

# PROSIGHT



## TEAM PROJECT

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# TEAM PROFILE

## Team Test Results

### Myers-Briggs

Each member of the team has taken a Myers-Briggs test as part of assignment one. Each member's results of this are below with a description of each.

- Alex Barron: ISTJ – Logistian (Sentinels)
  - *Practical and fact minded individuals, whose reliability cannot be doubted.*
- Shane Miller: INTP – Logician (Analysts)
  - *Innovative inventors with an unquenchable thirst for knowledge*
- Brandon Moroney: INFJ – Advocate (Diplomats)
  - *Quiet and mystical, yet very inspiring and tireless idealists.*
- Natalie Ogilive: INTP – Logician (Analyst)
  - *Innovative inventors with an unquenchable thirst for knowledge*
- Emily Petrie: ISFP – Adventurer (Explorers)
  - *Flexible and charming artists, always ready to explore and experience something new.*

### How can this be helpful to the group?

Having a mix of personality types is helpful to the group as long as we understand the benefits and challenges of each personality type. This will allow us to adapt how we work and be empathetic with other members of the group. Knowing someone has a different style allows us to adjust our expectations and compromise when appropriate. There are four distinct results for our team, with Shane and Natalie both Logicians.

Alex, Shane, Brandon, Natalie and Emily all favour introversion. Introverts need to think things through and need to consider before making a decision.

Alex and Emily focus more on sensation, whereas Shane, Brandon and Natalie lean more towards intuition. Sensors use facts to make a decision while Intuitives look at the big picture.

Alex, Shane and Natalie lean more towards thinking, whereas Brandon and Emily lean more towards feeling. Thinkers set their emotions to one side, often not making an immediate decision while feelers typically judge situations, taking into account personal values.

Alex and Brandon focus on judging where Shane, Natalie and Emily fall more towards perceiving. Judgers favour correctness and definition, perceivers will favour open time frames.

Interestingly the whole team expresses introverted personality aspects. This is beneficial with our team as often communication problems and issues can occur when introverted and extroverted people "butt-heads". The disadvantage to this is that we are all less likely to speak up and address issues if we are not comfortable with something, we need to be conscious of this when working together and keep communication lines open.



**Learning Styles**

Each member of the team took a learning style assessment as part of assignment one. Each member's results of this are below with a description of each.

- Alex Barron: Visual learner
- Shane Miller: Visual learner
- Brandon Moroney: Visual learner
- Natalie Ogilive: Auditory learner
- Emily Petrie: Tactile learner

Visual learners learn best by seeing information, visual concepts help learning. Auditory Learners learn best when information is presented in an auditory fashion, hearing information helps these students learn.

Kinaesthetic/Tactile learners learn best when information is presented to them and enables them to use their body to experience the concepts taught.

**How can this be helpful to the group?**

The way people process information impacts how someone learns and deals with both new information and new concepts. With team performance, we will need to share information between each other, often including new concepts. Understanding the best way to deliver this information can help us perform better as a team. For example, using these results, Natalie is at her best listening to instructions and executing on them, whereas Alex, Shane and Brandon work best seeing the steps written down and Emily would be at her best get hands on experience to learn. If we look at some of the project steps, such as accessing via GitHub with a group repository, which is a new concept, we need to disseminate the information in the most appropriate ways and if we only choose one, understand that other members of the team may need more or less support.

**Additional Test Results**

In addition to the Myers-Briggs and Learning Styles tests, we also took an additional personality test of our choice. Our team used three different tests. Alex, Shane and Brandon utilised the "Big 5" personality test, Natalie used a creative-problem-solving-test and Emily used an Enneagram personality test.

The results of these tests are displayed below.

*Big 5 Personality test (OCEAN) – Openness (O), Conscientiousness (C), Extraversion (E), Agreeableness (A), Neuroticism(N)*

- Alex Barron: (O) 52%, (C) 52%, (E) 52%, (A) 54%, (N) 50%
- Shane Miller: (O) 83%, (C) 56%, (E) 8%, (A) 50%, (N) 58%
- Brandon Moroney: (O) 71%, (C) 56%, (E) 29%, (A) 73%, (N) 54%

Creative Problem-Solving Test

- Natalie Ogilive: Openness to creativity - 78

Enneagram Personality Test

- Emily Petrie: Achiever

**How can this be helpful to the group?**

Understanding additional elements of the team's personality helps us become a more cohesive team faster. It is important for us as a new team with limited time, working remotely, to work through problems faster. Teams that have worked together for a long time understand where strengths and weaknesses in the team lie, without that luxury these tests assist us in forming a strong team that can perform strongly in this module's assignments.

# IDEAL JOBS

The groups ideal jobs are the following:

Alex – Technical Solutions Engineer

Brandon – Technical Analyst

Emily – Ride Control Software Engineer

Natale – Web Designer

Shane – Unity Developer

## Comparison

Common elements that are required for these jobs are experience in programming languages and/or knowledge on software design. Alex and Emily's job both require some engineering experience. At a glance all our ideal jobs are in different fields, a technical solution engineer involves working with customers to resolve their issues across Google technologies. A technical analyst will be responsible for providing technical support to investigations with the Australian Federal Police. A ride control software engineer is responsible for designing, facilitating and managing the systems and equipment used in operating a ride or attraction. A web designer will be creating websites and liaising with clients. A unity developer will be maintaining existing products and developing new features and prototype 3D interactive software.

All career paths are very different, they can be linked together with the common factor that we require experience and knowledge in programming language and/or software design. We will all also need the soft skills in communication and group work. As a group we have chosen quite different career paths which shows the variety of options available in industry to support IT professionals.



# TOOLS

**Link to group website:**

<https://brandon-m-tech.github.io/Group-Assignment-2/>

**Link to group GitHub repository:**

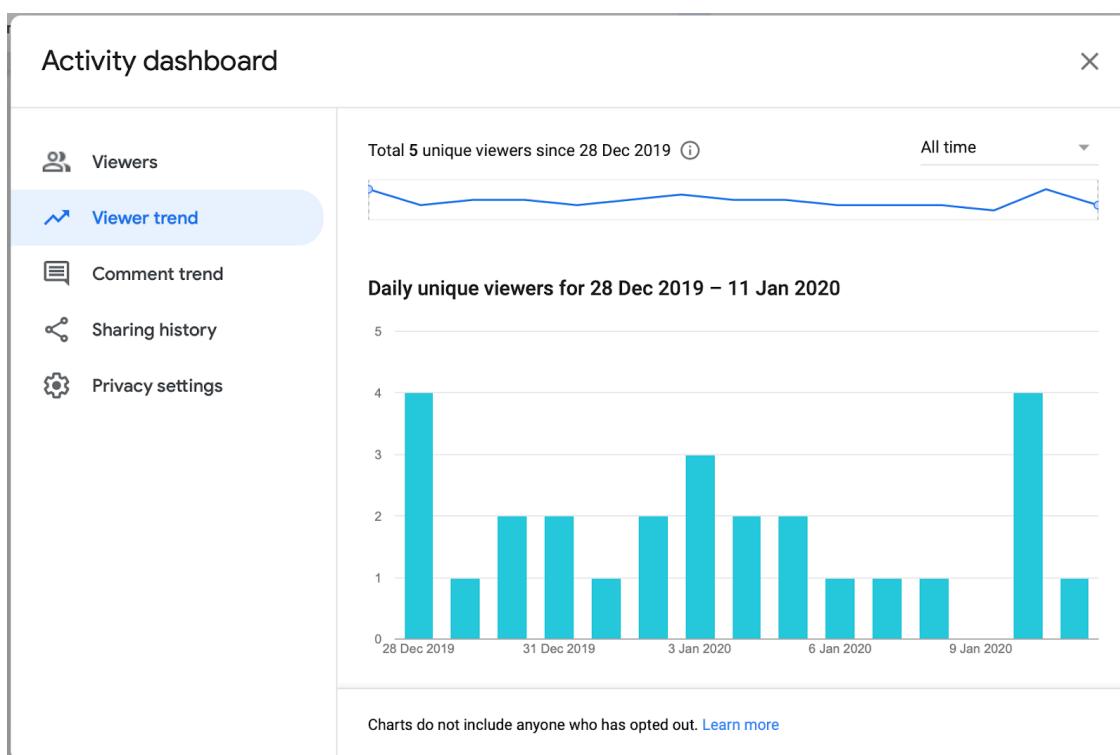
<https://github.com/Brandon-M-Tech/Group-Assignment-2>

Our group communicated through the use of Discord. This was our primary communication tool. In addition to communicating through Discord, we used Google Docs to list our assigned and outstanding tasks. Over 1000 messages have been exchanged through Discord for this assignment.

Our GitHub repository was used to upload documents, photos, reports and anything else needed. The group used this well with all documents being named. This helped with organisation and having an overview of what tasks were left to do.

Our Github activity log reflects how well everyone participated in this assignment. It shows consistent work over the past few weeks and contributions by everyone in the group. In total there has been 81 commits to the repository showing the consistency of uploads.

Below also shows the activity on the Google doc we used showing most days someone viewing to check on their tasks.



# INDUSTRY DATA

## What are our ideal jobs and what is their demand?

This is the data from our personal profiles, and ranked against the Burning Glass data provided.

Alex Barron - Technical Solutions Engineer - 2,291 (Technology Consultant)

Shane Miller - Unity Developer - 5,162 (Graphic designer / Desktop publisher)

Brandon Moroney - Technical Analyst - 2,914 (Cyber information security engineer/analyst)

Natalie Ogilvie - Web Designer - 5,990 (Web developer)

Emily Petrie - Ride Control Software Engineer - 29,456 (Software developer / Engineer)

The number represents the amount of current listings for that occupation there is for time period Mar. 01, 2017 - Feb. 28, 2018. (the higher the number the more in demand the job is)

## What are the required skills for our jobs?

We have listed the skills required for each of our ideal jobs.

### Alex

- Bachelor's degree in the field of Science, Technology, Engineering, Math or equivalent
- practical experience in technical support, professional services, software development, or product operations management.
- Experience reading or debugging in one or more of the following: Java, C, C++, .NET, Python, Shell, Perl, JavaScript.
- Experience in advocating for customer issues or needs.
- Experience as a system/network administrator working with Linux/Unix or Windows systems, from Kernel to Shell, file systems, and client-server protocols.
- Experience with Kubernetes, system virtualization, on-prem and/or hybrid cloud computing, cloud Identity and security system, cloud monitoring and logging, and/or local/cloud storage.
- Experience with SQL database administration, Google App Engine, open-source software communities, Cloud networking solutions, and/or distributed computing technology.
- Experience in computer networking. Understanding of web technologies.
- Ability to quickly prioritize multiple tasks in a fast-paced environment.
- Excellent attention to detail, troubleshooting, and written and verbal communication skills.

### Shane

- Proficiency with the Unity game engine.
- Strong understanding of C# / .Net framework.
- Understanding of 3D modelling/texturing work-flows for game engines (UV mapping, materials, exporting, importing etc).
- Passion for writing efficient, well commented code with clean and consistent formatting.
- Keen learner with a drive for problem solving and self-improvement. Working with new technologies is a celebrated part of what we do here. If diving into new territory, pushing the boundaries of what you know in order to find a solution appeals to you then you might be who we're after.
- Solid collaborative skills. While it's important to be comfortable working autonomously, maintaining clear and consistent communication with the team is a critical component of day to day responsibilities and helps us learn and build on our skills together.
- Solid grasp of modern UI/UX design.
- University degrees aren't mandatory, but a strong portfolio of work is. Please link to at least two projects (personal or paid) that demonstrate your experience.

### Brandon

- Be able to obtain a Top Secret Positive Vetting, this allows you access to classified information and resources at all classification levels.
- Experience with different programming languages (eg. Python/Java/C).
- Multiple other certificates ontop of a tertiary qualification in a technical field, these include.
- SANS Sec 401: Security Essentials Bootcamp Style
- SANS For 500: Windows Forensic Analysis
- SANS For 508: Advanced Digital Forensics, Incident Response, and Threat Hunting
- SANS Sec 560: Network
- Penetration Testing and Ethical Hacking

**Natalie**

- Bachelor's degree or higher qualification preferably in relevant field Or at least two to three years of relevant experience to substitute the formal qualification.
- You must be Australian Citizen/ Permanent Resident or have proper working rights in Australia.
- General Responsibilities:
- Excellent Communication skills
- Team Leader
- Multitasking
- Time Management
- Can work without supervision
- Can work under pressure and meet client's deadlines

**Emily**

- At least 5 to 10 years of experience with design, engineering, installation, and commissioning of control systems for electromechanical systems
- Experienced in fail-safe and safety-related system and software design, including defensive design techniques, and defensive programming
- Extensive knowledge of control processors, components, and communication networks used in multi-processing real-time industrial and/or embedded applications
- Demonstrated experience in industrial control system installation, integration and commissioning
- Proficient in software/system algorithm design and modeling methodologies such as UML/SysML
- Solid understanding of communication technologies/protocols: TCP/IP, Profinet, Ethernet/IP, EtherCAT
- Knowledge and familiarity with amusement and automation industry standards
- Experience in broad application of control system theory (closed-loop control, MIMO systems, positioning and navigation)
- Proficient in developing and reading electrical schematics and one-line diagrams
- Demonstrated experience in scheduling and estimating control systems development and implementation scope
- Demonstrated experience in contractor/vendor management and technical contract documents
- Proficient with engineering design tools, including AutoCAD, Matlab, Simulink, Solidworks
- Ability to travel and work both domestically and internationally, for varying durations that could be over 1 year
- As a minimum a Bachelor of Science Degree in an engineering field from an accredited university
- Some Physics Coursework (Motion Equations / Dynamics) required.

**From all these various different skills required, the IT/General related skills that match the demand from the burning glass data are as follows:**

**Alex**

- IT: SQL, JavaScript, Java, Microsoft windows, Technical support, Linux, customer service, .NET, Python. Software development.
- General: Communication Skills, Trouble Shooting, Detail-Orientated, Multi-Tasking.

**Brandon**

- IT: Java, Microsoft windows, Python.
- General: Nothing matches the general demands on job ad.

**Emily**

- IT: Software engineering, Systems Engineering.
- General: Nothing matches the general demands on the job ad.

**Natalie**

- IT: Nothing that specifically matches the job ad but I'm sure website production will be on there.
- General: Communication skills, Leadership, Time Management, Meeting Deadlines.

**Shane**

- IT: Graphic design, C#.
- General: Communication Skills, Problem Solving, Team Work/Collaboration, Team Building

**The rankings of the required skills we have are:**

- SQL = 3,570 (highest skill in demand)
- JavaScript = 2,946
- Java = 2,860
- Microsoft Windows = 2,699
- Graphic Design = 2,068
- Technical Support = 1,830
- C# = 1,643
- Linux = 1,632
- Customer Service = 1,411
- Software Engineering = 1,372
- .NET = 1,370
- Python = 1,150
- Systems Engineering = 1,037.

The next 3 highest IT ranked skills in demand which we don't currently have are:  
Project Management, SAP and Business Management.

The next 3 highest General ranked skills in demand which we don't currently have are:  
Organisational Skills, Writing and Planning.

#### **Has your opinion changed for your ideal job after viewing the burning glass data?**

**Brandon:** Although there isn't many skills in my ideal job that matches what most employers are looking for. I feel like this occupation is very specific and unique with not a lot of turn over, meaning there are fewer job ads. Based on this I have not changed my mind about my ideal job. Note. I also find Emily's ideal job to be very interesting. If I had not gone with a Technical Analyst, it would have been very similar to Emily's.

**Alex:** The Burning Glass data hasn't really changed my opinion. Whilst the ranking is low on demand, the reason for looking at the job isn't really the demand, it is the day to day work that interests me. The Burning Glass data has shown however that as the demand is low, there is potential for competition to be high and as such this may be a hard goal to achieve.

**Shane:** Ultimately I would like to forge my career path in a way that suits me as an individual and therefore I will continue to work towards building content on Unity. The Burning Glass data has not changed my opinion of this. Graphic design ranks tenth on Skills in Greatest Demand of the Burning Glass data and my chosen field relates to this. I do enjoy Java and it ranks third, so that may be a more tangible career path, however C# is primarily used with Unity.

**Emily:** Prior to looking at the Burning Glass data regarding my ideal job, I was already very aware of the obscurity of it, and the low level of demand. The data hasn't changed my mind in terms of my long-term goals, but has reinforced the level of work and commitment that is required for me to attain them.

**Natalie:** The Burning Glass data has not changed my mine for my ideal job. I feel the job will suit me well because it will allow me to freelance and work from home, which is a massive plus for me. Learning my ideal job has plenty of room for further education in the field and learning other coding languages.

# IT WORK

In order to provide the required information on IT work, we elected to interview an IT Professional in order to understand more about the IT industry.

The IT Professional we interviewed was Scott McCormack from Chironix in Perth.

Web: [www.chironix.com](http://www.chironix.com)

LinkedIn: <https://www.linkedin.com/in/scott-mccormack>

GitHub: <https://github.com/ScottMcCormack>

Chironix is a software development company focused on robotic autonomy and artificial intelligence. Chironix work in specialist areas and as such their expertise is in demand globally.

Their wearables division covers wearable and IoT devices for mobile personnel, such as first responders, maintenance technicians and defence. The applied robotics team work on autonomous robotic solutions, specialising in harsh environments, such as the mining industry. The Machine Learning and Cloud Computing teams use a range of solutions to solve client's problems.

In Scott's role as the Lead Cloud Architect, he leads a team of software developers creating novel applications that interact with and leverage cloud services. The role also involves providing cloud consulting to clients looking to move to the cloud. This may be in the form of advisory consulting, where they require assistance with planning, or this may be managing professional services where the client may be executing their migrations. As a Data and Analytics specialist, a lot of the newer work with clients is on the advisory side, looking at how they can gain more value from their existing data and begin to make use of machine learning and artificial intelligence. Scott estimates that approximately 50%-60% of his time is client facing, either in a presales or consultative capacity. The majority of his remaining time is spent producing reports on the client interactions or managing his team.

There is a wide range of technologies that Scott uses within his day to day business, such as software to manage client interactions and projects, such as Jira. There are also a number of collaboration tools, including G Suite, that Scott uses to maintain effective communications through video conferencing, text-based chat and emails.

Scott works with numerous stakeholders in his work locally, nationally and internationally with a wide range of interests and personalities. As a solutions partner, Chironix focus a lot of their time with clients. With these clients, this may be technical stakeholders as well as business and operations staff to gain an understanding of their problems. In Scott's words "What's the point of spending time in a business to try and help them if you don't know what's broken". Scott works with a lot of different industries, however as a WA headquartered organisation that specialises in robotics, there is a resources heavy focus to the industries. Many of the companies are either resources/industrial or support the resources industry.

There are also internal stakeholders that Scott deals with, managing the team of software developers of varying skillsets and experience, along with sales and marketing professionals to assist with driving new business.

Reading and tailoring the approach to each type of person and meeting Scott has found essential to being able to communicate, maintain positive working relationships and produce good outcomes.

Scott illustrated his work life with a typical example of a client he recently worked with to deliver a Data Analytics platform for in Perth.

Initially Google had engaged with the customer to discuss how they could improve their platform. As Chironix are a Google partner, Scott and his managing director were engaged by Google to work with them and the client. As part of the initial phase, this involved gaining an understanding from Google what had been discussed with the client and working with his managing director and the client to sell the value of partnering with both Google and Chironix to the client. After this initial phase, this involved engaging the client's existing data team to understand what they had and some of the technical challenges in addition to their operations manager, delivery manager and marketing team to understand and gather their requirements. Following this Scott engaged with Google's technical team and Chironix's software development team to create and validate a solution that would meet all the requirements that they had gathered. This is the part that Scott really enjoys, working to develop an innovative solution that works and can't simply be bought off the shelf. Scott then managed and oversaw the delivery of the proof of concept with the client to ensure that expectations were met on all sides. Keeping both the client and the vendor informed and happy is a tough challenge in these interactions as often priorities can conflict.



Scott McCormack

From this example it's clear that there is a wide range of complex people that Scott deals with, both technical and non-technical and requires strong communication skills to manage these relationships.

Scott finds the people side the most challenging part of working in IT. Technologies change and that is a challenge to keep up with, but technology changes linearly. You expect new technologies and disruptions to happen in IT. The primary resource required to stay on top in technology is time, which is a scarce commodity, but can be managed. However, people vary a lot more than technology in Scott's opinion. Dealing with people is a skill that takes time to master and requires constant dedication to maintain good relationships.

As someone who manages a developer team with a number of recent graduates, we asked Scott what advice he would give to someone beginning their career in IT. Scott would advise anyone who is starting their career in IT to be measured in their opinions and to be mindful of the approaches they take when starting their work. He has seen often with new graduates they move straight into "solutioning mode" without always considering all the challenges that may lay before them.

# IT TECHNOLOGIES

## Machine Learning

### Overview

In its most basic sense, machine learning is the application of artificial intelligence (referred to in this report as AI) which gives computer systems the capability to autonomously learn, refine and improve through experience, without the requirement of explicit instructions or programming. Machine learning is primarily employed within the field of data science, but can be found in multiple streams of mathematics, statistics and other computational fields. Algorithms written for machine learning will generally focus on giving a level of autonomy to the system in use, whether that be for collection of specific data or the completion of some other action or set of tasks. (Expert System 2017)

Machine learning is a concept that was likely first conceived over 60 years ago, but its vast application potential and variety of uses were not truly uncovered until towards the end of the 20th century (Dataversity 2019) Even now, machine learning is applied to more fields and areas as modern technology continues to shift and change at an accelerating pace.

While the range and possibility of machine learning is far reaching and much of its potential still remains unknown, several front runners have emerged as recently as the last few years, revolutionising the way we look at AI, data and even robotics. Machine learning allows us to combine many of these areas in both experimental and sometimes immediately practical ways.

An area making strides in recent years is reinforcement learning (RL), an area of machine learning that involves training AI to play games at a level equal to or surpassing that of humans. George Anadiotis, a contributor for the Big on Data blog at tech news site Zdnet, points out the potential for more real-world applications of what seems to be a novelty concept. "More important than the sensationalist aspect of "AI beats humans", however, are the methods through which RL may reach such outcomes: Play driven learning, simulation and real-world combination, and curiosity-driven exploration." (Zdnet 2019) Training AI to "play games" is another way to teach it to learn tasks or commands by trial and error, much the way a young child develops their cognitive and physical skills through play and interaction with the world around them. In contrast, Anadiotis refers to a report by Nathan Benaich, founder of the Research and Applied AI Summit (RAAIS), in which he points out the pros and cons of using games as an AI tool.

While he notes that games are a great place to start due to the customisable complexity of their environments and ability to reflect real-world aspects, "...the majority of games do not accurately mimic the real world and its plentiful nuances. This means that they're a great place to start, but not an end in themselves." (Benaich 2019)

The nature of machine learning is in itself ever-changing, but much of its development also depends on contribution from and development of other fields and areas of technology. Benaich takes some time in his State of AI report to discuss the concept of "deep learning" which is another, somewhat more extensive, branch of machine learning. He goes into much detail about the potential for deep learning's use especially in the medical field, and points out some interesting applications for this technology, such as "the potential for brain computer interfaces to restore communication for paralysed patients" through synthesised speech via monitored and recorded brain activity. (Benaich 2019) Perhaps even more revolutionary is the potential for deep learning to assist in technology for restoring limb control to those who may have suffered brain injuries resulting in paralysis.

### Impact

It perhaps goes without saying that these medical applications would have a huge impact on the quality of life of patients who otherwise have no options within the realm of current medical treatments, or perhaps even medical research outside of related machine learning. Should these undertakings in deep learning be successful, such an impact is clear, substantial and immediate. While Anadiotis describes these feats as "science-fiction-like" (Zdnet 2019), it's worth considering that much of our current technology, some of which we now consider as everyday conveniences, would once have been described in similar, fantastical terms.

There are other sides to the impact of machine learning that are less dramatic, but still worth discussing. Much research and discovery lies between the two extremes of reinforcement learning and teaching AI to "play games", and the astonishing applications of deep learning to restore human limb functionality and speech capability.

Some aspects may be more obvious than others, especially those we are more inclined to associate with data, statistics and numbers in general. Fields such as finance, insurance, economics, advertising and marketing, and of course, software engineering, all rely on various types of data and numbers in general to function in some respects. Machine learning makes it easier to complete much of the work and tasks required. While there are obvious benefits to this automation of how data is mined and used, there are drawbacks that will affect our society at least to a noticeable degree

Vinod Khosla, a renowned Silicon Valley investor, published an article a few years ago describing how medical diagnostic software, much of which relies on machine learning, will eventually replace up to 80% of medical doctors within the next two decades. (TechCrunch 2012) While this is perhaps a more extreme claim, its basis remains rooted in the fact that technology has replaced many historically human-held positions, and while it has created a huge volume of new jobs research streams and career paths, it has also made many others redundant.

As with all technology, pros and cons will always exist, but as professionals in the field, we should always be looking towards progress, new discoveries and new applications, while still acknowledging that sacrifices must be made in order to move forward.

### **Personal Impact**

As someone that is studying information technology and will one day work in a field or profession that is highly likely to employ some type of machine learning, there is an undeniable impact on my future and career. My daily life is already impacted by developments in machine learning, and that of friends and family, due to the technological advancements in recent years and our geographical location in mostly developed countries. Friends and family working in statistics and finance use data mining software and programs that automate large portions of their daily work, or perhaps increase their productivity on the job. As my grandparents attend their routine medical appointments, it is likely that some type of medical diagnostic software will be used. The next time I research prices for an overseas flight, advertisements may be recommended to me based off of data collected by some type of machine learning system.

The impact of machine learning is undeniable as someone living a "typical" existence in many parts of the globe. Even so, the likelihood is that we are only seeing a small portion of its capabilities to revolutionise more than just our daily lives, and this will only be revealed with research over time and future breakthroughs.

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# Raspberry Pis, Arduinos, Makey Makeys and other small computing devices

## Overview

As computing power and miniaturization continues to develop, we can achieve smaller and more powerful computing devices. Some such tools are the Raspberry Pi, Arduino, and Makey Makey. A Raspberry Pi is essentially a tiny credit-card-sized computer [1], while an Arduino is a programmable microcontroller.[2] Makey Makey is a system of introducing science, technology, engineering, and mathematics (STEM) education around electronics and programming at a young age. By mimicking a keyboard and mouse, the Makey Makey lets you control computer programs with everyday objects.[3] All of these are small computing devices that can connect to all different sensors that can then do some action based on some event.

The current Raspberry Pi board is up to version 4. It has up to 4GB of RAM, gigabit Ethernet, 2 USB 3 ports, 2 USB 2 ports, and two micro HDMI ports allowing support of 2 4k displays.[1] The Arduino comes in many forms. You have your basic Uno board, the smaller Nano, and the Mega.[2] Other companies make Arduino compatible boards with a variety of extra features. Some of these boards are designed with industry in mind making Arduino based programmable logic controllers (PLCs).[5]

While Makey Makey might aim at games and instruments, Arduino and Raspberry Pi's are capable of complex electronic circuitry. The small form factor and relatively low cost of these devices make them ideal for both educational and industrial applications. They are inexpensive and straightforward to use, which allows anyone to create things such as autonomous vehicles, 3d printers, irrigation systems, and with the Raspberry Pi things like Twitter bots, baby monitors, and web servers. You can connect many sensors to the Arduino, such as thermistors, which can detect temperatures and buttons to detect user input. Then the Arduino can output to things such as LCD screens to display user-readable information.

Whilst larger than these devices, there has also been an increase in small form factor computers where more compute power is required with solutions such as the Intel NUC, which is capable of running a full operating system and more intensive applications in a 4" x 4" form factor.

We are likely to see more use of these technologies in the classroom environment as STEM education expands, enabling younger and younger inventors to create projects. Currently, fifty percent of current jobs with skill shortages are in STEM fields.[4] In the next three years or so, we should see more modules and shields developed for market and more open-sourced projects available online. We are likely to see more ruggedized housings for Raspberry Pi, essentially making them PLC's, ready for industrial usage. There are a number of industries leveraging these technologies to provide AI responses and IOT applications where the core may be in the cloud and low latency is required. In the next 3-5 years, AI processing at the edge will increase and drive more usage of these in applications such as autonomous vehicles and home automation.

Open-source software, hardware, plus the maker community, makes it possible for almost everyone to develop complex machines. Nearly any kind of sensor is available as either as components, modules, or shields. Shields are a term used to describe boards that can be plugged directly into an Arduino board to give it enhanced features. Raspberry Pi's have a similar concept where 'hats' (sensors and circuit boards) can be added to risers on the board for additional features.

## Impact

I believe the people primarily affected by these developments are students looking to do projects for schooling and engineers/developers looking for a cheap way to prototype effectively.

Because the cost of these small computing devices is so low, people can prototype unique solutions to problems and test the solution before production. They are thus allowing the industry to produce a final product based on the components and code needed, making the solution more efficient and robust. This will also allow more innovation as the barrier to creating a new product is lowered, potentially allowing a small company to create new products without the resources that their larger competitors would have.

Many industries will adopt these types of technologies as they look to achieve more local responses in a distributed world. As an example, these technologies could be deployed within a building to detect human presence in order to optimise the lighting and climate to reduce operations and their carbon footprint. Sensors and microcomputer devices could control traffic flow systems to accommodate peak traffic hours, weather conditions and unexpected events such as accidents.

This technology is primarily used for computer science and engineering education or small projects and prototypes. There is the capability of automating a lot of real-world applications with these types of boards, making some tasks redundant, more accessible, or more efficient. I don't think these devices will replace or create unnecessary jobs, but perhaps the use of these devices will enhance employee skill sets, making them more valuable to the job market. Teaching electronics with the aid of Arduino is already happening now and will probably continue in the next three years.

## **Personal Impact**

These technologies will affect me in my daily life by being incorporated into my hobbies and continuing education. I have an Arduino board that I tinker with at present, which is very rewarding. I will also incorporate Arduino projects into my university studies where I can, as Brandy Hoffer did with his electronics thesis "Satisfying STEM Education Using the Arduino Microprocessor in C Programming"[7]. My background is in electronics, and I enjoy programming, so with these cheap solutions, I can forge personalized products for around home.

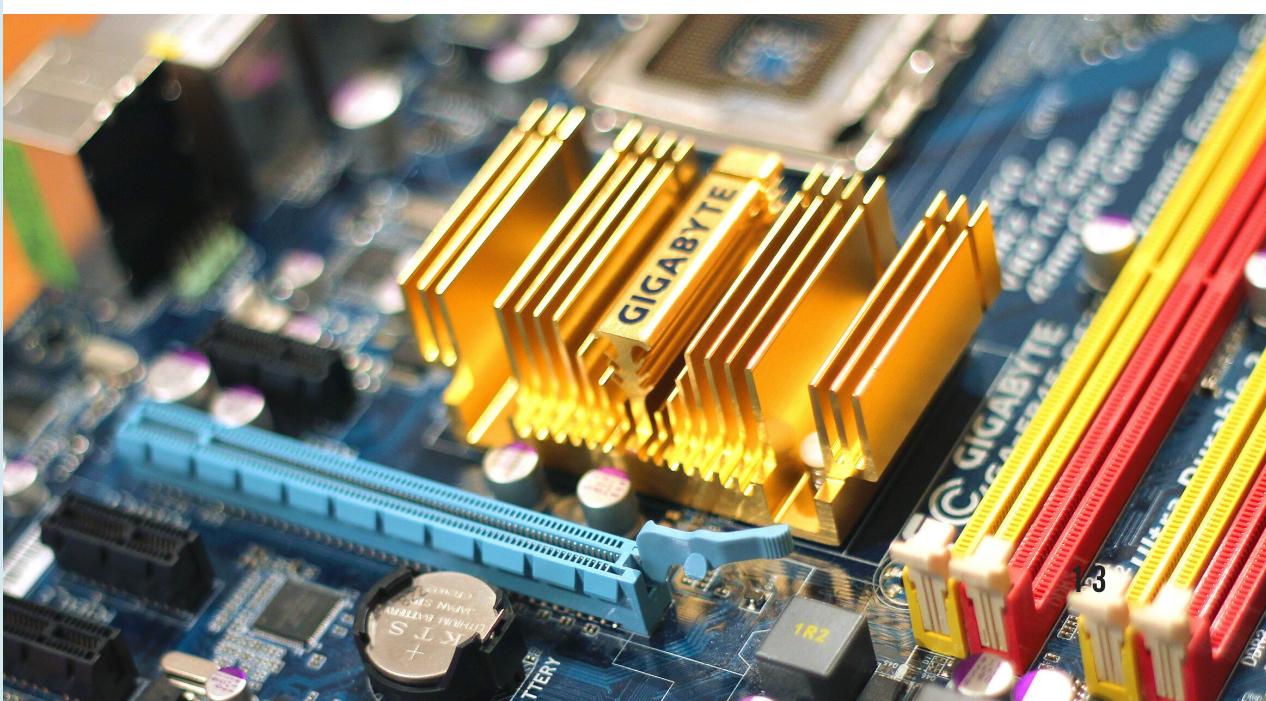
I can also use the learnings from these technologies to help me further my career. Whilst Makey Makey device career specific roles are limited, using the learnings from these devices and their application in real world environments can give experience that employers are looking for, for example using these skills in the design of smart cities, or industrial IoT devices.

I will also use my knowledge of electronics and programming with these systems to help educate my niece and nephew on these concepts, helping them get a head start into more complex and exciting learning subjects. I bought my nephew an Arduino electronics kit for Christmas last year, and he is very excited to learn all about it.

My family might directly benefit from my small to medium scale projects I deploy around the household. My house may become more and more 'smart' as the years go on, and my education expands, incorporating smart irrigation, lighting, and security systems.

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# Clouds, Services & Servers

## Overview

The cloud is the delivery of computing systems over the internet. To use the cloud means to store, access and use data via a remote provider through the use of the internet. It eliminates the need to use your computers physical storage space (hard drive). Cloud servers are a virtual server, used and built on the cloud network. You are provided with all of the same services that you would get on a normal server but accessed via the internet. With a cloud server, a user does not need to install or maintain any on-site infrastructure, this is beneficial for businesses because it saves money by only paying for the space used and also allows for a more scalable business.

Services fall under 3 categories: IaaS, PaaS and SaaS.

IaaS stands for "infrastructure as a service", this means you are paying for the hardware that you would normally use on-site in your business. IaaS is delivered over the internet, you are paying for servers, storage and networking. You are to manage your own applications and data. IaaS benefits business or users who do not want the maintenance of any physical equipment and have a fast growing business. Some examples of IaaS are AWS Ec2, Microsoft Azure and Google Compute Engine.

PaaS stands for "Platform as a service". This is more commonly used for developers because it provides the tools to develop applications. PaaS Is delivered over the internet and is beneficial to user who want to create applications without committing to taking all of the responsibility of maintaining and building the infrastructure required. PaaS is beneficial for developers because they don't have to start from scratch when developing applications. PaaS can provide application hosting and deployment for your applications. Some examples of PaaS are Google App Engine and AWS Elastic Beanstalk.

SaaS stands for "Software as a service". SaaS makes software available over the internet without the need for installing anything onto your computer. SaaS is beneficial to users because it is generally a very straightforward payment system (usually monthly), the vendor provides all of the background work including updates and infrastructure management and SaaS can be accessed from anywhere as long as you have an internet connection. Some examples of SaaS are Microsoft Office, DropBox and Shopify.

## *What is the state of the art in cloud technology?*

Over the last few years businesses have been starting to use what we call a "Hybrid Cloud". Public cloud is when your storage, networking and applications are managed by a third party via their data centres. Private cloud is similar to the public cloud with the exception that the cloud environment has only single tenant servers. Private clouds can be managed on premise or also at a third parties data centre. So what is the hybrid cloud? Hybrid cloud is the use of combining public cloud technology with private cloud technology that allows your data to be shared between the two. Hybrid cloud can benefit companies that need a scalable cloud environment, when workflow increases the overflow from the private cloud can be taken over on their public cloud and then visa-versa when things quieten down. Another benefit of this is that security sensitive information can always be kept on the businesses private cloud. With security being the biggest issue in the cloud environment, the future looks bright for Hybrid cloud computing. [www.dqindia.com](http://www.dqindia.com) reports that "Nearly three-fourths (73%) of respondents reported that they are moving some applications off the public cloud and back on premises". In 2017 Microsoft launched Azure Stack, a hybrid cloud computing software allowing users to use Azure in their own data centres. Google and Amazon have not been far off in developing hybrid cloud solutions with Amazons "AWS Outposts" and Googles "Anthos".

## Impact

With the use of cloud technology increasing, the requirements for on-site infrastructure in businesses decreases. For businesses, moving your networks onto the cloud is definitely going to affect jobs in your workplace. Moving onto the cloud eliminates the need for staff to maintain any on-site infrastructure (such as servers), can cut down on administrative roles and also sometimes in-house help desk support. But with the need for cloud computing growing, so will jobs in this field. Rather than having job roles being made redundant, staff need to build and migrate their skills. Popular sought-after jobs in this field can include being a software engineer, a software engineer designs, maintains and tests software for computers. A business analyst, this can be to help guide businesses in the transition to the cloud or advise on what cloud software to use. Another rising role in the I.T cloud industry is a security architect (or otherwise known as security engineer). Security is one of the major concerns when it comes to cloud computing, especially because of how much user data is being stored. A security architect is someone who would be responsible for maintaining computer and cloud security and creating secured layers in the cloud. Some notable skills to have that will benefit working in the cloud industry are coding such as Java or Python, business management, database management and any knowledge in popular cloud businesses such as Amazon Aws, Microsoft Azure and VMware.

## Personal Impact

How does cloud technology affect me? I use cloud technology every day, all my social media accounts, its where I store all my photos and allows me to study online and collaborate. A few years ago I would transfer all of my photos on to a physical hard drive and store them on there, now I have a Google Drive account and that automatically backs up everything for me on my phone. Part time I run my own business, to do all my bookings I use a program called Schedul which I can access over the internet. Schedul is a great example of SaaS, they take care of all the background work and I can easily use and access the program anytime and anywhere as long as I have an internet connection. Social media accounts, especially Facebook are a benefit of cloud computing. Accessed via the internet I can talk to my family and friends, which benefits me a lot because I live remotely. This helps me and my family feel more connected, we can video chat, share photos and talk anytime that we want. I feel that cloud technology will start to become more and more common in the world as time goes on, we are starting to see products now such as Google Home, Alexa and Siri becoming everyday household products and making "smart homes" more popular.

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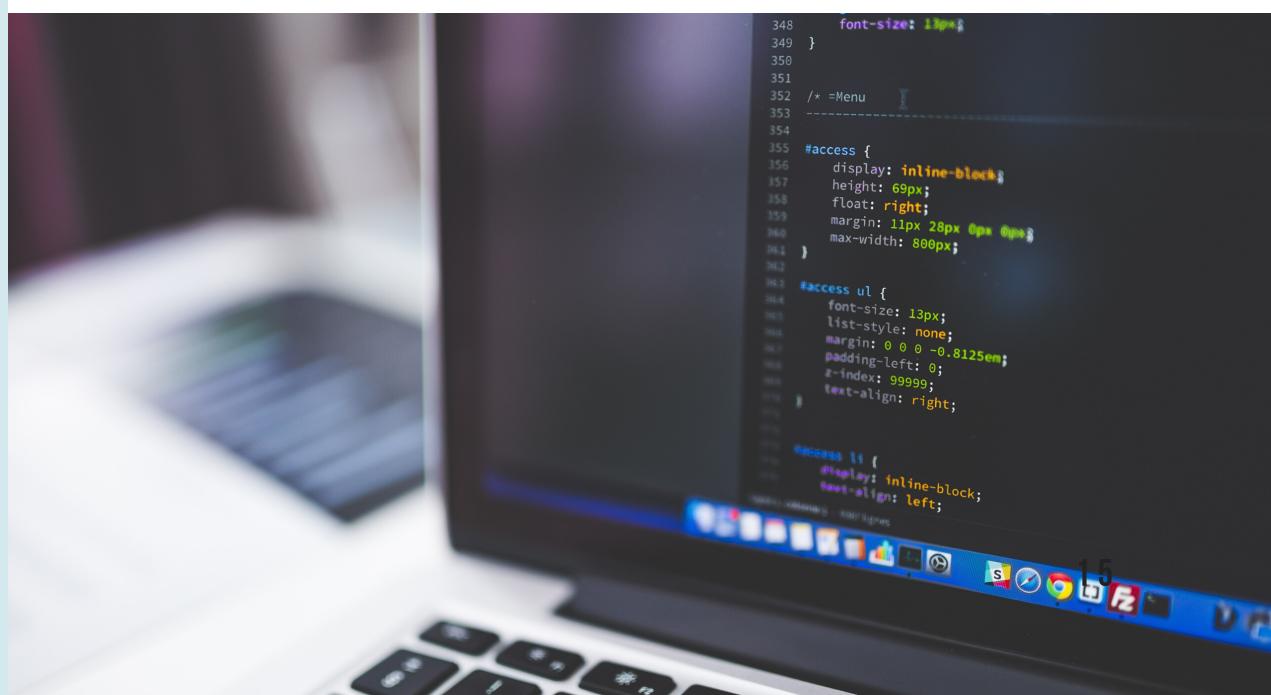
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# Robots

## Overview

Modern day robotics can be found within many different fields, from healthcare and manufacturing to entertainment and construction. While science fiction usually portrays robots in a highly fantastical light, oftentimes not ending particularly well for humans, their application and use in the 21st century is more about how our lives and environments can be improved, or how tasks can be carried out in a better, more efficient way. With so much interesting research and incredible progress in recent years, especially when combined with fields such as machine learning and artificial intelligence, robots are an exciting part of technology that still leaves much to be learned and discovered.

Perhaps one of the more common types of robots we would think of in a practical sense are those involved in manufacturing. Certain tasks that may be involved in a manufacturing process, such as within the auto industry, are relatively dangerous to humans even when undertaken with care and workplace precaution. There is almost always some type of risk involved when it comes to machine labour, but these jobs also require a level of thought and perception that only humans generally possess, meaning that humans will generally proceed with the task despite the danger. Robots are essentially used to eliminate the risk to human life or safety by being "employed" for these tasks instead. (Wired 2018) Naturally, there are other results from this, some of which may be seen as undesirable, which will be discussed further in a latter section of this report.

Robots used for factory work were more traditionally those that remained in place, unable to walk around freely, and perhaps didn't look like the usual archetype of a "robot" we have come to expect. (Wired 2018) They were generally programmed to work and exist within mostly static environments, completing the same repetitive tasks. While they could certainly move as was required of these tasks, there was very much a limit to their mobility. Around the 1980s, Honda began creating a new type of "humanoid" robot that could not only walk around, but also perform simple social actions, such as shaking hands or waving. This revolutionary prototype led to more advanced bipedal robots, which in turn resulted in the flourishing move towards highly advanced robotics, which we see today. (Wired 2018)

The advances we see in the media around robotics are usually the particularly exciting ones – not necessarily Roombas or repair units. The entertainment industry is heavily involved with robotics research, especially as robots have grown more lifelike, intricate and advanced. Robotic advancements can be seen in the film and themed entertainment sectors, especially as animatronics become more detailed and "realistic". Animatronics is a field of robotics encompassing many different mediums, such as animation and audio, that aims to emulate human (or animal) life. Animatronic robot research has become so advanced that an acrobatic humanoid figure able to "flip through the air and stick a landing every time" was recently revealed. (TechCrunch 2018)

Perhaps most significant is the way in which robotics has elevated the healthcare industry. Robots can be seen as remedying a part of humanity that can sometimes lead us astray – our emotions. Robots don't have to factor in personal emotion at all, whereas humans base a significant portion of their decisions from how they feel. Removing that element is especially impactful when considering difficult surgical procedures. Robots do not get emotional, tired or distracted, leading to decisions based purely from fact and programmed knowledge. A popular line of thinking within medical robotics is that this could essentially render a procedure "safer" for a patient. (Create Digital 2017)

## Impact

Much of the impact of robotics feels like it may be quite obvious – we are living in a time when we are privy to some of the most exciting strides in robotics and AI occurring, which are generally widely publicised in the headlines. Of course, new developments are often met with a level of distrust or even panic. There is always a fear that people may lose jobs and careers to robots, and perhaps some of these fears are at least a little valid. Robots have replaced humans in jobs before, and continue to do so, but there is probably something to be said for the balance of progress and efficiency. Simply put, over the course of civilization, if humans have found an easier way to do something, we usually do it. There is something to be said for thinking of this no differently.

Continuing the discussion around medical robotics, it is often suggested by researchers that robots will be able to make more accurate diagnoses than humans, especially as specialised robots are trained on how to read X-rays, MRIs and even blood samples. As we have discussed, once emotion is removed from the decision-making process, there is less room for error. This hypothesis is being tested currently on cadavers, with robots undertaking generally minor surgical procedures, which although minor still require a high level of skill and carry varying degrees of risk for the so-called "patient". (Create Digital 2017)

While opinions on this topic are strong, the biggest impact of progress should always be positive. Of course, there are negatives and positives to everything, even in scientific research, but despite potential redundancies and huge industry shake-ups, there are far more reasons to be excited about robotics developments than concerned.

## **Personal Impact**

It's difficult to say for sure how much robotics will affect us, whether in our daily life or the workplace. It's quite safe, however, to say that we should expect more changes over time than less. We can already see huge shifts in the way work has been accomplished over time, before and after the technology boom, or even further back, prior to the Industrial Revolution. Robotics is still a fairly new field, and considering how much research is currently being done, it's almost impossible to see where it will all actually go from here.

Having worked as an electronics repairer, I can certainly see that role eventually being fully automated, rather than employing manual labour to accomplish the task. This could be the same for many of my friends and family, especially those with some kind of technical trade or physical work. Other friends working in data science or finance could also find their jobs changing to a degree due to the robotics industry. I think that many other jobs, however, may require human empathy, emotion, or contact, which would mean they could be better suited to traditional employees instead of robots.

In terms of my future career, I would be excited to see the way that robots can be created to seem more realistic, or ways a favourite character from the screen could be brought to life. Immersive experiences are more and more popular as a means of entertainment, and robotics certainly have a huge hand in this. Robots could (and do) definitely make our lives easier, but they can also make our lives more creative and exciting.

Medical robots especially have the ability to improve human quality of life. In my opinion, the positive impacts greatly outweigh the potential negatives, and it's exciting seeing this field advance.

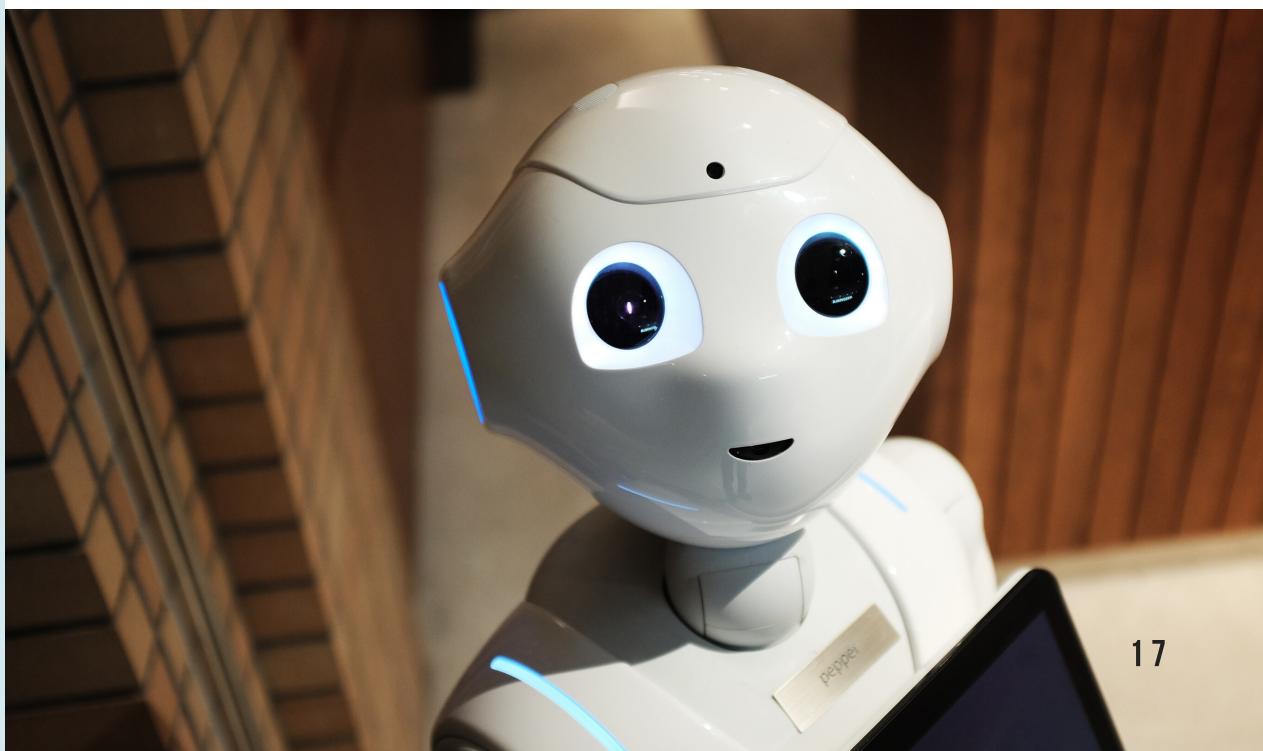
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# PROJECT IDEA

We reviewed everyone in the team's project ideas.

These are summarised below:

Alex: Recycling tool

- Raspberry Pi based solution to tell you whether something should be recycled or not.

Shane: RFID Power Switch

- A smart switch to power on or off a PC using a Arduino technology.

Brandon: Learning Style App

- An app that lets students/teachers assess what learning style suits best.

Natalie: Communal delivery App

- An app that lets remote towns arrange and split shipping costs for group deliveries.

Emily: An online academic assistance app

- Allowing STEM Students to search for help and resources based on their profiles.

We then decided as a team that Brandon and Emily's ideas had a number of similarities and treated them as a single idea. This then gave us two paths to go down, a hardware focused path with Shane and Alex looking at using Raspberry Pis or a software defined path with Emily, Brandon and Natalie looking at developing applications. We did look at a number of approaches to choosing the idea we wanted to work with for the remainder of this course, looking at their merits, relative complexities and our skill sets. We decided to focus on the software path and as we are students learning, we saw a lot of merit in the combined idea of Emily and Brandon's projects.

## What is the project idea?

The project idea is a mobile app or interactive website that allows STEM students to search for help or assistance on a particular topic and filters the resulting resources based off of the student's individual profile (for example, the units they are taking and the level they are studying at). In addition to this, the app would also incorporate assessing what learning styles best suits the students' needs and using this to influence the resources provided. For example, providing more video content to a visual learner or practical exercises to a kinaesthetic learner.

## Why do we think this is a good project idea?

STEM is an already underrepresented area of education within Australia that will drive jobs for the workforce of the future. In addition, more universities and teaching resources are available online than ever before. Even if a student is studying on campus, the chances are that they will need to access online content and extra resources outside of the teaching materials given. As every student is different, and has different learning requirements and styles, a way to better tailor and filter the huge amount of information and assistance out there could really benefit a lot of people.

A 2018 report titled Programme for International Student Assessment (PISA) details the long-term decline in Australian students in Science, Reading and Mathematics subjects in comparison to Chinese students. Specifically, the report details that Australian students are on average 3.5 years behind Chinese students in mathematics. With this information, we see a market for our project, not just in Australia, but in every country.

## How do we anticipate the project working?

A student will register on either the website or download the mobile application. Then the service will require students to go through a preliminary profiling process. We anticipate this would include the following.

Student fills out an entry profile, information about them will then be taken into account when producing search results for them as an individual user, such as their skill level, learning style, previous studies and even special circumstances (for example, specialised support for minorities, those with a disability, etc).

A qualifying quiz is then taken after they set up their profile for each subject or study area, they select that will help to ascertain their current strengths and weaknesses in that subject.

Once the student has registered, appropriate resources can be allocated based on a library. The intention is that the library is dynamically populated based on content that is available on the internet. Although academic help will be the main focus, other support services like those touched on above will also be recommended or given as an option. The resources would have to be classified as part of the search and delivered to the users. Resource distribution would be influenced by the following:

1. *Auditory learners*
  - a. Resources that can be converted to speech
  - b. Discussions that the user can be involved in
  - c. Providing audio recordings of the user to reinforce learning points.
2. *Visual learners*
  - a. Photo essays to tell stories.
  - b. Mind maps, diagrams and flowcharts to show links between items.
  - c. Playing videos to reinforce learning points.
3. *Kinaesthetic learners*
  - a. Activities that can be hands on, such as games or interactive stories.
  - b. Resources that encourage the user to participate
  - c. Immersive experiences



A review system will also be put in place, and students will be able to "upvote" different resources depending on how helpful they are with a particular concept or issue. The idea is that the recommended websites, videos, articles and so on will improve in accuracy and helpfulness for each individual.

#### **What tools and skills are required?**

There are four key components required to deliver the service. These are the website/mobile app, the data storage solution for users and resources, the content indexing tools to grab and index content and the rating system which would use machine learning and feedback loops to rate and provide appropriate content.

The tools used to initially build the site/service would probably include an interactive programming language, such as JavaScript. If a mobile application was developed to compliment the website, it would most likely be written in something like Swift for iOS and Java for Android. It would require a team with a very good understanding of the programming language that is going to be used. The team here would also be responsible to the user experience and so a front-end developer would be key here.

The data storage and indexing solutions would need to be created to store user information and resource access. This would require a team with skills in relational databases and also big data to collate the resources we would recommend. This could be achieved with a combination of SQL and NoSQL databases. Web crawlers would be needed to understand educational sites and the content they have. Security would also be key here to prevent user information from being exposed. There would need to be checks in place to ensure resources are linked rather than copied to maintain copyright with the original owners.

The algorithms designed for the user to find accurate and personalised information would require knowledge of machine learning tools and languages. This would require a team of engineers that understand Python and how to build a recommendation engine using an environment such as TensorFlow.

Outside of these areas, we will need an overview team that consists of architects and project management to deliver the project effectively. This would ensure consistency of the deployment and keep the project to scope and on time.

#### **What does a successful outcome mean?**

Upon successful completion, it would open up personalised academic help to all students able to access the site (depending on where the service is made available). It would help bridge the gap between online students and specialised support, and help finding online study resources an easier and more accurate process for everyone. This could potentially bring Australian STEM students to a higher standard, giving every student a chance to learn the way that they learn best. This project would encourage and empower students in completing their education.

# GROUP REFLECTION

## Alex

As the first time meeting and dealing with each other, using Discord was a great communication tool. One thing that I think we all found challenging was working and completing other courses at the same time, this I think surprised us all. I think we could improve in future projects by completing peer reviews earlier in the project to reduce the workload at the end. I learned that groups have a diversity of skills that we need to leverage. My contribution was completing the IT interview and supporting the rest of the team.

## Brandon

The group worked really well together. There was no arguing and there wasn't any time when one of the members didn't like what they had to do, because everyone picked their own tasks. Using discord for communication and google docs for organising made it very simple. My contribution was mainly the creation of the group website using Dreamweaver(adobe) and comparing our ideal jobs to the data given by Burning glass. What surprised me the most was how handy GitHub is, not only for code but how easy it was to link all our files together and to track what everyone was up to. The most challenging part for me was the time management, this can be improved by having more scheduled collab sessions.

## Emily

Our group worked really well together and communicated effectively to complete this assignment. I think we were all respectful of each other's ideas and worked out solutions pretty quickly whenever we got stuck. My main contribution aside from the group work done towards our project idea was completing two of the 'IT Technologies' report, Robotics and Machine Learning.

## Shane

I think our group worked well together, with no conflicts arising. We all chose tasks that we wanted to do, and that worked out great. My main contribution was a report on small computing devices and participation in our group chats on Discord. We could improve on our next project by trying to get drafts ready in a timely fashion, giving more time for feedback and corrections later on. What I found surprising about working with this team is how well we have come together to collaborate. We had one member of the team drop out early, but we didn't let that affect our performance. We had no conflicts over anything, which was also a pleasant surprise.

## Natalie

I feel our group worked together very efficiently, communication lines were always open and everyone was eager to participate and help each other out. What I think we could improve on is probably assigning all tasks at the start, so left over jobs aren't left to the last week. What surprised me was how many new programs I learnt to use and how they can be used in a group collaboration, i.e Google Docs, Github and Discord. These were programs that I had never used before. My main contribution was doing the Cloud, Services & Servers in the "IT Technologies" category and helping put together the final report on Canva. I have learned about groups how easy collaboration can be with the right tools, the thought of group work was a tad daunting for me before this.