all content related to the project readily and clearly available.
- ~Created and edited a video presentation of the project.

Following this, the team hopes to spend the Christmas break researching around the project some more, particularly in learning to program the Kinect and getting it to work with Macintosh computers, before researching more advanced techniques to use in the system such as active shape modelling mentioned earlier. Next term, focus should be far more on getting actual code written and building functional prototypes of the final system, as opposed to this term which has been focused on understanding and designing the system.

### Individual Description of Tasks

#### Ed Collins

Over the previous two weeks I have focused on creating necessary documentation for the project. I intended to help Tom create a prototype of the system, but unfortunately could not get the Kinect to work with my laptop which is proving to be a real problem. Hopefully this issue will be resolved over the Christmas break.

Therefore, rather than helping with the prototype I designed the structure of the website in terms of what content should be placed where and have worked on creating some of this, including finalising the UI designs and writing a summary of them to be included on the website, as well as formally writing the requirements listing. Documents still left to create include a formal write up of the project background and the team's plans and goals for next term. In addition I have created some aspects of the video presentation (with Tom) and will be adding a further section of the video to this.

#### Tom Page

Over the last two weeks I have developed some prototype software to be able to demonstrate the proof of concept for our system which we shall develop next term. These small programs consisted of image processing algorithms which will be helpful in the forward progress of the project. The first of these was a depth sensing program which uses the Kinect to give a bitmap giving the depth of the objects in the image. The second program was one which removes the red from an image, thus giving what would be the tool in the body, as the tissue would be red coloured and therefore removed. The effect was similar to that of a green screen with red rather than green.

These two algorithms will eventually work together in order to find the foreground objects and then determine the distance to the background objects. This is the primary goal for next term.

In addition to these programs I also created a video presentation to demonstrate the prototype and also to give a tutorial on how to rewire a Kinect. During the Christmas holidays the aim is to conduct more research and perhaps continue to develop and improve the algorithms which will be used next term.

**Kirthi Muralikrishnan**

I have been working on the website for the last few weeks, adding all necessary content to it and more generally designing it. The team had completed the prototype a week ago. The content structure of the website was finalised as well, giving the website a logical structure. The next step is to develop the website further. We have decided to use the tool Bootstrap to make the website interactive and look professional. I have started to learn to use Bootstrap and the work is very promising. We have also planned to work on the video and get a major part of it done over the weekend before the Christmas break. I have also planned to set up a Kinect and start working with it and programming it.