Placement Report

Faculty of Computing, Engineering & the Built Environment

Student Name: Adam Grimley

Student Number: B00691778

Course: BEng (Hons) Software Engineering

Placement Organisation: Kainos

Submission Date: **31/5/18**

Employer Signoff

Placement Student Name: ADAM GRIMLEY

Placement Organisation: KAINOS

As the designated Company Supervisor for the above named placement student, I hereby confirm that I have reviewed the Final Report for the student and that this is a fair and accurate reflection of the student's placement experience and I am happy for it to be submitted.

I am content / not content (please delete as appropriate) for this report to be submitted.

Company Supervisor Name: Luke McNeice

Position in the Company: Innovation lead

Signed:
on behalf of the Placement Employer: Luke McNeice

Date: 31/may/18

In the unlikely situation where you as the Company Supervisor are not content to sign off on this report, would you please provide a written explanation to:

Clare Clarke
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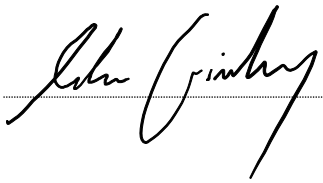
Plagiarism Statement

I declare that this is my own work and that any material I have referred to has been accurately and consistently referenced. I have read the University's policy on plagiarism and understand the definition of plagiarism as given in the Project Handbook. If it is shown that material has been plagiarised, or I have otherwise attempted to obtain an unfair advantage for myself or others, I understand that I may face sanctions in accordance with the policies and procedures of the University. A mark of zero may be awarded and the reason for that mark will be recorded on my file.

Student Signature: 

Acknowledgements

This placement would not have been as successful nor as enjoyable if it weren't for the incredible support of my team in Kainos to help me make an impact on the organisation:

Aaron Meehan

Luke McNeice

Mary-Jane McBride

Jordan McDonald

Liam Ferris

Andrew Taylor

Laura McKeague

Contents

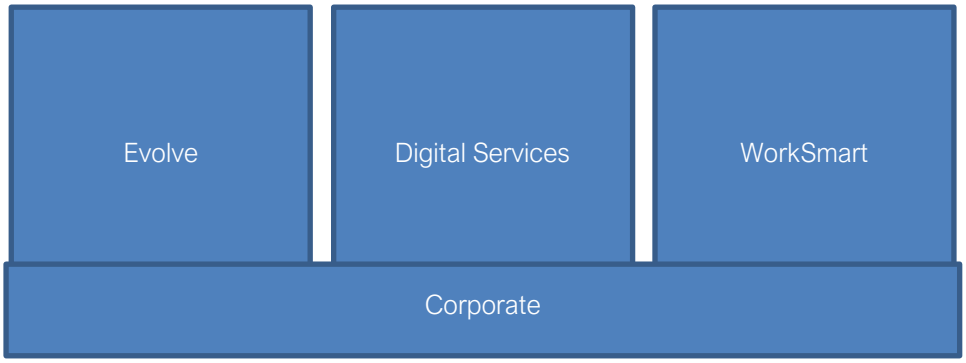
1. Introduction

I was placed at Kainos, a software organisation building solutions across both the public and private sector. I was placed in the Applied Innovation team, a section of Kainos devoted to exploring the business cases that can be found within cutting edge technology including (but not limited to) Machine Learning, Artificial Intelligence, and Immersive technology. This report is a glimpse into my time here.

2. The Placement Organisation

Kainos is one of the longest standing digital technology companies in the UK, celebrating it's 30th anniversary in 2016. Formed in 1986 Kainos went on to develop the Evolve platform, a medical platform currently used in over 100 hospitals (Taylor 2017). Evolve is at its core is a document management platform which greatly reduces the number of medical documents that need printing and shortens wait times for test results because of this. The goal of Evolve is to make it faster and easier for doctors to diagnose and care for a patient and access all records relating to the patient.

Kainos has also developed a relationship with creators of WorkDay, a HR management system used across many large corporations. This relationship was largely due to the development of the Kainos WorkSmart software which allows WorkDay customers to easily deploy, test, and optimise their implementation.



Kainos is split internally into 4 structures (business units), each largely independent with its own management and strategy but working in unison to transform technology across the UK and Europe. In the diagram above you will notice a corporate BU underneath which spans across all 3 other BUs. This is the corporate BU which includes the systems support, legal, finance department, and others which form the backbone of the company. Inside this BU is where my team – the Applied Innovation team – operate.

3. My Role

My job description in Kainos is a trainee placement software engineer. This is advertised externally as:

"As a Trainee Placement Software Engineer with Kainos, you will spend your year learning and working on projects where you can make a real difference to people's lives – the lives of people you know. After taking part in our award-winning, eight-week Trainee Development Programme, you will then join one of our many project teams, to learn from our experienced developers, project managers and customer-facing staff. You'll have great support and mentoring, balanced with the experience of being given real, meaningful work to do, to help you truly develop both technically and professionally." (Kainos, 2018)

Internally, as an Applied Innovation engineer, we would be described as engineers skilled with working on the cutting edge of technology and evaluation of advanced technology based on possible impact on Kainos as a business. During my placement, I worked on the immersive side of the team. This included work with both cutting edge AR and VR technology.

I answer to Luke McNeice (Innovation lead) and Jordan McDonald who would be the person I would go to for any queries relation to my goals in the company and any administrative issues arising from my work. As innovators within the company, we would have many 'internal customers' who would be employees who have an idea of using new tech to advance their own projects, and we would support these employees or even generate our own PoC to support their idea. During my time in the team, I worked closely with the HMPS, WorkSmart, and DVSA teams on innovative ideas internal employees had.

My working day begins with a 10am standup, a key part of the team day as it is often followed by a discussion on different ways to approach any issues you may have. After this I head back to our VR lab, a room dedicated to immersive development and hardware. Here is where in between strategy meetings and helping other team members with issues, I work on developing on any immersive projects our team currently had ongoing.

Kainos has a large focus on the social side of IT, holding monthly social events such as payday drinks in which the entire Belfast office go on a night out paid for by the company as well as team nights out. This encourages everyone in the company to be social at least once a month and helps reinforce the positive and friendly atmosphere found throughout Kainos.

4. Reflection & Evaluation

a. Placement Competencies

Independence

independence on my team was not hard to achieve. One of the pillars of being on the team is ownership of your projects. Since my first project, I have had complete ownership over all of my projects with the exception of an immersive mission rehearsal government project which is a wider project scope although I do have control of the direction of the engineering work involved in this project. The project that shows the most independence however, is a research project into gaze detection within VR in which I was one of only a handful of developers in the world using the hardware. The output of this was an internal research blog an abstract of which is presented in appendix A in its current form. This document will be rewritten as a comparison of immersive eye tracking technologies and be made public in the coming months.

Having the independence throughout my placement has been one of the most valuable things I have experienced this year and I believe it will serve me well in both my career and in university. The ability to work on projects alone yet being able to ask for help when needed from more experienced people is a skill I know will help going forward.

Flexibility

As a member of the applied innovation team, throughout my placement I was required to respond quickly to changing deadlines and specifications. My working day also had to be flexible and I proved my competency in this through my second research project which was based on using drone mounted photogrammetry solutions while indoors. For this project I worked with UUB facilities coordinator Andy Drake to gain access to the campus for testing however this would require my working day on several occasions to begin at 4am rather than my standard 9:30am. This was necessary to get the results required for the client at the time and was something that I do still see as valuable. This example is not the only time my working schedule has had to change but it is the most drastic form of change in the

schedule I have had so far. Other examples include 5am drive to Dublin and working late nights on several occasions when critical issues appear in our solutions.

Although this competency was not difficult to prove, I found it incredibly valuable to my career to show that I can and will work no matter what time or what the project entails.

Timekeeping

I have so far not missed a deadline that was given with the exception of one soft deadline in which I was 2 days late with testing due to hardware issues out of my control. Even with some of the deadlines this year being almost out of my reach as a trainee engineer I have made each one. This competency was not made easy to achieve in my placement however it was part of the reason I enjoyed my time at Kainos so much. The challenge to work harder and to understand complex technologies at a quick turnover rate made each day unique.

Teamwork

In the Applied Innovation team, we all work on varying topics but at the end of the day we are one team and we work together as such. Should anyone have a problem on your project, the remainder of the team are always there to share experiences and help work through the problem as has happened to me many times. I have previously worked through issues arising from both chatbots and ML implementations regardless of these not being my area of development. This form of teamwork was incredibly valuable to learn as it has taught me valuable lessons in using other people's experience to help my projects, whether that be development experience or not.

Interpersonal skills

I believe I have shown my interpersonal competency through both my professional communications and my input to our team's social atmosphere. Professional communications is something I still believe I need to work on as my communication style is very casual and I have received feedback supporting this. Being formal in communications is something I am not experienced in however I have gained enough experience this year to work on this and continue to grow.

Self-awareness

This is a competency that is continually being developed for me, as I have never been effective in evaluations or being aware of personal professional requirements. I do believe I have made great strides in this thanks to my manager with the use of continual evaluations and constant feedback that I am able to act upon. This was the most valuable of the competency developments in my opinion as it will serve me well going forward in my career.

Organisation & Planning

This competency can be seen throughout my work. During placement I believe I made effective use of my time in order to meet incredibly short deadlines throughout. I have also been a part of all immersive planning activities and made an impact on the ongoing team strategy around immersive development planning with the introduction of new testing and review pipelines developed for large scale projects. This will continue to help me through my career as it shows that I can step into the leadership roles if required.

Social & Professional awareness

This competency was one I had no choice to achieve. Due to the nature of our projects, I was required to understand and act upon the legal obligations as a developer on confidential projects. It is valuable to know these obligations and know how to act upon them as going forward in my career, I assume this will not be the last time I work on a confidential project so having this experience under a clear management team has allowed a learning process around these practices that I may not get the chance to experience again.

b. Learning & Skills

Throughout my placement I have used many new technologies, several of which I was one of only a handful of people in the world working on these. This comes with many new skills that I have picked up, be it best routes for learning as much about a technology in as short a time necessary or communicating with hardware manufacturers to learn more about systems being used. These skills will serve me well throughout my career as I intend to stay either within the R&D field or the immersive sector where new technologies are released and used regularly.

Immersive technology is still a growing sector and although many are coming into it from university, there is still not a large number of students at my level that are working within it. Through my work in Kainos, I have gained experience with 10 different immersive headsets which does not include other hardware peripherals such as the pupil labs gaze tracking inserts. The skills I have learned that allow me to develop for these headsets is not formal learning through Kainos but continual learning while on my team. It is part of my job to learn and relay what I have learned to the team and often to the rest of the Kainos employees.

My only formal training in Kainos has been their award winning TDP course which all graduates and placements go through upon joining the company. Through this I learned more about presentation skills, different areas of the company, and how the agile workflow is used in Kainos. This course is going to be valuable through university and my ongoing career as it was a crash course in working and becoming friends with a team I had no prior contact with. Even though this was the only formal learning opportunity, I have still learned many things through my experiences such as presentation skills from talking about my work at a conference [below] or interacting with VIPs when giving demos such as our demo to the current UK home secretary Sajid Javid at the immersive lab Belfast with Digital Catapult NI.

Seeing how all of these skills will relate to my course and my career is not a stretch. Through my placement I have worked at the forefront of the NI immersive sector and intend to continue this work even through university with the help of Kainos. I have also used many different technologies and programming languages, giving me a wide range of opportunities in final year and beyond.

c. Response to Feedback

During the process of writing this document, I have received my end of year review. Without going into too much detail, I have been made aware about many points in which to focus on going forward. One such point was based around my casual presentation style in professional communications. As professional communications is a large amount of my job as an applied innovation engineer, I am now turning my focus to move away from my casual style when outside the normal team atmosphere and in conferences or customer meetings. This is something that does not come naturally as I am a very casual person and will take a lot of work to change to be more professional in my working life.

Alongside this end of year review, Kainos has a large focus on feedback culture with one of our focuses being the submission of feedback for your fellow employees when they do something good or if they can do something better. Through this I had received early feedback on my teamwork and leadership skills and have continued to improve this. This feedback was verbal feedback from my manager and pointed out my lack of ability to influence my colleagues and have my voice heard and reflected in projects. I believe that this feedback served me well as I have since led a project and am currently the lead engineer on two others.

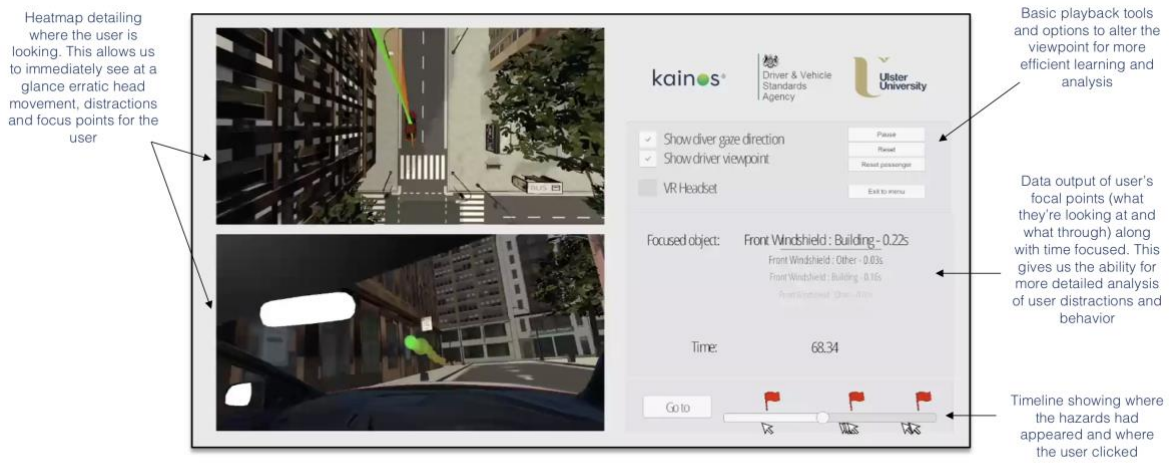
d. Challenges, Achievements & Disappointments

The greatest repeated challenge of my time at Kainos is the very short deadlines that were placed on my work throughout. This was of course due to the fast paced nature of our team however there were several times in which I was given large estimates of work and asked to complete the work in less than half the time estimated. Of course this is a challenge but I worked fast enough that I was able to complete these. I think this work ethic will serve me well throughout the remainder of university as I anticipate many hard deadlines throughout final year. If I were to repeat the year, I would push for more time between deadlines in which to review and better plan work rather than rushing development and creating large technical debt.

The greatest achievement is twofold. During the work with the DVSA on an immersive hazard perception tool, I had the opportunity to work closely with UU researcher Raymond Bond and from this I helped to develop a research paper based on my immersive engineering work which was submitted for publish the day I am writing this. Alongside the research paper, I was given the opportunity to appear at several conferences around Ireland including ARVR in Dublin several weeks ago. At each conference I was able to both present my work on stage (as was mentioned in section B) and talk with many officials about the impact this work will have, including Irish Minister Pat Breen. What I have learnt with these achievements is the impact my work is able to have. Through these achievements I have seen first hand the impact that I can have on the industry – even as a placement student.

e. Impact of the Placement

As a member of the Applied Innovation team, my impact has been in furthering the new technologies introduced into Kainos. The two main examples of this that have come from my work are the UK home office immersive project and our DVSA research tool. The DVSA research tool is the most effective as it has strengthened the relationship between Kainos and the DVSA who were already one of Kainos' biggest customers. This tool as seen below allows for fast and clear analysis of hazard perception tests and gives us the ability to determine driver behaviour to analyse what makes a good driver and a bad driver.



This project is already changing how the DVSA approach the hazard perception tests and has the potential to change how we learn to drive across the UK. Not only does this project leave a lasting impression in Kainos (by opening up a new revenue stream in the form of immersive development in the public sector) but will open up more opportunities for immersive companies to move into public sector work by changing the attitude towards virtual reality for research purposes.

f. Personal & Professional Development

This placement has completely changed my career goals and path. Over the year I have gained an insight into the corporate IT environment and where before I thought I would be happy there, I no longer believe that corporate IT sector is where I will see the most enjoyment and growth. I now believe that the small/medium companies is where I will have most impact and see myself working after university. This is mostly because of the larger teams and sprawling hierarchy seen in the corporate sector and as a junior engineer, it seems to be a long climb to get to where your impact on the project can be really felt. This has not been the case too much in the Applied Innovation team but in discussions with other placements and graduates, I have seen this demoralise people and completely shatter their enjoyment of IT.

My current plan is to return to Kainos for a year after graduation then move into a more immersive focused development role. Previous to starting my role in Kainos, I would have stayed for longer and worked my way up the internal ladder but I have found more enjoyment in immersive development than any other software development experience.

My plan is to continue immersive development in final year as both part time work and as my final year project. This will allow me to exit university with 2 years immersive experience, opening more opportunities for jobs down the line.

5. References

- Taylor, C 2017, *Kainos wins contract with University Hospital Galway parent,* viewed 25th May 2018, https://www.irishtimes.com/business/technology/kainos-wins-contract-with-university-hospital-galway-parent-1.3145290

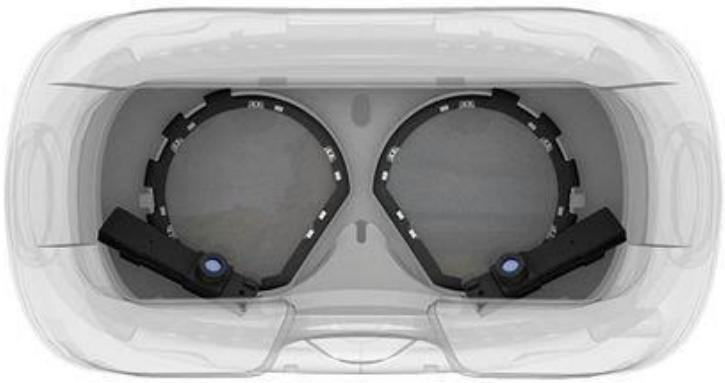
- Kainos, 2018, *Placement Trainee Software Engineer: Birmingham,* viewed 25th May 2018, https://www.kainos.com/careers/vacancies/job/Placement-Trainee-Software-Engineer_JR_1611

Appendixes

i. Pupil Labs internal research document

Eye tracking, a new era for VR or just another gimmick?

Virtual reality has become common place now as with many major entertainment or technology focused companies having something to do with the technology, whether it be in developing the software we use or the devices that push the boundaries of our imagination. The development of new hardware is currently coming faster than expected with the new mixed reality headsets that use the new inside-out tracking technology (read more about how this works here) from Microsoft based on the hololens technology. This gives us 6 degrees of freedom without the tracking stations we have become used to having. Even with these new developments, one thing that has yet to make it to the VR headsets so far is good eye-tracking hardware—yet it's something that many in this industry believes would be a game changing addition to the field. This is supported by Tobii, the world leader in eye tracking technology, now developing tracking hardware for the Vive, Tobii have previously partnered with microsoft and alienware to provide eye tracking solutions..

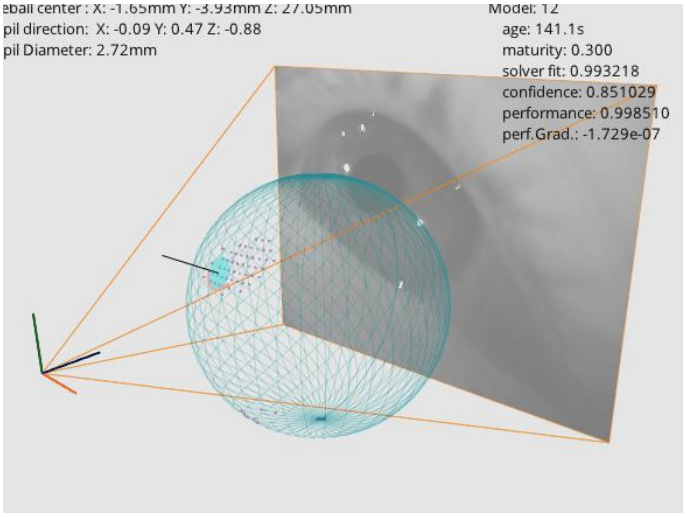


Pupil Labs Vive inserts

Thanks to support from Digital Catapult NI, I was able to get my hands on the new Pupil Labs Vive eye tracking inserts and play around with them (As part of the Kainos Applied Innovation team, "play around with" roughly translates as "try and break"). The guys over at Pupil Labs have been working on open source eye tracking software using their proprietary hardware since 2012. Since then they have grown from a small startup doing basic eye tracking to a market leader in gaze detection and eye tracking hardware. A great benefit to me as a developer was their open source mindset, with 4462 commits on their github for base software and a further 234 commits on their VR unity plugin, it is easy to find out how the software works and fix any issue you have—my version ended up looking like a monster from a H.P. Lovecraft book, but more on that later.

When I started out with the eye tracking technology, I definitely did not take into account how strange it is to stare at your own eyeball for hours at a time. … The 3D detection adds a green circle onto this diagram. This is the software essentially estimating the size and position of your full eyeball. To do this it uses calculations based on pupil diameter, and average eyeball size. Using this it can then generate a 3D

model of your eyeball [below], along with more data for developers to use such as the estimated eye diameter, and the generated sphere radius and diameter.



You might be wondering by now how accurate really is it? And the short answer to this is it depends. The hardware itself is very delicate, including the focal lengths of each eye. This means when you are focusing the camera on each eye, a few degrees too much either way can be the difference between 99% confidence and 80% confidence. Along with this you have the actual camera-eye distance to think about. Pupil labs have their own headset which gives a lot of light between the cameras and your eyes and a few centimetres. With the Vive inserts, we are down to almost no light passing through and around one centimetre between the camera and your eyes. Currently to use the trackers, I have to increase the lens distance on the Vive by a few centimetres, sacrificing some of the crisp images the Vive can produce at its best.

All in all, it's about a day's setup to get right and even with the best focus you can get, and the perfect distance from the eyes, there will still be times when the tracking will not work because someone has put on the Vive too high on their face or slightly sideward. After moving the cameras and tweaking the headset over the course of the next week I was able to get the eye trackers working 99% of the time, where the other 1% was just a user putting the headset on incorrectly.

…

Full draft report can found online at:

https://medium.com/@a.grimley/eye-tracking-a-new-era-for-vr-or-just-another-gimmick-115f1ad7e441

ii. CV

Adam Grimley

12 Somerdale Park, Belfast, BT14 7HD | 07481647147 | adamgrimley@outlook.com

Overview

I am a hardworking individual with a great focus on expanding my knowledge of the digital space and how it can be used to change our way of thinking. Currently I am studying Software Engineering where my main strength is in programming and data manipulation. I am currently looking to focus on immersive driven development as it is an upcoming sector and it is where my experience lies.

Education

A-LEVELS | 2015 | ST MALACHY'S COLLEGE

Software and Systems Development A, Mathematics B, Moving Image Arts C

SOFTWARE ENGINEERING | 2015- 2019 | ULSTER UNIVERSITY

First year module marks:

Mathematics for Computing	71
Computer Technologies	66
Introduction to Databases	88
Programming I	83
Academic Skills for Computing	83
Professional Awareness	81

Second year module marks:

Data Communication & Networking	73
Systems Development	59
Database Engineering	67
Professional Development	60
Programming II	81
Programming III	78

Skills & Abilities

OPERATING SYSTEMS AND HARDWARE EXPERIENCE

Current IT work includes knowledge in all 3 major systems (MacOS, Windows, Unix/Linux) with main Linux distro used being Ubuntu for ease of access.

I have completed development work in the immersive sector using all major headsets including Vive, Rift, and GearVR.

DEVELOPMENT LANGUAGES

I have focused most of my recent work on C# for Immersive development in the unity environment.

Other competencies include Python, Java, SQL, and JS.

I have lead development for production systems for Citysightseeing Belfast including an internal booking system, a bus pricing algorithm and a tracker viewing system and supported these for one year post development before leaving.

COMMUNICATION

Through working with Citysighseeing Belfast I have worked very closely with hotels spread across Belfast to deliver the customer service Citysightseeing Worldwide strive for.

I have personally developed and pushed through solutions to productivity issues within the workplace including an internal booking system that could store information on payments and even employee details.

I have presented work and spoken at several major conferences in Ireland including Beltech and ARVR Innovate.

I have attended and supported many tech meetups and events in NI including Digital Catapult Immersive lab launch and AINI meetups.

I have several technology blogs currently listed on Medium and have supported many other blogs.

Computing Experience

SOFTWARE ENGINEER | KAINOS | JULY 2018 – CURRENT

Member of the Applied Innovation team within Kainos under Luke McNeice and Tom Grey.

Immersive technology lead, developing projects for the UK government and the DVSA.

Main function in the company was to examine new and upcoming technologies and explore any business cases for Kainos within them.

Gained experience with chatbots, machine learning, and immersive development.

OFFICE ADMINISTRATOR | BELFAST CITYSIGHTSEEING | MARCH 2015 – JUNE 2018

In charge of general administration for the company including general bookings, customer service and private hire of coaches.

Main task includes working with a booking system and websites to keep our online presence updated and correct at all times.

Have developed several systems to increase productivity in the workplace (internal booking system, bus tracking integration with systems, private hire quotation system).

WORK EXPERIENCE | ALLSTATE | SUMMER 2014

Shadowed people from each department.

Learned about the product lifecycle and how a large company worked on the inside.

Got an idea of many different types of roles in a large software company.

WORK EXPREIENCE | LIBERTY IT | SUMMER 2014

Shadowed a software engineer for 2 days to get an idea of what they do in a large company.

Finished the work experience java exercises too quickly within the given timeframe so helped develop the new work experience exercise.

Shadowed an infrastructure engineer for a day and got an idea of their role within the company.

Other Experience

SHOP ASSISTANT | IRISH TOUR TICKETS | JUNE 2013 – MARCH 2018

Work with handling the cash and serving customers for a range of tours covering Northern Ireland.

Handled reports of daily earnings.

Developed several tours and promoted each to hotels and centers around Belfast.

Interests

I keep myself up to date on any programming news using online resources such as reddit and newsletters from different computing companies (git, MS, etc.) so I am able to hop into a new challenge as soon as it presents itself. I usually end up bored with personal projects often which tends to keep me jumping around new and innovative technologies.

I am also heavily involved with the UUSU through university in my capacity as head of the LINK Gaming Society. Through this I have liaised with societies across all three Ulster University campuses as well as businesses off campus to organize events. I have several hobbies in my spare time such as running or tabletop gaming which both keep me active and creative. I do also have a tattoo on my upper left arm which is coverable.

References

Luke McNeice | innovation lead

l.mcneice@kainos.com

07909992561

Paul Cunningham | Managing director

paul.cunningham@citysightseeingbelfast.com

07786034865

iii. Placement Snapshot

Placement Work Summary Form

To be completed by the student and uploaded to Recruit as an appendix in the Placement Report.

Placement Organisation	Job Title	Placement Location
Kainos	Trainee Software Engineer	Belfast

This section is optional. Complete only if you are prepared to be contacted by second year students during your final year.

Student Name	Course Title	Contact Email
Adam Grimley	Software Engineering	adamgrimley@outlook.com

This information may be shared with other students as part of the placement preparation process.

Student Summary	
Hardware Used	- Majority of immersive headsets including Rift, Vive, and GearVR. - Jetson TX2 with DJI Inspire 2 Drone and stereolabs Zed camera. - LIV reality capture - Leap Motion controller - Perception Neuron MoCap suit - Pupil Labs gaze tracking inserts - Presentation clicker (as an immersive controller)
Software Used	- Unity Game engine - Luis NLP - Microsoft bot framework - Scipi - OpenCV - PWA technology including appcache and service worker
Typical Duties	As an applied innovation engineer I had to continually learn and teach skills to other employees within kainos. For me that was focused around learning more about immersive technology and sharing this with the company. Typical development duties were to take ownership and lead projects with the goal of a PoC for a new technology that may be capitalised on by Kainos.
Salary	£16,000

Overall Opinion	Pretty good, at the end of the day work is work but the Applied Innovation team was a unique experience and one I would suggest anyone take if they are given the chance.