Table of Contents

[Team Profile 4](#_Toc101548817)

[Personal Profiles 4](#_Toc101548818)

[Grant Nicholas 4](#_Toc101548819)

[William Prebendarcik 4](#_Toc101548820)

[Maritza Molina 5](#_Toc101548821)

[James Falla 5](#_Toc101548822)

[Stephen Lincoln 5](#_Toc101548823)

[Profile Types 6](#_Toc101548824)

[Myers-Briggs Types 6](#_Toc101548825)

[Grant Nicholas 6](#_Toc101548826)

[William Prebendarcik 6](#_Toc101548827)

[Maritza Molina 6](#_Toc101548828)

[James Falla 7](#_Toc101548829)

[Stephen Lincoln 7](#_Toc101548830)

[Learning Styles 7](#_Toc101548831)

[Big 5 Personality Test 7](#_Toc101548832)

[Enneagram 8](#_Toc101548833)

[Leadership Style 8](#_Toc101548834)

[Grant Nicholas 8](#_Toc101548835)

[James Falla 8](#_Toc101548836)

[Industry Data 9](#_Toc101548837)

[Ideal Jobs – Compare and Contrast 12](#_Toc101548838)

[Personal Job Evaluation 13](#_Toc101548839)

[Tools 14](#_Toc101548840)

[The tools used by the team for IIT - Assessment2 14](#_Toc101548841)

[Links to relevant artifacts 14](#_Toc101548842)

[IT Work – Professional Interview with Alexis Molina 15](#_Toc101548843)

[What kind of work is done by the IT professional? 15](#_Toc101548844)

[What kinds of people does the IT professional interact with? Are they other IT professionals? Clients? Investors? The general public? 15](#_Toc101548845)

[Where does the IT professional spend most of their time? 15](#_Toc101548846)

[What aspect of their position is most challenging? 15](#_Toc101548847)

[Autonomous vehicles 16](#_Toc101548848)

[What does it do? 16](#_Toc101548849)

[What is the likely impact? 19](#_Toc101548850)

[How will this affect you? 19](#_Toc101548851)

[**References** 20](#_Toc101548852)

[IT Technologies - Robots 22](#_Toc101548853)

[What does it do? 22](#_Toc101548854)

[What is the likely impact? 23](#_Toc101548855)

[How will this affect you? 25](#_Toc101548856)

[References 26](#_Toc101548857)

[IT Technologies - Blockchain and Cryptocurrencies 28](#_Toc101548858)

[What does it do? 28](#_Toc101548859)

[What is the likely Impact? 29](#_Toc101548860)

[How will this affect you? 29](#_Toc101548861)

[Clouds, Servers and Services 31](#_Toc101548862)

[Project Proposal 33](#_Toc101548863)

[Overview 33](#_Toc101548864)

[Motivation 33](#_Toc101548865)

[Description 33](#_Toc101548866)

[Tools and Technologies 35](#_Toc101548867)

[Application functional workflow 36](#_Toc101548868)

[Application functional outline and workflow 37](#_Toc101548869)

[Commercial Opportunity 40](#_Toc101548870)

[Skills Required 40](#_Toc101548871)

[Outcome 40](#_Toc101548872)

[Reference 41](#_Toc101548873)

# Team Profile

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| A person standing next to a truck  Description automatically generated with medium confidence | A person wearing glasses  Description automatically generated with medium confidence | A picture containing clothing  Description automatically generated | A person with a beard  Description automatically generated with low confidence | A person sitting in front of a television  Description automatically generated with low confidence |
| Grant Nicholas | William Prebendarcik | Maritza Molina | James Falla | Stephen Lincoln |

## Personal Profiles

### Grant Nicholas

Student ID: S3954897

My love of fishing prompted a friend and I to begin our own startup company and releasing a Mobile Application called “iDfish” that has been live on the Apple’s App Store and Google Play for the last 6 years. I am also an avid cross country mountain biker. I ride local trails around the Brisbane area for fitness and fun. I have been working with electronic systems, automation and control systems and the IT industry in various capacities for the past 30 plus years. It is my involvement with iDfish that has prompted be to further my knowledge by getting a Bachelor of information Technology at RMIT.

### William Prebendarcik

Student ID: S3912780

I have had an interest in IT for most of my life. I was lucky to have owned an ATARI 2600, purchased in 1983. The Commodore 64 arrived on the scene three years later; I had a plan to learn C64 BASIC which never eventuated. A lost opportunity, and one of many. The Amiga 500 came a couple of years later, followed by a few iterations of PC clones. As much as I had wanted to “get into” programming, I never did. Now I’m finally studying at RMIT. I still enjoy gaming (on a PC), reading, and occasionally doing some exercise, whether weights or cardio.

### Maritza Molina

Student ID: S3956706

My professional background began in Finance after completing a Diploma in Bookkeeping and Accounting after I graduated High School. Technology was a non-consequential part of my occupation as the focus was always process and accuracy. A break in-between jobs resulted in me being recruited for a temporary contract role within Queensland Health during what has been described as the worst Payroll Software Rollout in history. Witnessing the “Payroll Debacle” firsthand, gave me a unique opportunity to see the impact of a poorly configured software rollout forced onto an unsuspecting and untrained end user. I stayed on for 5 years as part of the improvement process and assisted in their now BAU (business as usual) process. I have since been passionate about the HRIS Systems and their need to be the seamless conduit within a fortnightly transaction, specifically SAP as a company.

### James Falla

Student ID: S3956749

My name is James Falla (student number: S3956749) a team member of LevelUp! . My hobbies include playing tennis, video games and painting miniatures. My IT interest came from when I built my first PC and slowly discovering the world of IT around it. Now I currently work for FYB Pty Ltd where I work on the support desk assisting various customers with the application Content Manager.

### Stephen Lincoln

Student ID: S3955566

Since high school I have studied bits and pieces from a variety of subjects including IT, Accounting, Cyber Security, and a bit of Psychology. My highest qualification thus far is my Certificate IV in Accounting and Bookkeeping. During my downtime I have been known to enjoy strategy games and occasionally take part in trading card tournaments, though I spend just as much time on analysis and strategy development as I do with the games themselves. Computing technology has always fascinated me, and since realising how well my strengths align with the work of the IT industry, I have been trying to carve my path to a career in the field. My ideal job would be to work as a Machine Learning Engineer, specifically focusing on Natural Language Processing if possible. After our industry analysis I see that I may have to consider an alternate, more attainable career goal.

## Profile Types

### Myers-Briggs Types

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Name | Grant Nicholas | William Prebendarcik | Maritza Molina | James Falla | Stephen Lincoln |
| Type | Protagonist | A close-up of a toy  Description automatically generated with low confidenceMediator | Shape  Description automatically generatedCampaigner | A picture containing text  Description automatically generatedDefender | A picture containing queen, envelope  Description automatically generatedLogician |
| Code | ENFJ-A | INFP-T | ENFP-T | ISFJ-A | INTP-T |
| Role | Diplomat | Diplomat | Diplomat | Sentinel | Analyst |
| Strategy | People Mastery | Constant Improvement | Social Engagement | Confident Individualism | Constant Improvement |

### Grant Nicholas

As a Diplomat with the People Mastery strategy, Grant fits well into the role of group leader. Diplomats prioritise communication and connecting with others; and those with the People Mastery strategy are particularly capable of stress management and maintaining their confidence. With the combination of seeking out connections, maintaining confidence, and comfortably leading in social situations, it is no surprise he has been chosen for the role of group leader.

### William Prebendarcik

Even though William was our second pick for team leader, his introversion and turbulence implies that he would have been less comfortable taking that position in the team, though would still have performed well in the role if required. The strategy of Constant Improvement can be a powerfully productive one when combined with confidence and knowledge of one’s own abilities, and it is plain to see that he knows what he is doing. These results suggest that William will be most comfortable in a role where he can get stuck in and do what he does best, produce quality work.

### Maritza Molina

A Diplomat with the Social Engagement strategy can be trusted to speak their mind and feel at home in social settings, caring deeply about the levels of communication within a group and more than prepared to reach out and make connections. With Maritza’s outstanding social confidence, she is the perfect choice for organising our IT professional interview and can be relied upon to be well involved in our meetings, keeping everyone up to date on her progress.

### James Falla

Sentinels are known for their confidence, co-operation, and grounded nature, working hard to maintain stability and steady progress, and carefully ensuring that all goes smoothly. That in combination with the Confident Individualism strategy paints a picture of someone who is self-motivated, efficient, and will fix anything he can when he sees the opportunity to do so. James has quickly proven himself to be a valuable member of the team, exhibiting these qualities and more. He knows his strengths and will use them wherever possible, doing what he can to ensure we get the job done.

### Stephen Lincoln

The Analyst role is one of logic and speculation, known for their thinking and occasional over-thinking. People of this type are sometimes seen as abrasive or unapproachable as they are not naturally inclined to surround themselves with others, a trait which can make it difficult to involve others when it is required. An Analyst with the Constant Improvement strategy may find themselves spending too much time considering approaches to a problem or task and having difficulty making their ideas a reality. Stephen will need to make a point of communicating with the group and ensuring that he materialises his plans or seeks guidance from others about how to proceed.

## Learning Styles

|  |  |
| --- | --- |
| Honey & Mumford | VARK Model |
| Grant: Pragmatist  James: Pragmatist  Stephen: Reflector | William: Visual  Maritza: Auditory  Stephen: Auditory |

## Big 5 Personality Test

|  |  |
| --- | --- |
| William | Chart, bar chart  Description automatically generated |
| Maritza | Chart, bar chart  Description automatically generated |
| Stephen | Chart, bar chart  Description automatically generated |

|  |  |
| --- | --- |
| Anagram | Leadership Style |
| Grant Nicholas | James Falla |
| Diagram  Description automatically generated with medium confidence | A picture containing arrow  Description automatically generated |

# Industry Data

The following are the job names for the group members:

Grant – Mobile App Developer

James – Records Management Officer

Maritza – Solution Architect

Stephen – Machine Learning Engineer

William – Python Engineer

“Mobile App Developer” is at position 116, with a 76 job share out of the surveyed total of approximately 120K advertised positions. A related category, “Android Developer” is at position 44, with 171 job postings.

“Machine Learning Engineer” – can’t find an equivalent category in the dataset for this job title.

“Python Engineer” appears at the 83rd position, under the name “Python Developer”, with 106 job postings.

“Solutions Architect” appears in the dataset in the first position, with 987 job postings.

“Records management Officer” is not present in the dataset but “Database Administrator” is, at 30th position and 238 job postings.

The combined required skillset for the group stands as follows:

IT-specific skills (knowledge of): Python, Java, Android and iOS, Git, Reactive Functional programming, REST back-ends, frameworks and best practices, data science, database administration, Office 365, Oracle, SQL, record-keeping, electronic document and records management system, deep learning and AI, full-stack development.

General skills: solution-orientated, lateral thinker, good communicator, work in a team environment, work under pressure, project management, scrum, software analysis and design (or software engineering), agile development, user interface design, life-cycle management, and product management.

Table 1: Comparison of Group IT Skills to “Skills in Greatest Demand” Burning Glass Dataset

|  |  |  |
| --- | --- | --- |
| **IT Skill** | **Rank** | **Job Postings (out of 27,435)** |
| **SQL** | 1 | 3,570 |
| **JAVA** | 3 | 2,860 |
| **.NET** | 8 | 1370 |
| **Microsoft Office** | 9 | 1341 |
| **Git** | 11 | 1230 |
| **Python** | 12 | 1150 |
| **Mobile Application Design** | 73 | 187 |
| **Android** | 80 | 158 |
| **Relational Database Management** | 86 | 147 |

Note: Some of the group skills do not appear in the dataset.

Table 2: Comparison of Group General Skills to “Skills in Greatest Demand” Burning Glass Dataset

|  |  |  |
| --- | --- | --- |
| **General Skill** | **Rank** | **Job Postings (out of 121,997)** |
| **Building relationships** | 5 | 9,326 |
| **Project Management** | 8 | 8,504 |
| **Software Engineering** | 19 | 5,816 |
| **Scrum** | 26 | 4,580 |
| **Agile Development** | 58 | 2,982 |
| **User Interface Design** | 89 | 1998 |
| **Application Development** | 163 | 1,220 |
| **Lifecycle Management** | 172 | 1,133 |
| **Strategic Management** | 189 | 1,017 |
| **Product Management** | 193 | 986 |

Note: Some skills traditionally thought of as “general” do not appear in the dataset; an example is “effective communicator”. This dataset contains skills that would ordinarily be considered IT skills – these were not considered for the table.

Table 3: Three Highest Ranked IT-specific Skills not in the Group Skill Set

|  |  |  |
| --- | --- | --- |
| **IT Skill** | **Rank** | **Job Postings (out of 27,435)** |
| **JavaScript** | 2 | 2,946 |
| **Microsoft Windows** | 4 | 2,699 |
| **Microsoft C#** | 6 | 1370 |

Table 4: Three Highest Ranked General Skills not in the Group Skill Set

|  |  |  |
| --- | --- | --- |
| **General Skill** | **Rank** | **Job Postings (out of 121,997)** |
| **Technical Support** | 7 | 8,700 |
| **Business Management** | 10 | 7,311 |
| **Customer Service** | 12 | 6,534 |

**Ideal Jobs – Compare and Contrast**

|  |  |
| --- | --- |
| **Name** | **Compare and Contrast of Ideal Jobs** |
| **Grant**  **Nicholas** | **Compare:** N/A |
| **Contrast:** Grant’s job is quite unique in comparison to the other members of the group – there is not much cross-over in terms of IT skills. |
| **James**  **Falla** | **Compare:** N/A |
| **Contrast:** James’ job is quite unique in comparison to the other members of the group – there is not much cross-over in terms of IT skills. |
| **Maritza**  **Molina** | **Compare: The** Software Engineering skill is in common with Stephen. |
| **Contrast:** Most of the skills a solutions architect would be engaged in are not in common with the ideal jobs of the other members of the group. |
| **Stephen**  **Lincoln** | **Compare:** Skills in common with William – “Machine learning Engineer” and “Python Engineer” job names – both interested in machine learning and Ai, require knowledge of Python language – as an Engineer, Stephen’s ideal job has software analysis and design in common with Maritza. |
| **Contrast:** Full-stack development sets Stephen’s job apart from the rest of the group. No-one except William has a job description matching with machine learning and AI. |
| **William**  **Prebendarcik** | **Compare:** Skills in common with Stephen – “Machine learning Engineer” and “Python Engineer” job names – both interested in machine learning and Ai, require knowledge of Python language |
| **Contrast:** No-one except William has a job description matching with machine learning and AI. |

Note: some skills are universal across the group members – these are general skills. The capacity to work in a team or individually and sound communication skills (written and oral) are good examples of such skills.

The learning plans are similar for the members of the group. The general consensus is that further study at RMIT and experience is important to the ultimate attainment of the ideal job.

# Ideal Jobs – Compare and Contrast

|  |  |
| --- | --- |
| **Name** | **Compare and Contrast of Ideal Jobs** |
| **Grant**  **Nicholas** | **Compare:** N/A |
| **Contrast:** Grant’s job is quite unique in comparison to the other members of the group – there is not much cross-over in terms of IT skills. |
| **James**  **Falla** | **Compare:** N/A |
| **Contrast:** James’ job is quite unique in comparison to the other members of the group – there is not much cross-over in terms of IT skills. |
| **Maritza**  **Molina** | **Compare: The** Software Engineering skill is in common with Stephen. |
| **Contrast:** Most of the skills a solutions architect would be engaged in are not in common with the ideal jobs of the other members of the group. |
| **Stephen**  **Lincoln** | **Compare:** Skills in common with William – “Machine learning Engineer” and “Python Engineer” job names – both interested in machine learning and Ai, require knowledge of Python language – as an Engineer, Stephen’s ideal job has software analysis and design in common with Maritza. |
| **Contrast:** Full-stack development sets Stephen’s job apart from the rest of the group. No-one except William has a job description matching with machine learning and AI. |
| **William**  **Prebendarcik** | **Compare:** Skills in common with Stephen – “Machine learning Engineer” and “Python Engineer” job names – both interested in machine learning and Ai, require knowledge of Python language |
| **Contrast:** No-one except William has a job description matching with machine learning and AI. |

Note: some skills are universal across the group members – these are general skills. The capacity to work in a team or individually and sound communication skills (written and oral) are good examples of such skills.

The learning plans are similar for the members of the group. The general consensus is that further study at RMIT and experience is important to the ultimate attainment of the ideal job.

## Personal Job Evaluation

**William Prebendarcik:** After examining the Burning Glass data, my ideal job has not changed. From a personal perspective being able to code Python is quite a sought-after skill; even though machine learning or AI was not mentioned specifically, I would rather not forgo these interests in the interest of acquiring a job.

**James Falla:** Reviewing the Burning Glass data my ideal job has not changed, my goals remain the same and I will strive to reach the goal of working in a Record’s Management team. The data was useful in highlighting that there is demand for the job, given the record keeping requirements of every business and Government organisation, the job will not be obsolete any time soon.

**Grant Nicholas:** My ideal job is a requirement for my own business and my initial focus was a Mobile app developer. With the expansion of my knowledge through this course and reviewing the Burning Glass data, my ideal job has now changed to a full stack developer with a database, mobile application flavor.

Maritza:

**Stephen Lincoln:** Seeing as there is very little data about Machine Learning Engineers in this dataset, I get the feeling that it may not be a common or perhaps feasible career goal. I will need to investigate alternate but similar career pathways.

# Tools

## The tools used by the team for IIT - Assessment2

**Canvas**

For posting notifications that needed to be emailed group wide as a backup to the posts on Teams

**Github**

Used for the collaboration and presentation of the files for the website

**Teams**

Point of contact and management of all files, direct communications via chat, announcements with feedback, polls for team decision making and kanban assignment project management.

**Microsoft Word**

All text based documentation from record keeping (Agenda’s, Minutes/Action) Stored on the files section of teams for IIT Assignment 2

**Microsoft Visio**

For the creation of the application workflow diagram

**Microsoft Forms**

For polling on some of the team decisions

**Kanban**

Project management tool to allocate tasked and to track progress

## Links to relevant artifacts

Github https://github.com/S3954897/IIT\_assign2/

# IT Work – Professional Interview with Alexis Molina

## What kind of work is done by the IT professional?

Alexis Molina is a Lead Software Engineer for Guerrilla Digital, a full-service digital agency who specialise in end-to-end marketing and brand management. Alexis is the head of a team of 8 people who build and maintain their clients’ Web Pages and Applications as part of a whole marketing solution. He has worked with Guerrilla for over 15 Years and has held various roles within the IT department of the organisation.

As the Lead Software Engineer, Alexis is in-charge of the production process from inception to production. He delegates duties to the in-house development team and Co-ordinates his team to ensure Project delivery timeframes, client requirements and budgets are adhered to. To quote Alexis, he is a “Jack of all Trades”.

Alexis is also responsible for Quality Assurance of Project delivery. This might include tasks such as:

• Collaborating in the design process with marketing team

• Presenting solutions and deliverables to Clients

• Developments of End User Friendly features

• Documenting processes, results, testing, layouts and recommendations

• Allowing the Development Team to conduct Testing and fixing bugs

• Preparing and Installing solutions

## What kinds of people does the IT professional interacts with?

In his role and due to his seniority within his workplace, Alexis interacts with various Employees and stakeholders. The majority of Alexis’ interactions are within his team directly as he co-ordinates resources on a daily basis. He regularly meets with Account Managers and Marketing Teams to discuss client briefs and prospects for upcoming projects. He meets with clients regularly to discuss timelines and deliverables for their projects.

## Where does the IT professional spend most of their time?

The majority of Alexis’ time is spent co-ordinating his team and project management. As the Lead Software Engineer, Alexis is also expected to attend cross Departmental Team Briefings to discuss projects and progression. Alexis is also required to meet with clients to establish and maintain rapport throughout their project delivery. Alexis both works from the office and remotely from home where permissible.

## What aspect of their position is most challenging?

In describing his answer, Alexis found that the Administration part of his role was the most challenging. He finds the technical part of his role easy and rewarding, however, documenting the processes and writing client briefs were his least favourite task. He also mentioned managing client’s expectations and deliverables to be a challenge as part of the project establishment process. All round he enjoys his role, challenges and all.

# Autonomous vehicles

## What does it do?

Autonomous vehicles can drive themselves “from a starting point to a predetermined destination in autopilot mode, using various in-vehicle technologies and sensors, including adaptive cruise control, active steering, anti-lock braking systems, GPS navigation technology, lasers and radar” (Gartner, 2012).

The Society of Automotive Engineers (SAE) has defined 6 levels of driving automation (Synopsys, 2019). The following graphic describes them:

Diagram

Description automatically generated

Figure 1: Levels of Driving Automation (Synopsis, 2019)

Within the first three levels, the human monitors the driving environment. Within the next three the automated system monitors the driving environment with different levels of automation, from conditional to full.

There’s an important distinction to be made here, as a preface to the following information – there is a difference between automated versus autonomous, at least as defined by the SAE. The Society prefers the use of automated in this particular context, as the word autonomous implies the vehicle would be self-aware, and capable of making its own choices.

Encapsulating current capabilities, the sensors of an autonomous vehicle gather real-time data of the environment as well as coordinates, car velocity and acceleration (vectors) and potential obstacles. They make use of a GPS, geographic navigation system to gather information about location (GIS) as well as an inertial navigation system (INS) to calculate relative vehicle location. Electronic maps (EM) store information about traffic and road facilities, currently available for vehicles at level 2 and 3 automation. Advanced Driver Assistance Systems (ADAR), which use laser, visual and radar perception, are available in vehicles with level 3-4 autonomy, and require about 12 to 24 Gbps of network bandwidth. Lastly, Vehicular Ad-Hoc Networks (VANETs), spontaneous networks of vehicles, are able to communicate with each other utilizing these formed networks (Singh and Saini, 2021).

Further exploring ADAS, the role of these systems “is to prevent deaths and injuries by reducing the number of car accidents and the serious impact of those that cannot be avoided” (www.synopsys.com, n.d.). Essential ADAS applications include pedestrian detection and avoidance, lane departure warning and correction, traffic sign recognition, automatic emergency breaking and blind-spot detection. The systems are incorporated into chips called SoCs (systems on a chip) (Synopsys, n.d.).

Diagram

Description automatically generated

Figure 2: Application of ADAS systems (Synopsys, n.d.)

There are two types of communication technologies in VANET architecture – vehicle to vehicle, and vehicle to infrastructure communication (Mahmood et al., 2021). Vehicles are able to communicate traffic-related information within the range of the network. When an accident occurs the contact vehicle sends alerts to other nodes accessing the network, telling them to avoid the area.

There currently seem to be security issues in the use of VANET architecture, and most of these are in the realm of security. A few examples are malware attacks where a virus can infiltrate the vehicular system, denial of service attacks where communication between a vehicle and its network can be disrupted, and spamming attacks which may bring about involuntary system crashes (Sharma, Sharma and Tomar, 2019). These are problems typical of any system embedded in a network.

Here is another look at the levels of driving automation, broken down by functionality:

Table

Description automatically generated

***Figure 3: Levels of Driving Automation by Functionality (Sachdev, n.d.)***

The highest level of automation available at present is a level three vehicle. “Level 2 vehicles are the current sweet spot for many automakers” (Sachdev, n.d.). This observation includes the famed Tesla vehicles. There are currently no level 4 vehicles available on the market. Elon Musk has stated that there may be a beta test of a level 4 Tesla soon, although no specific dates are mentioned (Cooley, n.d.). The Hyundai Nexo was touted as the first level 4 vehicle during its development (Green Car Congress, n.d.), but current reviews do not mention any aspect of automation functionality – see Drive (2021) for an example.

What about the near future? The key premise, and one of the main drivers of the autonomous vehicle market has been the provision of safe travel. An extremely high proportion – 9 out of 10 crashes in fact – have been found to have occurred as a result of human error (Kadry, 2021).

Before this statistic can be changed in a meaningful way, however, automated systems will have to be able to perceive the road and associated environment better than the best human driver. Data is important here; in the future autonomous cars will generate 300TB of data per year per vehicle. This is an astounding amount of data per trip, considering our vehicles are parked 95% of the time on average (Streetsblog USA, 2016), and 645 GB of data generated per hour. 5G technologies that will permit the use of Artificial Intelligence will also be very important in the development of vehicle automation and increased safety (Cubic, 2021).

## What is the likely impact?

Fundamentally, the wide adoption of autonomous vehicles would mean fewer accidents. This would mean less injuries and fatalities, and lower costs for users and insurance companies. The amount of time the users of autonomous vehicles have available would increase – as the “driver”, at least in a vehicle with a high autonomous level, would not have to be in control, and their time while in a vehicle could be spent more productively (Klaver, n.d.).

What about the impact on jobs? The most obvious change would occur in the transportation sector. As the sector adopts autonomous vehicles, whether for transporting goods or the public, many drivers would lose their jobs. In the US, the total loss of income would amount to approximately 180 billion per year. Employment in service and repair centers would also be affected, as the lower number of vehicle crashes would cause loss of income for occupations in this sector (Klaver, n.d.). As at any time in the past, as advancements in technology become widely adopted, workers involved with occupations affected by the technological change may be forced to reskill, and experience loss of income for some time.

There is a huge upside to the adoption of autonomous vehicles. The new tech will be able to cut emissions by improving vehicles’ braking and acceleration, eventually reducing emissions by 90% (Klaver, n.d.).

## How will this affect you?

I do not think I will be directly affected in an economic sense; I do not have employment that is directly or even indirectly related to any technological changes in this sector. Neither do any members of my family. From a social, societal perspective, I believe everyone will be affected – it will take some time for these new technologies to be widely accepted, to the extent that we will be comfortable being inside a vehicle the motion of which is not being controlled by a human operator. We will need to find ways of occupying ourselves during this time; the obvious benefits of completing work-related activity cannot be understated but being able to spend time on social activities with family and friends will become quite common. This probably seems strange to most of us right now but will most likely become commonplace in the near future. I am looking forward to it.

### **References**

Cooley, B. (n.d.). *Driver Assistance Advancements in 2022*. [online] Roadshow. Available at: <https://www.cnet.com/roadshow/news/the-most-important-self-driving-cars-of-2022/>.

Cubic. (2021). *Planning for Tomorrow’s Mobility with 5G and Cellular Vehicle-to-Everything (C-V2X)*. [online] Available at: https://www.cubictelecom.com/blog/c-v2x-cellular-vehicle-to-everything-5g/ [Accessed 15 Apr. 2022].

Drive. (2021). *2021 Hyundai Nexo review*. [online] Available at: https://www.drive.com.au/reviews/2021-hyundai-nexo-review/ [Accessed 15 Apr. 2022].

Gartner (2012). *Autonomous Vehicles*. [online] Gartner. Available at: <https://www.gartner.com/en/information-technology/glossary/autonomous-vehicles>.

Green Car Congress. (n.d.). *Hyundai NEXO fuel-cell vehicles self-drive (Level 4) 118 miles from Seoul to Pyeongchang*. [online] Available at: https://www.greencarcongress.com/2018/02/20180204-nexo.html [Accessed 15 Apr. 2022].

Kadry, M. (2021). *Road to 2030: the Future of Autonomous Vehicles*. [online] Cubic. Available at: <https://www.cubictelecom.com/blog/self-driving-cars-future-of-autonomous-vehicles-automotive-vehicles-2030/>.

Klaver, F. (n.d.). *The economic and social impacts of fully autonomous vehicles*. [online] Compact. Available at: <https://www.compact.nl/en/articles/the-economic-and-social-impacts-of-fully-autonomous-vehicles/>.

Mahmood, J., Duan, Z., Yang, Y., Wang, Q., Nebhen, J. and Bhutta, M.N.M. (2021). Security in Vehicular Ad Hoc Networks: Challenges and Countermeasures. *Security and Communication Networks*, [online] 2021, p.e9997771. Available at: <https://www.hindawi.com/journals/scn/2021/9997771/>.

Sachdev, M. (n.d.). *Explanation of the 6 Levels of Driving Automation*. [online] blog.rgbsi.com. Available at: <https://blog.rgbsi.com/6-levels-of-driving-automation>.

Sharma, B., Sharma, M.S.P. and Tomar, R.S. (2019). *A Survey: Issues and Challenges of Vehicular Ad Hoc Networks (VANETs)*. [online] papers.ssrn.com. Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract\_id=3363555 [Accessed 14 Apr. 2022].

Singh, S. and Saini, B.S. (2021). Autonomous cars: Recent developments, challenges, and possible solutions. *IOP Conference Series: Materials Science and Engineering*, 1022, p.012028.

‌ Streetsblog USA. (2016). *It’s True: The Typical Car Is Parked 95 Percent of the Time*. [online] Available at: <https://usa.streetsblog.org/2016/03/10/its-true-the-typical-car-is-parked-95-percent-of-the-time/>.

Synopsys (2019). *What is an Autonomous Car? – How Self-Driving Cars Work | Synopsys*. [online] Synopsys.com. Available at: <https://www.synopsys.com/automotive/what-is-autonomous-car.html>.

‌Synopsis (n.d.). *What is ADAS (Advanced Driver Assistance Systems)? – Overview of ADAS Applications | Synopsys*. [online] Available at: <https://www.synopsys.com/automotive/what-is-adas.html>.

‌

# 

# IT Technologies - Robots

## What does it do?

The field of robotics has come a long way since its humble beginnings. The earliest creation of modern robots has been attributed to George Devol. He invented a programmable calculator called “Unimate” in the early 1950s; the name is derived from the phrase “Universal Automation” (cs.stanford.edu, n.d.). The actual word “robot” was originally derived from the Czech noun “robota” which means “labour”, and is the invention of cubist painter and writer Josef Capek (Adelaide Robotics Academy, 2016).

Before robotics is discussed it would be wise to have an understanding of the definition of the word. Robotics is a “branch of mechanical engineering, electrical engineering and computer science that deals with the design, construction, operation, and application of robots, as well as computer systems for their control, sensory feedback, and information processing” (Wikipedia, 2022). Why is this important? Essentially, the field of robotics is attempting to develop machines that are capable of replacing humans and their actions. As to the various contexts within which this might be important, we need to consider where development is already taking place.

Health care, agriculture, food preparation, manufacturing and unfortunately the military sector are the top five applications (Ohio University, 2018). Some others that make the list appear to be e-commerce, including warehousing and shipping, the hotel industry, fashion, and retail (Martina Große Bley, 2018). Robots are also being developed to be companions, in various contexts, from being able to provide friendship for seniors (the Guardian, 2021) to the provision of relationships of a more intimate, even sexual nature (TFlex Tech, 2020).

To elaborate, robots are being utilized in work practices that are dangerous and/or repetitive. Industries in which speed and accuracy in completing work processes are an important consideration have also seen a wide adoption of robots. Humans being primarily social creatures crave companionship, and robots have started to fill a remarkably large niche here as well. It is important to remember that the umbrella term “robots” includes machines that are heterogenous in nature, and the form and function of which will heavily depend on their particular application.

In the realm of retail Amazon currently leads the pack. Amazon warehouses and distribution centers use 200,000 autonomous robots. Amazon scout delivery bots are also currently being rolled out, replacing the need for delivery drivers (Digital Engine, 2021). The state of the art in warehousing bots however, is “Handle”, by Boston Dynamics (Boston Dynamics, 2019). Handle is a manipulation robot designed for logistics. Handle autonomously performs pallet building and depalletizing. The on-board vision system on Handle tracks the marked pallets for navigation and can find and place individual boxes.

The best example in manufacturing by far is that of Elon Musk’s vehicle production lines. Musk created 10 of the world’s largest manufacturing robots for his Tesla facilities. Being a completely automated process, it takes just three days to build an entire Tesla vehicle from scratch (Digital Engine, 2021).

In health care, AI and robotics are being used in early detection, diagnosis, decision making and treatment of illnesses, including the use of the “Internet of Medical Things” (IoMT) (PricewaterhouseCoopers, 2017). As an example of early detection, the use of AI is enabling the review of mammograms at a thirty times quicker rate, with 99% accuracy. Google’s “Deep Mind Health” technology combines machine learning and systems neuroscience to construct learning algorithms which can be used in diagnosis. Robots have been used for a long time in the realm of medical science; surgical robots now exist which can complete medical procedures without human input.  The Hinotori Medicaroid is a good example. It does not have a narrow specialization and can perform a wide range of operations (Pro Robots 2022).

Cooking and catering/service bots have been proliferating within the food industry. The “Moley Robotic Kitchen” has robotic arms attached to the ceiling, and can cook more than 5000 recipes. The arms are capable of turning on appliances, picking up and putting down saucepans and spatulas, and can also stir, whisk, and flip. Robotic waiters such as those sold by Robowaiter (n.d.) are autonomous service bots that have “Intelligent obstacle avoidance”, including LIDAR, depth vision, stereo vision (RGBD), collision sensor, and infrared ranging depth vision.

Examples of agricultural applications include drones that use AI to pick only fruit which is ripe and avoid collision with each other, while other drones are being used for seeding, spraying and frost control. Large autonomous harvesters can also pick ripe produce but on a large scale. Seeding and weeding robots use GPS technology to navigate their environment. Another type of bot can analyze the growth of crops and detect diseases due to the application of machine learning (Interesting Engineering, 2021).

Companion robots come in a wide variety of shapes, sizes and purposes. At one end of the spectrum there are bots such as “Buddy the Emotional Robot” (BUDDY The Emotional Robot, n.d.). He is presented in a cute package with “gentle curves, big sparkling eyes and a smile radiating the atmosphere, thus creating empathy and the desire to interact”. This bot is a personal assistant, is interactive and can provide entertainment, and has the capacity to connect to your smart home devices.

Solidly at the other end of our imagined spectrum lie the bots designed for intimacy and the provision of sexual services. Male and female bots are available – and depending on how much a potential customer is willing to spend, they come prepackaged with different functions. They usually come with some AI on board, and the customer can pick from a range of personalities. Some are also apparently able to learn from conversations with their user and memorize information, for example their name and interests. Face recognition and automatic tracking are in the works for the future (Future of Sex, 2022).

The field of robotics is multidisciplinary, and therefore the overall pace of development will depend on related disciplines such as software engineering, Artificial intelligence, motor control, kinematics and machine vision. The application of these developments will then widen the overall vision of what is possible in robotics.

## What is the likely impact?

Throughout history, advancements in technology have always had an effect on the way jobs were executed, and even whether jobs would continue to be performed by humans at all. We can consider, as examples, jobs such as bowling pin setter, human alarm clock, or pre-radar listener (Ethical Jobs, n.d.). The development of machines to replace humans often resulted in those jobs being performed more quickly and with increased accuracy, and probably at a lower cost – a win-win situation for the former employees of the now unemployed humans. Modern developments in robotics are no exception.

In the case of Amazon, their 200,000 bots work with 300,000 humans. The bots have cut the rate of mistakes in half, and have increased the productivity of workers by 400%. It is entirely possible that Amazon will phase out more of its human workers in the very near future. The introduction of delivery drones and automated regional distribution centers in the future might also spell disaster for Amazon employees (Digital Engine, 2021).

Elon Musk’s automated Tesla production lines have meant that a smaller human workforce is being retained. Human workers cannot compete with the speed of the automated process, which sees a new part being made every six seconds. These production lines are making Musk the richest man in the world (Digital Engine, 2021).

Despite the above examples, the research shows that the adoption of robots and automation in the workforce is not all doom and gloom (The Century Foundation, 2019). Apparently, there is insufficient evidence to suggest that the use of robots is leading to widespread job displacement. The seemingly obvious effect that industries with larger adoption of robots see increased loss of human employment is negated by the displaced human employees being able to find work elsewhere; the net losses are balanced by employment opportunities. The key takeaway however (one that is not being mentioned) is that these people might have to retrain for a different industry and will suffer from the loss of income for some time.

As technology and economic considerations drive the adoption of robots the way some jobs are executed will change drastically, and some may even disappear altogether (at least as far as humans are concerned). Currently, this is happening the most in the industries most affected by the adoption – particularly e-commerce, manufacturing and agriculture. To put it differently, the industries with most change will see the biggest worker displacements.

We should also look at the impact of developments with the various companion bots. Besides the obvious potential profits that may be accrued for this industry, there are ethical and psychological considerations.

In a study of an elderly group of residents of an aged care facility, residents that interacted with a companion robot had significant decreases in loneliness over the length of the study (Robinson et al., 2013). A meta-analysis also found benefits in randomized controlled trials performed with dementia patients. Agitation and depression levels decreased significantly (Lu et al., 2021). Robots are also able to assist with emotional, physical and social rehabilitation (Chaffee, I. 2017).

Humans have been described as ultrasocial animals (Prescott and Robillard, 2021), and companion bots have been filling a need for the more neuro-typical among us as well. Apparently, people “can spontaneously form socio-emotional bonds with robots, even ones not designed to elicit social behavior”. Because robots can act as companions, they are able to decrease the loneliness and social isolation a person might feel, and some suggest that they may be able to catalyze interaction with other humans. Critics argue that robot relationships could decrease humans’ ability to socialize with other humans, as well as the desire to do so, because robot relationships are artificial and non-challenging.

What will the future bring? Can we imagine the continual “live” presence of a robot? Will everyone have a robot companion? "Imagine a companion also knowing what news events you would be interested in, how to update you on your sports team, tell you when you have a message from your husband or wife, or even diagnosing medical problems so both yourself and doctors save time” (London, L., n.d.). With the potential of having the perfect companion manufactured to our specifications, will humans want to spend time with other humans?

## How will this affect you?

With regard to job displacement on a personal level, I don’t think these changes will have an effect – I (as many of us are) am retraining in software development, and so hopefully I am able to stay ahead of the bow wave of the change as I maintain employment in the future. This will not affect my family a great deal, as my parents are too old, and my children are too young; they are still at school, and will adapt to future technological revolutions.

In terms of the social impacts of the adoption of companion robots to the fullest extent of what is expected, that change has not quite arrived yet. The technology, AI, and other required developments are not substantial enough for these bots to make a substantial mark on society. I do believe, however, that in the future robots will have a great impact on how we live our lives and how we relate to each other.Page Break

### References

cs.stanford.edu. (n.d.). *Robotics: A Brief History*. [online] Available at: <https://cs.stanford.edu/people/eroberts/courses/soco/projects/1998-99/robotics/history.html>

Wikipedia. (2022). *Outline of robotics*. [online] Available at:

<https://en.wikipedia.org/wiki/Outline_of_robotics>

Adelaide Robotics Academy. (2016). *Who did invent the word “robot” and what does it mean?* [online] Available at: <https://www.roboticsacademy.com.au/who-invented-the-word-robot-and-what-does-it-mean/>

Ohio University. (2018). *Top 5 Industries Utilizing Robotics*. [online] Available at: <https://onlinemasters.ohio.edu/blog/5-industries-utilizing-robotics/>

Martina Große Bley (2018). *Robots Replacing Humans – These 6 Industries Started Already - Global Female Leaders summit*. [online] Global Female Leaders summit. Available at: <https://www.globalfemaleleaders.com/blog/robots-replacing-humans/>

‌the Guardian. (2021). *ElliQ is 93-year-old Juanita’s friend. She’s also a robot*. [online] Available at: <https://www.theguardian.com/us-news/2021/aug/13/elliq-robot-companion-seniors>.

‌TFlex Tech (2020). *Top 5 Female Humanoid Robots 2020 - Artificial Intelligence And Future*. *YouTube*. Available at: https://www.youtube.com/watch?v=XSgfE2vg-Kk [Accessed 30 Mar. 2022]

Digital engine (2021). *What They Don’t Want You To See. Boston Dynamics and AI.* *YouTube.* Available at: <https://www.youtube.com/watch?v=SiZZkrEyw5Q> [Accessed 30 Mar. 2022]

Boston Dynamics (2019). *Handle Robot Reimagined for Logistics*. *YouTube*. Available at: https://www.youtube.com/watch?v=5iV\_hB08Uns [Accessed 30 Mar. 2022].

PricewaterhouseCoopers (2017). *AI and robotics are transforming healthcare: Why AI and robotics will define New Health: Publications: Healthcare: Industries: PwC*. [online] PwC. Available at: <https://www.pwc.com/gx/en/industries/healthcare/publications/ai-robotics-new-health/transforming-healthcare.html>.

Pro Robots (2022). *IREX 2022 - Japan’s largest robot exhibition | The latest robots and incredible gadgets!* [online] Available at: https://www.youtube.com/watch?v=2AiYirZPwIs [Accessed 31 Mar. 2022].

BBC News (2021). *The robot chefs that can cook your Christmas dinner.*[online] 20 Dec. Available at: https://www.bbc.com/news/business-59651334 [Accessed 31 Mar. 2022].

‌ RoboWaiter Australia. (n.d.). *RoboWaiter Australia*. [online] Available at: https://www.robowaiter.com.au/ [Accessed 31 Mar. 2022].

‌ Interesting Engineering (2021). *The futuristic robots transforming agriculture*. [online] Available at: https://www.youtube.com/watch?v=fygXIUv3O\_Q [Accessed 31 Mar. 2022].

BUDDY The Emotional Robot. (n.d.). *BUDDY The Emotional Robot*. [online] Available at: <https://buddytherobot.com/en/buddy-the-emotional-robot/>.

‌Future of Sex. (2022). *Sexbot Market Guide: The Best AI Sex Dolls and Sex Robots*. [online] Available at: https://futureofsex.net/robots/state-of-the-sexbot-market-the-worlds-best-sex-robot-and-ai-love-doll-companies/ [Accessed 31 Mar. 2022].

EthicalJobs.com.au. (n.d.). *11 jobs that no longer exist:* [online] Available at: <https://www.ethicaljobs.com.au/blog/11-jobs-that-no-longer-exist>.

‌The Century Foundation. (2019). *How Robots Are Beginning to Affect Workers and Their Wages*. [online] Available at: <https://tcf.org/content/report/robots-beginning-affect-workers-wages/?agreed=1>.

‌Robinson, H., MacDonald, B., Kerse, N. and Broadbent, E. (2013). The Psychosocial Effects of a Companion Robot: A Randomized Controlled Trial. *Journal of the American Medical Directors Association (2013)*, [online] 14(9), pp.661–667. Available at: https://www.sciencedirect.com/science/article/pii/S1525861013000972?casa\_token=WptUtgE5LSgAAAAA:xLw\_9pk58FT7CoCsZ92SuAs4xZxZ4aPm-Mqd7GvOiDlvow23NJwZ0onY0ed99mBG9pyDrigY-Q [Accessed 1 Apr. 2022].

‌Lu, L.-C., Lan, S.-H., Hsieh, Y.-P., Lin, L.-Y., Lan, S.-J. and Chen, J.-C. (2021). Effectiveness of Companion Robot Care for Dementia: A Systematic Review and Meta-Analysis. *Innovation in Aging*.

‌Prescott, T.J. and Robillard, J.M. (2021). Are friends electric? The benefits and risks of human-robot relationships. *iScience*, 24(1), p.101993.

‌London, L. (n.d.). *This Is What The Future Of Robots Might Do To Humanity*. [online] Forbes. Available at: https://www.forbes.com/sites/lelalondon/2018/11/28/this-is-what-the-future-of-robots-might-do-to-humanity/?sh=5fca9b7472ae [Accessed 1 Apr. 2022].

Chaffee, Ian. (2017). *A future with robots as companions could be closer than you think*. [online] Available at: https://news.usc.edu/117383/a-future-with-robots-as-companions-could-be-closer-than-you-think/ [Accessed 1 Apr. 2022].

# IT Technologies - Blockchain and Cryptocurrencies

## What does it do?

Blockchain technologies are a unique way of acquiring, storing and sharing information via a Ledger on a public or private network where all users have access to verify and view data using encryption. The concept begun in 1991 but was popularised in 2008 by an entity by the name of Satoshi Nakamoto, who released a white paper concept using Blockchain technologies for currency, starting Cryptocurrency, specifically, Bitcoin.

Records of a transaction are recorded as Blocks of data that can show information of who, what where or why of any asset or product you are wanting to track. As a Block can only hold a limited amount of data, new Blocks are created to create a chain. The Block is then assigned a unique set of numbers and letters, which can be up to 64 digits long called a cryptographic hash. This hash code is what organises the information to be added to the ledger in Blocks, linking the Block with the previous Block and joining a new Block to the chain. These transactions once created, cannot be reversed because they are linked to the Blocks before them in a chronological order. This information sits on a distributed database that is visible to all users and no single user has control over the information, however, every user can verify records of any transaction. The concept of peer to peer transparency and the irreversible chain is what makes Blockchain technology a secure way of storing transactions in an anonymous way. Cryptocurrency was borne of the idea that you could use Blockchain to store and transmit digital payment systems that don’t rely on banks to verify them, instead being verified by the peers in the user network.

There are currently over 18,000 cryptocurrencies with Bitcoin remaining the most popular, and the majority of the currencies being dormant. Bitcoin has remained the popular choice due to it being the original cryptocurrency to be launched and its wide acceptance on trading sites and digital wallets. Bitcoin’s price history remained largely unchanged from its launch in 2009 where it remained a digital payment of choice for anonymous users of the dark web platform Silk Road. The closure of Silk Road was the end of bitcoin’s beginning. It was perhaps the moment it became clear that removing financial institutions from money would not necessarily mean a more trustworthy environment, and it also didn’t guarantee protection from the state. Ethereum was the beginning of another big shift in the community: the change in focus from bitcoin per se to blockchain as a technology. Using the blockchain, Ethereum lets users write applications and make money from their work. The best-known application is the “smart contract.” (Though this technology bills itself as a way of replacing lawyers, it is incredibly difficult to get lawyers out of anything once they’ve dug in. Just saying!) Here’s a very reductive way of establishing a smart contract: let’s say you and I have agreed that if I write you a history of bitcoin, you’ll send me $10 on my birthday this year. We can do that via a legally enforceable contract, which involves lawyers, notaries, and so on — or we can do it via Ethereum. In the latter case, you put $10 worth of smart coins in escrow, and when the terms of the contract are met, those coins are released to me. If I don’t meet the terms of our agreement, the coins are released back to you.

Automating trust in Blockchain is emerging as the next step to legitimise the process. To automate trust, Essential Eight technologies — especially blockchain, IoT and AI — can work together to ensure the authenticity of data, verify identities and enable secure multiparty transactions. Converged technologies can provide ways to automate trust in physical, digital and human assets. In a typical example, IoT sensors can track a pallet of food from the time it leaves the farm to when it gets to the warehouse and then to the retail store, verifying the entire supply chain. This authenticates where a specific shipment is along the route, as well as the condition of the food during each leg of the journey: Is the shipping container becoming too hot, too cold or too humid? This information is recorded in a secure, immutable blockchain. Together, IoT and blockchain can create an immutable supply chain, ensuring that buyers are getting an authentic product that has not been damaged or switched along the way. These technologies can also verify whether a product that contains hazardous materials has been disposed of correctly and safely. Trust is at the heart of all business and personal relationships. If employees, customers, investors, and communities can’t trust the safety, security and privacy of data, systems and processes, your business will suffer. Without trust and transparency, you also could be subject to regulatory and legal actions.

## What is the likely Impact?

China has banned cryptocurrency trading multiple times. An outright ban on crypto mining last year was a massive loss to the industry, as most crypto mining happened in China. Mining involves running software on computer servers to solve cryptographic algorithms. This process validates transactions and maintains a shared record of transactions across the blockchain network. People who participate, the “miners” are automatically rewarded in cryptocurrency. Mining is an international industry, and large capital outlay goes towards the land, power and infrastructure needed to set up mining warehouses. In September 2021, when China banned all cryptocurrency-related activity, it reshaped an industry for which it had provided a haven. Miners scrambled into crypto-friendly Kazakhstan, propelling the country into world’s second-biggest Bitcoin production base, by one estimate. Trapped in lockdown, Shanghai residents turn to WeChat groups for food

But six months later, the industry is already being pushed out. Facing civil unrest and blackouts on the electricity grid, the government has throttled the power supply of the miners it once welcomed. As it buckles under infighting and government pressure, Kazakhstan’s significant mining base is preparing to move on, industry players and experts say. Smaller players can either flee somewhere like Russia — a risky jurisdiction, whose hostile politics would imply another temporary home — or, for bigger outfits, swallow higher costs to join the swelling ranks in the U.S., where the mining industry is clearly beginning to concentrate.

## How will this affect you?

While I personally have not invested in Cryptocurrency, the majority of my family live overseas in El Salvador who I personally support financially by way of money transfers from established agencies such as Western Union. El Salvador is an emerging country, having been through 21 years of civil war and only recently electing an independent government who is trying to bring the country in line with the first world by creating a Crypto friendly environment. In September of 2021, Bitcoin was made legal tender in El Salvador as all citizens with the government issuing a digital “Chivo Wallet” containing $30 for all citizens signing up to the scheme. From its inception, people were logging on only to notice their identities had been stolen, along with their promised sign up bonus. The majority of citizens lost faith once they realised their internet connections were too weak to support the internet infrastructure to make fast transactions needed to make the scheme viable. When I first heard about this rollout, I was happy to speak to my relatives about it and the possible make the change from our current money transfer arrangement to an instant exchange with no fees, but quickly found the process stressful when my relatives could not find an ATM to withdraw the funds. By the time they had found someone who would trade with Bitcoin, their value had dropped considerably from the time it was sent. Whilst in theory the idea of circumventing traditional banking practices in emerging economies sounds like utopia, the reality is the crypto economy is too mercurial and leave the people it intends to help, in an even more vulnerable position by people who don’t even live in their economy.

References

*​Benefits of Blockchain* . (n.d.). Retrieved from www.ibm.com: https://www.ibm.com/topics/what-is-blockchain - Viewed 10 April 2022

[**https://freemanlaw.com/mining-explained-a-detailed-guide-on-how-cryptocurrency-mining-works/**](https://freemanlaw.com/mining-explained-a-detailed-guide-on-how-cryptocurrency-mining-works/) **- Viewed 20April 2022**

[**https://www.bbc.com/news/av/technology-60148754**](https://www.bbc.com/news/av/technology-60148754) **- Viewed 10 April 2022**

# Clouds, Servers and Services

From your hand-held mobile phone to your office PC, servers and services are constantly being accessed, used and applied and for the most part without being acutely aware of it. What is a server or a service, and what do either of those have to do with the cloud?

A server is defined as a computer, either virtual or physical, that provides functionality and services to other PCs, often referred to as Client machines. If you have ever played an online video game then you have most likely connected to a server with other Client machines where all involved have access to the same services (The Video Game). A service then, is defined by the functionality and applications that a user has access to and can use. A service doesn’t need a server to be used as your own local machine has plenty of services that you have access to, however, a server allows users to access those services without needing to directly access it from your local machine.

With the ever increasing and improving technology that’s where clouds come into play, clouds are the next step in evolution of a server, accessible to users via an internet connection, allowing for shared data stored on virtualised machine to act as a server. Virtualisation can be conceptualised as a partition of a physical computer to create one or in most instances multiple other instances of a computer that accesses the physical computer’s hardware and resources.

Several companies such as Microsoft and Google have already started to implement this technology in our day to day lives, if for example you’ve ever used Google Docs, then those documents you are creating are being saved to Google Drive, a Cloud storage where your documents are stored and backed up. There are plenty more examples of cloud servers and services being used in the background of daily activities, like phone contacts being saved to a cloud storage so it will be accessible to your next device via the same login to the streaming services such as Netflix allowing you access to their cloud storage to be viewed at your own convenience.

With ever improving hardware capabilities and improvements in internet speed worldwide, the cloud is becoming ever more prevalent, which has brought about the phrase “X as a Service”. The phrase is used to describe the cloud's impact on various applications that users now have access to via the cloud. Instead of either purchasing a physical copy of a movie or downloading it via the provider directly, there are now many shows as a service applications that can allow the streaming of the movie without needing to purchase it, and instead pay for the service.

In the future, Cloud computing, services and servers will replace traditional servers or direct client access to services as a means to centralise that information, completely in the control of the hosting company to determine what a client has or hasn’t got access to. Not too far in the future, Infrastructure as a service will become ever more prevalent, allowing companies and businesses to rent or lease a cloud server without the additional costs associated with continual maintenance and upkeep of the servers. The benefit this can bring businesses is immense, with the data stored to the cloud, recovery of lost information from a local machine connected to the infrastructure as a service can be restored and still allow the client machines access to their various applications and services hosted on the cloud server.

The impact that Cloud computing is having on modern services is already being felt, from the data saved on your PC being backed up and stored automatically to a service like OneDrive, to the various subscription’s users have to access various services such as movies or video games. It may not be immediately apparent, but with those changes comes a change in how our data is being used or the ownership of said data. The movie you watched on Netflix, do you own it? Did you ever own the movie if you originally purchased it as a physical disc copy? Companies are beginning to understand the power and control that cloud computing lets them have over their intellectual property, no longer will clients own their data, instead they will be renting the service to have access to the application that holds that data. Fortunately, services such as OneDrive and Google Drive are free, so your data is always accessible and is still your intellectual property.

The biggest impact will be felt within Governments and Business that need to store their data securely while following strict guidelines as to the proper handling and disposal of said data in accordance with the law of that country. Currently, most Government organisations and businesses store their data on physical in-house servers, where their Database and System Administrators constantly monitor and upkeep the servers to ensure no loss of data or services occur. With Cloud servers, those roles and responsibilities fall to the cloud server provider, making the jobs of those database Administrators and System Administrators more limiting and in time may even become redundant as the technology improves to complete their tasks.

Our day to day lives have already begun to be impacted, from our files being stored to cloud services either for our phones or our computers, to companies moving their services to the cloud for users to access easily with just an internet connection. From 10 years ago, hosting LAN parties where video games were connected over a local connection to now having access to servers online that we can connect to, the improvement to cloud and server technology has evolved many of the tasks we used to do.

Accessibility to these services via the cloud will greatly improve and impact the way I complete my day to day tasks, from writing this assignment in a Google Doc so that it’s synced to my Google Drive and easily accessible from any PC I may be working on as long as I sign into my Google account, to all my phone contacts being saved to my Google account as well so that changing my phone will be as easy as just signing back into my account. The quality-of-life improvements that come from information being stored in cloud storage, or services we want to access being available on the cloud has improved the efficiency of our day to day tasks.

With those improvements always comes a risk, with the data stored in a situation that isn’t directly in our control, data breaches are possible and have happened in the past, but just as the cloud services improves, so does that security and technology behind it. My parents who are hesitant towards technology have even begun to trust these cloud storage and services, with my mum completing saving most of her work to her OneDrive account and dad learning how to sync his phone contacts across new phones. The technology is becoming ever more accessible with more and more users picking up the technology and adding it to their day to day lives, we can only start to the imagine where the technology will continue to go from here.

# Project Proposal

## Overview

Using a mobile device such as a phone to scan a serial number of a bike, e-bike, e-scooter and/or mobility scooter to then record and store this item specific information against an individual's personal account in a cloud-based server. This will help to deter would be theft and subsequent sale of stolen items. This registration data can be accessed by a user looking to register a new item or check if an item that is being purchased second hand has been flagged as stolen. The system would also allow one user to transfer item registration to another as proof of a legitimate sale transaction.

## Motivation

The Level up team have had several bicycles stolen over the years. Each bicycle can be individually identified by a serial number stamped or marked into the frame. Unfortunately, there is no central location to track and store these serial numbers, so the serial numbers are ineffective as a means of tracking the legitimacy of ownership or status. By creating a public registration system that can be easily accessed and utilised with mobile devices, this helps rectify this problem by making the sale of the stolen bicycle more difficult and being able to prove legitimate ownership.

‘In response to increasing concerns about stolen bikes across Victoria, Bicycle Network undertook a detailed investigation into the common characteristics of bike theft cases.

We found that:

• The number of bicycle thefts reported in Victoria has increased by 81.2 per cent in the past 10 years

• Only 9 per cent of bike theft cases are solved

• Bike thefts at car parks and multi-dwellings are growing by 40.7 per cent each year

• Only three Victorian local government areas have experienced no year-on-year growth in bike thefts

The results highlight that bike theft remains a poorly resolved issue across metropolitan and regional Victoria, and may worsen into the future without proper action being taken.’ (Bicycle Network Theft Report 2011-2020, July 2021, page 3).

## Description

**My Bike Register** would be a Mobile Cloud Computing (MCC) service for a cloud based mobile application for multiplatform delivery that can be accessed either by mobile device or desk top computer. User generated accounts that record the identification and contact details of the account holder. Name, Current Address, Profile Picture, Email Address and Mobile Number.

Account legitimacy would need to be verified with a mobile number and/or email address. In addition, two factor authorisation (2FA) security will be integrated into each account to ensure secure access by only the account holder.

Once a user account has been successfully established and verified, bicycles can be added to the account. Bicycles would contain the following information: Serial number, Type, Make, Model, Year of Manufacture, Colour, Place of Purchase, upload a photo of the bicycle, upload proof of purchase receipt and status of the bicycle (for example – Current Owner, For Sale or Stolen).

The user can store up to one (1) bicycle on the free system. To store more than one (1) bicycle then the user would need to subscribe for five (5) additional storage locations.

Mobile device applications would include the optical character recognition feature that could be used to read and then populate the serial number field of the bicycle form.

If an owner of a registered bicycle were to sell a bicycle, they would flag the bicycle status flag as “For Sale.” A potential buyer could go to the mobile app and scan or enter the serial number. The buyer would receive the “For Sale” verification notification. As part of the transaction, the bicycle would be transferred to the purchasing users account with all the associated details including the original proof of purchase etc.

A bicycle that has been stolen can have its status changed to “Stolen.” In this instance there can also be a field made available for the police report reference number with relevant details of where the report was made and to whom. Now when a potential buyer scans or enters the serial number, they will receive a “Stolen” notification. This will simultaneously notify the registered owner of the bicycle's location. The potential buyer will also be presented with a questionnaire regarding the details of the contact with the stolen bicycle and this will be provided to the legitimate owner.

Secondary advantages to the user of the register will be the ability to create a report for insurance companies that list the users registered bicycles and provide proof of purchase details. In the event of a claim these details are requested by the insurance company.

Additional commercial advantages of the register will be the ability to provide targeted advertising to users of insurance companies, bicycle shops or bicycle events happening in the area using geo-fencing features.

This system can be used for e-bikes and e-scooters as well as mobility scooters. With the values of these items in thousands of dollars, it is a logical step to create this register. This process has truly global potential and is not restricted to the Australian market.

Future additions that may be considered is to have a second-hand bicycle sales platform. Resembling carsales.com or bikesales.com.

## Tools and Technologies

* Server – SQL Database  cPanel
* Well defined database structure that allows for remote hosting and allows for an established interface that can be remotely accessed and monitored
* Html editor – Atom
  + This is a no cost solution to create the HTML interface to the database. The site design being primarily for use on mobile devices.
* Xcode – iOS compiler
  + Used to generate the application for apple devices utilising Swift as the programming language.
* Android Studio – Android compiler
  + Used for to generate the application for Android devices utilising Kotlin as the programming language.
* Github – code repository
  + For the collaboration storage of all part of the code for all devices and platforms.
* Teams – team project management
  + To allow for seamless communication of all team members during all stages of the project
* Photoshop – artistic editing of interface
  + Graphic design tool for the application and the web-based application
* Illustrator – artistic editing of interface
  + Graphic design tool for the application and the web-based application
* OCR frameworks - Yet to be confirmed but likely contenders for this feature include:
* Vision – Faster, cross platform capable, good review
* VisionKit – Apple’s generic version. Not cross platforms.
* Tesseract – not as flexible across platforms, still has good reviews
* ACME Animated QR Code Generator REST API v0.6
  + Allows for the creation and decoding of QR codes
* Real-Time Email Verification API
  + Used in the account creation and verification process
* Fencer API
  + Geo fencing API for advertising purposes
* Google Mobile ads (GMA) SDK
  + For targeted advertising via banner ads on pages of the application.

## Application functional workflow

A picture containing text, crossword puzzle

Description automatically generated

## Application functional outline and workflow

The outcome of the application is to make the user experience as easy as possible without creating obstacles to discourage the continuation of the collection of information. This needs to be achieved in a way that still ensures the security of the user's information and maintain the overall database integrity.

The start screen **-** will guide **new users to a registration** screen to collect basic information including name and email address and desired password. An email will be sent back to that address to validate its authenticity. Once verified the user will reach the home screen. Alternatively, a registered user will be required to login with their username and password details. Device biometric security features of the individual devices such as facial recognition or fingerprint recognition can populate the login details to expedite the process.

User Home Screen – This is the main navigation page of the application and allows the user to navigate to their account's details/settings screen, they can also navigate item check status screen and items list screen. The user will have the following options

* Logout
* Account Details/settings
* Check item status
* Receive new item
* User Item list

Logout **-** will secure the application manually and take the user back to the login screen

The application will automatically logout once the program has not been accessed for a period of 5 mins. This will be a setting within the account details/setup screen. The option will be 1 minute, 3 minutes 5 minutes, 15 minutes, 60 minutes and do not automatically log me out.

Account details **-** will have, in addition to the automatic logout options, additional personal details including the following fields not completed at initial registration. A reminder will pop up encouraging the completion of these fields once the first item is entered into the system.

*Additional details include*

* First Name
* Last Name
* Date of Birth
* Current physical address
* Profile picture
* Contact phone number

*Fields already completed*

* Email address
* Password

The user can edit their personal account details on this screen from this screen. In keeping with the new account keeping requirements of the apple iOS platform there also needs to be an option to delete all user account details from the system. This feature will be made available at this screen.

Term/Conditions and Legal information

**New user Verification -** will require an email or SMS to be sent to the user and the user to reply to this correspondence. This is to ensure that the user is authentic. This is a typical plugin feature. A secondary benefit of collecting and verifying the email address is this information can be used at a later stage for communication of relevant marketing information to the user should they opt in for this service.

**Login –** once the account has been established then the user will be required to login to their account with their login name and password.

**Account Details/Settings –** this is the screen where they can edit their personal details, update their profile picture, modify their opt in settings, etc. as part of apples new policies there also needs to be an option to delete the user and remove all information from the system. This option will be made available on this screen. Navigation from this screen is back to the Home Screen.

**Items List –** This screen contains the list of items with a basic view of the item's description and status that the user currently has stored against their profile. Within the database, this is a second list containing all the items of all the users. Each item is linked to each user via an internally generated user ID key. This process simplifies the transfer of items to different users. (See Exchange user/Sale an item) From this screen a user can navigate to item details/status screen or add a new item screen.

**Item Detail/Status –** This screen shows the additional information of each item stored against the user's account. Additional information such as a more detailed description of the item, photo of the bike, serial number of the frame, proof of purchase, modifications, make, model, colour, place of purchase and its status. The status displayed will be predefined as either “current”, “for sale” or “stolen”. This page will also allow for the user to delete the item from the list. From this screen the user can navigate back to the Home Screen or to the edit item details screen. This item information can be supported with artefacts such as the purchase receipt, photo of the item, photo of modifications and modification receipts and/or photos of the user with the item. By having all these artefacts and information stored against the item, in a single place it makes supporting arguments of ownership indisputable.

**Edit Item Details –** This screen allows the user to modify/update/change any of the item specific details. From this screen the user will be able to access a variety of functions that include file access, scanner access, camera access and optical character recognition (OCR) to assist with the collection of information and artefacts of the item and to strengthen proof of ownership. The status of the item can also be changed at the screen.

**New Item –** Adding a new item to the list of items that is attached to the user's account.  Information recorded includes things such as detailed description of the item, photo of the item, serial number of the frame, proof of purchase, modifications, make, model, colour, place of purchase and its status from a selection of “current”, “for sale” or “stolen”. This screen also allows access to a variety of functions that include file access, scanner access, camera access and optical character recognition (OCR) to assist with the collection of information and artefacts of the item and to strengthen proof of ownership. The status of the item can also be changed at the screen.

Exchange user/Sale an item – If a user wishes to sell an item the from the edit item details screen the user changes the item status to “for sale”.  When this is done a screen with a for sale QR code is generated. This can be attached to any image from the user's photo library as a layer and the user can then post this picture of the item with the QR code layer to any sale platform or marketplace platform with the QR code layer attached. Any potential purchaser can then scan the QR code that is on the image, and it would link to item details so the potential purchaser will see that it is a legitimately advertised for sale item. When a transaction occurs a unique code and QR code is generated. The buyer will enter in the code or scan the QR code. The seller/user will acknowledge notification on their device to accept the transaction. The item and all the relevant data will then be transferred to the new owners account with a receipt of the transaction being left on both user's accounts as evidence of the legitimate transfer of the item. The transfer of the item on a technical level is changing the items host. All items when entered the system are independent of the host (user) and linked to the host with the host id number. When a transfer of item occurs the host id reference number is changed to the new host id.

**Check Item Status –** This screen is accessed via the User Home Screen. It provides the user with an area to enter in the item serial number. Alternatively, the OCR camera can be engaged to scan the serial number automatically. Once the unique number is entered into the system and varified by the user it can them scan the database for a matching item number. If the item is identified in the database, it will return the status of the item to the user presenting them with one of four possible options.

*Option 1. the item is registered as active*

This is an indication the items details are registered on the system, but it is in normal use.

*Option 2. the item is registered and is flagged for sale*

This is an indication that the current registered user has the item set for sale and that it is a legitimate sale, and the user has all the relevant proof of owner ship information that can be transferred during a sales transaction.

*Option 3. The item is registered and is flagged as stolen*

This is an indication that the legitimate owner of this item has flagged it as a stolen item. The user will then be presented with a small list of questions regarding the location of the contact, contact details of the person trying to sell the item, where they found the item for sale, etc. This information will be sent as a notification to the legitimate owner of the item which they can then use by contacting police with their case ID

*Option 4. The item is not registered on the system.*

This is an item that has not been registered on the system.

New Owner/Receiver of the goods – Accessed through the for-sale item status screen or directly from the home screen. This allows the user to enter in the transfer code or scan the QR code provided by the seller to facilitate the transfer of the item to the user.  The transfer of the item on a technical level is changing the items host. All items when entered the system are independent of the host (user) and linked to the host with the host id number. When a transfer of item occurs the host id reference number is changed to the new host id.

## Commercial Opportunity

An opportunity exists to use the platform to advertise to a specific demographic. Enhance this cohort with geo fencing feature and you have high level targeted market access. With banner advertisements on selected screens of the application, a potential marketer can access potential customers in their region with highly relevant material. This marketing can be outsourced to Google Ads that take the demographic information and control and advertisement content. Revenue is established by clicks and is paid by Google Ads.

## Skills Required

Skill required include have the programming knowledge for the following languages and software

Swift – used for the programming language for the iOS operating system

Kotlin – used for the programming language for the Android operating system

HTML – Used to build the front end of the web interface

PHP – Used for the backend of the web interface

SQL – Used to create the database

Adobe Photoshop – Graphic art components

Adobe Illustrator – Graphic art components

## 

## Outcome

With this project completion there will be an international database for the storage and tracking of bicycles, e-bikes, e-scooters, and mobility scooters. This will act as a deterrent for the would-be criminal and give law enforcement a tool for tracking and tracing these items. This will decrease the amount of theft and increase the number of cases solved.

Additional benefits include the ease of access and security of documentation for insurance policies and claims and the registered pawn brokers can have security in ensuring a products legitimacy prior to any exchange occurring.

## Reference

Alexander Miller, Dr Nicholas Hunter, 31 August 2021, *Bicycle Network Theft Report 2011-2020*, Bicycle Network, viewed 19 March 2022, [<https://s23705.pcdn.co/wp-content/uploads/2021/09/Bicycle-Network-theft-report\_2011-2020\_v1.4.pdf>](https://s23705.pcdn.co/wp-content/uploads/2021/09/Bicycle-Network-theft-report_2011-2020_v1.4.pdf)

<https://www.programmableweb.com/api/acme-animated-qr-code-generator-rest-api-v06>  Viewed 17 April 2022

<https://www.email-validator.net/api.html> Viewed 17 April 2022

<https://support.google.com/admanager/answer/6238692?hl=en> Viewed 17 April 2022

NOTE: Hosting options Amazon webservices

https://unsplash.com/photos/0ClfreiNppM

Photo by [Tiffany Nutt](https://unsplash.com/@tiffanylnutt?utm_source=unsplash&utm_medium=referral&utm_content=creditCopyText) on [Unsplash](https://unsplash.com/s/photos/bicycle?utm_source=unsplash&utm_medium=referral&utm_content=creditCopyText)

Viewed 18/04/2022

Group Reflection

As a group we came together and organised our time very efficiently, meetings were organised promptly and ran on time biweekly. There were issues early on with Team member’s leaving during the early stages of the group allocations and towards the end we unfortunately had one of the team members drop out, however, the greatest strength of our team was our resolve to get on with the work and complete the tasks at hand, with everyone picking up the slack where required.

Improvements could definitely be made to how the meetings were run, with many going over time. An agenda was used and the conversations were fruitful in that it helped build teamwork amongst the team, however, it also drew away the focus at times. Keeping a hard limit on the lengths of meetings could have helped avoid these issues in the future.

The team overall was definitely surprised with how quickly we clicked together, roles were decided promptly, tasks were allocated and there was little to no bickering at any point. It’s not unusual to have teams formed that work well together, but given we were all strangers, the speed in which we were able to become a cohesive team was certainly surprising.

As the days and weeks continued on during the project, the team developed and learnt many skills required for completing the tasks. Examples include; effective interviewing practices such as; proving the questions prior to the interview to allocating who would lead the questioning and when the others could interject with their own questions and comments. Not only were their improvements to our interviewing practices, but the writing or our reports and the research that went into it improved drastically, with the team coming together, bouncing ideas off of each other and assisting in reviewing and updating each piece of work that any team member had put forward for submission.

 Our team decided early on to use the collaborative function of Microsoft Teams to allow files to be uploaded to a Teams Channel where anyone was then able to view and modify the files. This allowed for a proactive reviewing system of the pieces of work that we were all completing, and a layered folder structure for effective organisation of those files. Having the meeting minutes and agenda kept in the same places as the work we were creating made it much easier for the team to quickly reference back and forth from. Unfortunately this meant a log of the GitHub logs came towards the later stages of the project, where the work we had created was then moved into the GitHub to be worked into the website we were creating. Despite that, the Github will demonstrate the sheer volume of work that we as a team completed and a clear log of how the final product came together.

Grant’s reflection

This has been a wonderful experience working with new people remotely on a variety of tasks with a host of new tools that I have not used before on subjects that I am not completely familiar. The team has been incredibly supportive, and the core members have also made significant contributions to the inevitable HD outcome of the assessment. The group has had trials during the assessment with one member dropping out without notification and a team member with personal issues that impacted their level of contribution to the team, but we have overcome these issues through clear understanding of the tasks that needed to be completed, acknowledgment of our individual strengths and the willingness maintain communication as a group and give their best to the work that was being completed. I enjoyed the meetings with the team. We kept them brief and concise and on point but still allowed everyone present to contribute equally and allowed a casual approach while maintaining the necessary formalities to meet the needs of the outcome. All points and suggestions from all the team members were considered and given weight, and I found that we all had complimentary personalities that allowed for the cooperation of the group.

Maritza's Reflection

My first reaction to a group project on the second assessment seemed daunting at first. Questions about how you chose team-mates and the fear of being the last one picked raced through my mind. Thankfully, the reality has been quite the opposite of my fears. From the time Grant mentioned in the group chat in a tutorial he had created a team and jumping in, his leadership throughout this project has been a testament to completing this assignment. He has gone above and beyond with organising and meticulous record keeping ensuring we met and exceed the task brief. I truly appreciate all of Grant's effort to create a supportive environment. The allocations of tasks were handled fairly and took into consideration individual strengths. There were challenges faced within the team which were overcome by keeping an open line of communication with the core group members. There has been no shortage of support shown by the core team members and have felt supported when I've not felt my most confident. I have enjoyed interacting with everyone and getting to know each other through our conversations in meetings. I feel we've all had a similar approach with this assessment and have been able to work collectively to achieve a positive outcome.

William’s Reflection

I have to be honest, my dislike for working in groups is intense. I generally have a frightening preconception of horrific engagements with group members, work not being completed in a timely manner, and misunderstandings between group members. I am very happy to say that this has not been the case with the current group. On the contrary, the experience has been quite enjoyable, and I am looking forward to working on Assignment three with the same group. There has been a relatively large amount of work to complete, but I feel that we have done an exceptional job at arriving at the finished product. Group communication has been very satisfactory, and we have managed to stay ahead of the time constraints we have set for ourselves. The regular Team meetings have also been very helpful, in discussing potential issues, clearing up misunderstandings, and planning for the next section of work to be completed. This experience has shifted my perspective and my attitude to working in groups to the more positive side of the dial.

James’ Reflection   
Looking back at this assignment, it has been a great experience, meeting new people with different skill sets and different strengths and weaknesses has broadened my own personal knowledge and experience. The way tasks were handled via Kanban and allocated to each person, with differing timelines for each stage of the development of those sections was an amazing tool to keep the team on track and inevitably completing our assignment on time.

As a team we could certainly have improved at the communication side of things, keeping other team members updates on progress especially if one of the meetings were missed. This led to certain tasks needing to be completed with further assistance from other team members to ensure it was of the expected quality.

I was surprised by how effective Teams was for storing, and allowing for updates to all of our documents, this allowed us to see the documents being uploaded and easily reviewed and edited by the team without needing to reupload,

I’ve learnt that groups can bring people of all different walks of life together, to work on and create an incredible project together, bringing their own personal flavour and touch to everything.

We predominantly used Microsoft Teams to capture our documentation and progress on our work, moving it into Github in the later stages of development.

Stephen’s Reflection

As someone who tends to struggle with group settings, this was always going to be a challenge for me. The regular group meetings, in combination with the consistent proactive engagement others have had in this project resulted in everything coming together nicely in the end. Grant’s expert coordination as leader supported by the amount of effort and detail put in by the team has proved to be a powerfully effective group structure. In future I will need to make a point of pushing through mental barriers and updating group members of my situation and where I am at so that work can be coordinated efficiently and productively. I was surprised how understanding the group was when I could not perform to the same level as others; going forward I think I will have less trouble with communicating my difficulties in group settings. I would have liked if we had managed to set up a way for each of us to directly contribute to the GitHub repository so that I could learn more about how it works and what it is like to collaborate in such a way. Microsoft Teams has mostly been sufficient for the purposes of completing this group assignment. I really like this group and I hope that if we continue to work together that I will be able to contribute more during the next project.