# Project Research Document

## TU Dublin Camp Booking System

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## Section 1 Detailed Discussion

I will be creating a booking system web application. This application will be used by our lecturers in TU Dublin, Tallaght campus who provide 100s of computer science outreach camps per year, to both primary and secondary schools all around Ireland. This booking system will allow schools to create accounts and after verifying their account, browse available camp dates and then make a booking. Successful bookings will be confirmed by email, reminders/instruction emails will automatically be sent out closer to camp date.

The booking process will be made as simple as possible for schools; once the school enters in their unique school roll number, the rest of the school’s information will be filled out automatically i.e. school name, address, eircode, phone number, email etc. The school will be asked for additional information such as start and end time for camp, class groups (6th class, 4th year etc.), topics to be covered (choose from a list created on admin side), and also if they would like to opt-in to take part into surveys.

These longitudinal surveys will help lecturers improve and transform their approach/techniques which will help develop the camps moving forward and in turn, allow lecturers to reach and inform as many students as possible, of what computer science really is, addressing stereotypes and incorrect perceptions of the subject. There will be a student survey and a separate teacher survey, optimizing research scope. The research will inform the team on pedagogical development, content and activity development. Due to the high number of surveys (2000, 3000 per year), and the fact that they need to be hand written to get parental consent, I will need to automate the process. Lecturers will be able to scan the surveys and upload them onto the system. I will then use the iText7 library to scan each pdf and extract the required data which will be entered into the database. Depending on the type of text and the quality I may need to use optical character recognition to achieve this. If this is the case, I will use Tesseract OCR library/toolkit.

I will use live CSV files from the government CSO website to gather information on every school in Ireland into the app database. Lecturers will be able to upload these CSV files on the admin panel (this will be needed as the CSV files are updated every few months). This information will facilitate the above pre-population of booking fields for schools and will also provide a wealth of information to lecturers such as school gender, school numbers, school location (LAT/LONG/X/Y). This location information can be used to calculate time to travel to schools for lecturers/google map directions using the google maps API.

As administrators, each lecturer can add dates which they are available for school camps. Lecturers can view a list of all bookings, search bookings by School Name & County, and also edit/close bookings. As mentioned above, lecturers will also be able to upload CSV files and surveys onto the system. Data analysis visualizations will be presented to lecturers using the extended booking data. These will be live visualizations that change with each booking. These visualizations will show information on number of bookings made by schools by county, number and genders of students in completed camps, number of bookings made by primary/secondary schools, most popular subject area choices, most popular class groups etc.

## Section 2 Existing Applications in this domain

There are many online booking systems available which all seem to be basic CRUD booking systems with email verification/reminders and online payment systems included (although we do not need a payment system included). Below is a list of the main providers in this area:

* Gettimely.com
* Checkfront.com
* Bookeo.com
* Planyo.com

Most of the above providers would allow for pre-population of databases (which we need for our government CSO CSV files). As far as I can see these booking system providers do not offer any data analyses or visualisations out of the box. Although some of these providers give the option to connect to the Google Maps API to give directions to the business itself, they do not provide the functionality we need to get directions to each separate database booking (school address in our case).

## Section 3 Platform, Technologies and Libraries

This web application will be developed through C# and Microsoft’s ASP.NET MVC framework. I think this framework is ideal for my project as the Model-View-Controller architecture is very current and popular in the industry at the minute. As a single developer on this project, MVC will allow me stay in full control of how schools and lecturers interact with the wep app front end. It will also allow me to govern how the business logic is arranged with the use of controllers. The models layer and the entity framework, provide a straight forward and flexible way to persist and modify the large amount of data in my application. ASP.NET Identity will provide a solid and secure way to add login functionality to the application for schools and lecturers/admins. I will also take advantage of Bootstrap within the MVC framework, which will allow the app to support all major browsers, including mobile access.

I will use SqlBulkCopy to retrieve the data from a DataTable(which will hold the data from the uploaded government CSO issued CSV files) and enter it into our database as a bulk entry. In order to automate the survey process I will be using the iText7 library and/or the Tesseract optical character recognition library/toolkit to extract the survey data from the .pdf files in order to facilitate research/data analytics. I will also integrate the Google API into the project to take advantage of the school LAT/LONG location information provided by the CSV files.

I will use the LiveCharts toolkit/library in order to provide live visualisations from the collected data in our database. Finally, I will implement a CI/CD pipeline with Azure DevOps which will automate the build/test and deploy to AWS process. Options for hosting on AWS include either elastic beanstalk which will host the application on VMs or a Kubernetes cluster if I decide to go down the containerisation route.

## Section 4 The risks

The main risk for my project to succeed comes from automating the survey to database process as this is the most important piece of functionality in the system due to the number of surveys (manually entering this information into the database is not an option) and the importance of the data to the system. As mentioned in section 1, is it vital that lecturers are able to upload the surveys in .pdf format onto the system for the data to be persisted in a database to facilitate research/data analytics. In order to implement this, I will need to use iText7 library which will allow me to extract all of the data we need from each .pdf file into a .csv file, so that it can then be entered it into our database. Depending on the success rate of these readings with iText7, I may need to use optical character recognition to complete the process successfully; Tesseract is an option if I need an OCR library for the .Net platform and will allow me to achieve this depending on the type and quality of text in the .pdf files.

Another piece of key functionality in the web application is the ability to populate the school’s database with information on every primary and secondary school in Ireland. The appropriate data will have to be sourced from the government CSO website and integrated into the application. As mentioned in section 1, this information will facilitate the pre-population of booking fields for schools and will also provide a wealth of information to lecturers such as school gender, school numbers, school location (LAT/LONG/X/Y). This location information is also important as it can be used to calculate time to travel to schools for lecturers/google map directions using the google maps API.I will facilitate this by having an upload on the admin panel for lecturers to upload these CSV files whenever they are updated by the CSO website.

Further key functionality includes the ability to present live data analytical visualizations in order to provide a clear view of trends in the data, to the team of lecturers. These visualizations may show information on the number of bookings made by schools by county, number and genders of students in completed camps, number of bookings made by primary/secondary schools, most popular subject area choices, most popular class groups etc. In order to achieve this piece of functionality, I will need to use a library to take pools of data from the database and transform it into live visualities – live bar/line/pie charts, data tables etc. The LiveCharts library is a flexible, interactive and powerful data visualization for the .Net platform and will allow me to facilitate this. DevExpress is another framework which offers the same tools to the project.

Finally, some other implementation which is also important to the project includes: implementing a CI/CD pipeline with Azure DevOps which will automate the build/test and deploy to AWS process, deciding on the best hosting environment between elastic beanstalk VMs or a Kubernetes cluster and lastly, integrating the Google Maps API into the system to take advantage of school locations provided by gov CSO files.