APPLICANT 4 – A COMPUTER SCIENCE PROJECT

What does/did your project aim to achieve? **Please write up to a maximum of 300 characters**
I aimed to design a two-player dice game that involves calculations and uses subprograms like functions and procedures. This project is my non-examined assessment for my Computer Science GCSE. I had to design a program that meets requirements and guidelines, these are described in details in the attached document.

Please describe and explain your project making clear and direct reference to your supporting documentation. **Please write up to a maximum of 1000 characters**
I was not given any instructions of how to start the program and so I had to decide how the program is going to run without any logic error or syntax error. Also, I needed to identify the purpose of the program and the most efficient way to achieve it. To show skills and techniques that I have learnt is the target that I set at the start to avoid any unnecessary steps to be done and to present a well planned project.

What have been the successes and failures of you project so far? **Please write up to a maximum of 500 characters**
As it progressed, I produced a check list to ensure that I was producing a robust program before I tested the program. I checked all validations and sanitisations are done so that the program would not stop running halfway and would not result in a wrong outcome. Then, I tested the first subprogram, authentication, which was processed without any errors.

What lessons of an engineering nature have you learnt from working on this project? **Please write up to a maximum of 500 characters**
Problem solving skills and logical thinking appeared to be essential when working on this project. Engineers need to think step by step, factor by factor like the way computers process instructions and data. Some people think computers are super brains but I think engineers are the real super brains who understand how adaptations take place and so human beings could adapt to the 'computational' society and computers could simulate human actions.

VISUAL EVIDENCE

Programming Project

Contents

Success criteria

I have chosen to do Task 2. This task is about a dice game between 2 players.

The solution must:
1- Include input sanitisation and validation.
2- Include authentication.
3- Include user interface.
4- Not include syntax and logic errors.
5- Do calculations correctly according to the scoring system.
6- Allow two players to enter their details.
7- Allows each player to roll two six-sided dice.
8- Calculates and outputs the points for each round and each player's total score.
9- Allows the players to play 5 rounds.
10- If both players have the same score after 5 rounds, allow each player to roll 1 die each until someone wins.
11- Outputs who has won at the end of the 5 rounds.
12- Stores the winner's score and their name in an external file.
13- Displays the score and player name of the 5 winning scores form the external file.
14- Runs correctly according to the rules.
15- Be divided into subprograms.

I have broken down the program in the way I have done because I think these are the main tasks that are essential for the program to run correctly and smoothly.

The main program is going to:
- Display welcome message
- Display result message
- Call subprograms

The Authorisation subprogram is going to:
- Ask the two players to enter their details one by one, the second player can only enter the details when the first player is confirmed authorised
- Has an array storing names in lower case of authorised players
- Do input sanitisation (as string and as lower case [presence check, type check]) then evalidation (compare to the names in the array)
- If the entered name is in the array, the player is authorised
- If the player has not entered authorised details, displays error message and askes the player to enter details again until two players are both authorised (If the first player is authorised and the second is not, ask the second player to enter details repeatedly until authorised details are entered.)
- Return the names of the players the main program – function
- iterative testing should be done during the program is being developed

The game subprogram is going to:
- Run a loop for 5 rounds and then compare results, the loop should run with following rules:
• The two players roll one by one, only when they both have finished their turn, one round is finished
• When the roll of the two dices of a player add up to be an even number, the number adds to the total which is zero before they rolled any die and 10 points are added to the total.
• When they add up to be an odd number, that number adds to the total and then 5 points are subtracted from the total. However, the total cannot go below zero at any point.
• When the two dices have the same number, the player get to roll one other die and the three numbers are all added to the total.
- After 5 turns, if the two players have the same total, they will roll one die one after the other and the number they get will add to their total. The two totals will then be compared again to identify the winner.
- Get the names of players from the main program and return the winner and the winner's total to the main program – function
- iterative testing should be carried out in order to ensure the correct calculations are done The external file program is going to:
- Get the name of the winner and the winner's total from the main program, does not return anything to the main program - procedure
- Prints the winner's name and total
- Prints the top 5 scores

After that, I had to add in codes that ask the players repeatedly to enter names if they have entered an unauthorised name. This could be done by not stopping the loop and output a try again message to instruct the players.

```
while auth1==False:
    player1 = input("Player1 please enter your name: ").lower() #input sanitisation
    if player1 in name:
        auth1 = True #player1 is authorised so it moves on to player2
    else: #if input not in array
        print("The name you entered is not authorised, please try again.")
while auth2==False:
    player2 = input("Player2 please enter your name: ").lower() #input sanitisation
    if player2 in name:
        if player2==player1: #the two names cannot be the same
            print("You cannot enter the same name as Player 1 does.")
        else: #if input in array and does not repeat first input
            auth2 = True #both players are authorised
    else: #if input not in array
        print("The name you entered is not authorised, please try again.")
```

MARKER'S COMMENTS

The visual evidence provided here are sections taken from the applicant's project folder. This applicant clearly works at a very high level and the project folder was easy to read and understand and was very logically laid out. If you use a Computer Science project in your application, then communication becomes even more important for the purposes of third-party assessment. We like the way that the lessons learnt are clearly linked to engineering and that the complexity of the programming is clear to see.

APPLICANT 3 – A RE-WORK OF A RAILWAY SYSTEM

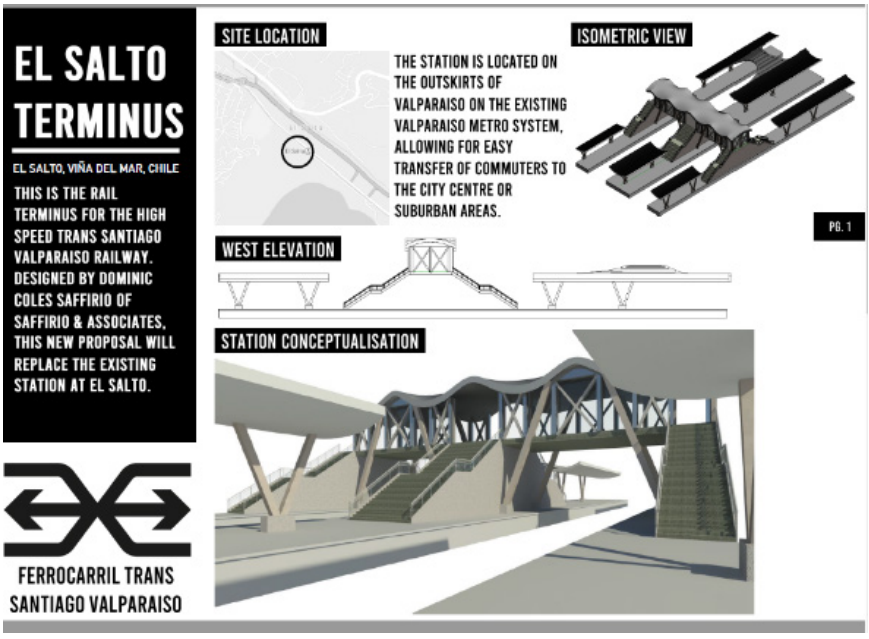
What does/did your project aim to achieve? **Please write up to a maximum of 300 characters**
It aimed to reduce road congestion and pollution by providing a high-speed electric rail connection between the two prosperous cities in Chile. The rail connection is fully sustainable as it would be powered by a new geothermal plant making the net production of CO2 zero. This railway link will turn a 2-hour polluted journey into a completely green 15-20 minute commute from between each city. The project also revitalises parts of the disused railway line and will encourage economic development.

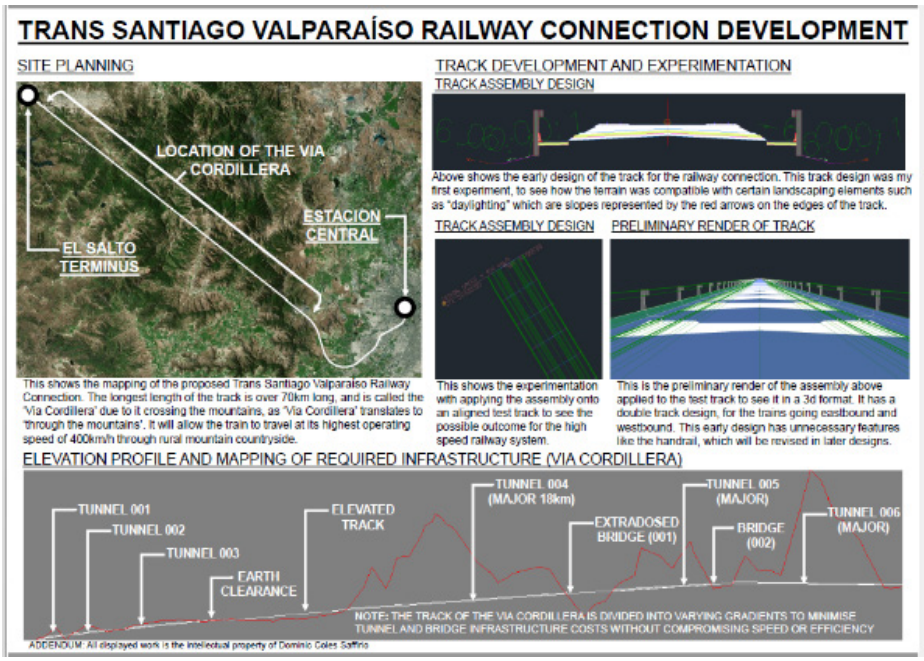
Please describe and explain your project making clear and direct reference to your supporting documentation. **Please write up to a maximum of 1000 characters**
Due to the high seismic activity in the area, the design of the track and other infrastructure had to be able to withstand high magnitude earthquakes. I solved this by creating my slab track based on the Shinkansen's design with reinforced concrete track and padding to help mitigate the effects of the P-Wave. I also designed a custom fastening assembly, to secure the track down safely and deal with the vibrations caused by the maximum operating train speed of 400km/h, the second-fastest globally.

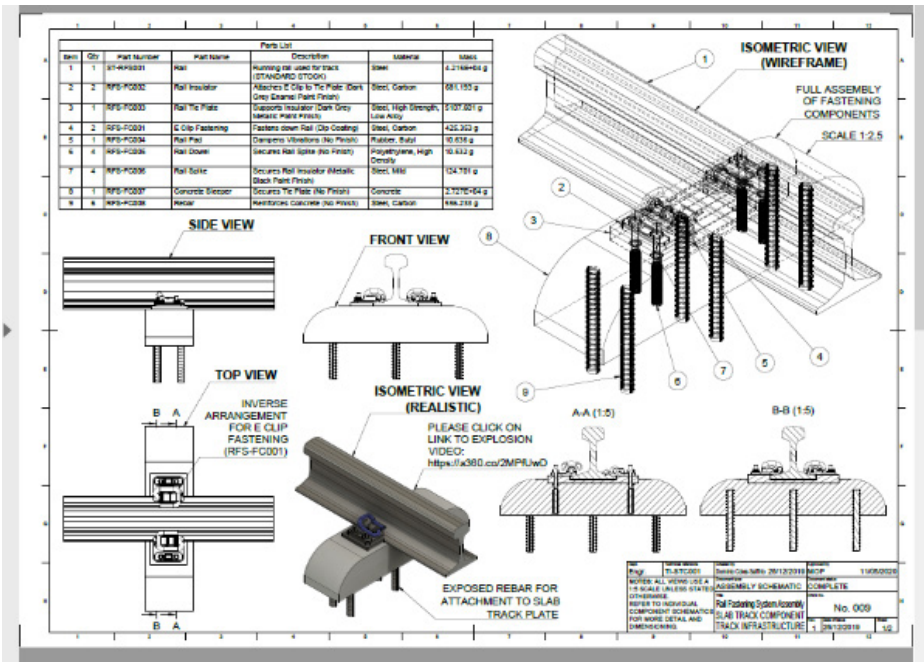
What have been the successes and failures of you project so far? **Please write up to a maximum of 500 characters**
As the rail line passes through the mountains, I needed to create tunnels and bridges, so I used Civil 3D to calculate the elevation profile and start to plan out the required earthworks and infrastructure. The cross-section of the track uses multiple shallow gradients to reduce tunnel length, as it is expensive but also creates the 'piston effect'. Currently, I am designing the tunnels, and I have designed perforated hoods at the entrance and exit of the tunnel to minimise the compression wave.

What lessons of an engineering nature have you learnt from working on this project? **Please write up to a maximum of 500 characters**
I have learnt that I need to pay attention to the smallest details that may hinder the overall efficiency of the railway line. I also taught myself how to use engineering programmes such as Fusion 360 for the fastening components, Autocad, Civil 3D and Revit for the terminus design which was a big challenge. I also researched heavily into structural engineering for the design of the rail terminus at Valparaíso, as well as researching fluid mechanics for the design of the 18km long major tunnel.

VISUAL EVIDENCE







MARKER'S COMMENTS

This project is extremely impressive and this particular application writeup is included just to show the level that some students achieve. It looks like the sort of project that consumed the applicant's every waking moment! Not only has the applicant delved into architectural engineering but also civil engineering, structural engineering, fluid mechanics and mechanical engineering, and the CAD work is outstanding. One criticism would be that the last section of this write up – lessons learnt - does not really tell us what *lessons* the applicant has learnt but more about *what* the applicant had to learn and do.

APPLICANT 1 – A DRONE

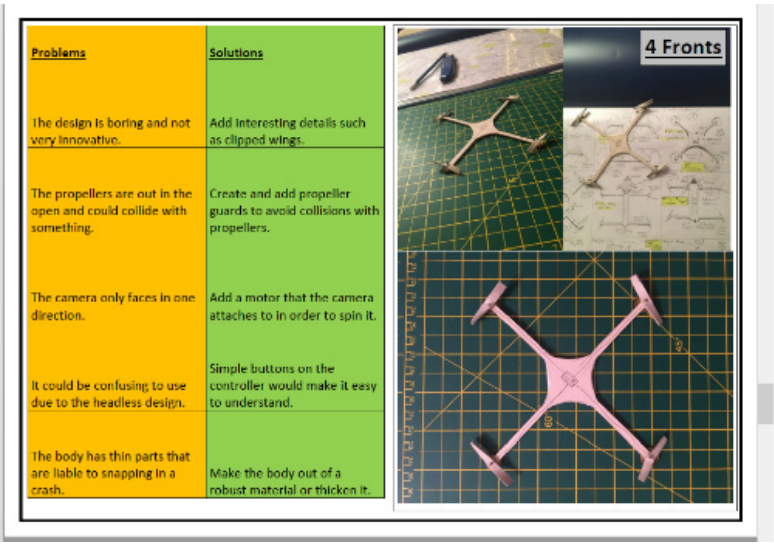
What does/did your project aim to achieve? **Please write up to a maximum of 300 characters**
Drones in the modern era are a common product, used in many different industries. In an age where the Earth's resource and environment management are becoming a crisis, I decided I would attempt to make drones more sustainable, as drones are not very sustainable at the moment. They use power from fossil fuel and nuclear plants, and are made of plastic or materials that do not decompose, so I set out to fix as many of the environmental issues with drone designing and building as I could.

Please describe and explain your project making clear and direct reference to your supporting documentation. **Please write up to a maximum of 1000 characters**
I began by having to create a list of issues with drones, so I could pinpoint the areas that would need improving later on. After locating issues, I came up with design changes I could make to drone designs that would improve their sustainability and functionality. The best idea I had was to use solar powered batteries, and materials that have less impact on the environment, like recycled plastic. These decisions were important as they created a base for the manufacturing part of the project.

What have been the successes and failures of you project so far? **Please write up to a maximum of 500 characters**
I began by having to create a list of issues with drones, so I could pinpoint the areas that would need improving later on. After locating issues, I came up with design changes I could make to drone designs that would improve their sustainability and functionality. The best idea I had was to use solar powered batteries, and materials that have less impact on the environment, like recycled plastic. These decisions were important as they created a base for the manufacturing part of the project.

What lessons of an engineering nature have you learnt from working on this project? **Please write up to a maximum of 500 characters**
I have learned how important planning and designing is to get a product manufactured correctly, and I have also learned how to use multiple types of machinery, including laser cutters, bandfacers, reciprocating saws, 3D printers and pillar drills. I have learned the importance of sustainability, and how important it is to keep our environment alive. I have learned to be more precise when drawing cutting lines on my material, as I needed to be for my prototypes to be accurately cut.

VISUAL EVIDENCE



Drone I'm using for manual research.jpg

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Engineering Scholarships

MARKER'S COMMENTS

This applicant has chosen a popular project to write about. The applicant uploaded a whole project folder and we have included a page from it. The drone in the second image (used in research) was not made by the applicant but was uploaded by the candidate. It doesn't really help us learn more about the applicant's engineering capability: we advise that all uploaded images be relevant. It is important to note at this stage that we do not assess the quality of the project but what the applicant has to say about it. In this case the idea to improve upon existing drones by using solar power seems a little ambitious and it is not clear from the information provided if the applicant managed to achieve this when the application was submitted, but they may have done so by the interview date. The 'lessons learnt' section could have been written in a slightly more expansive way and possibly included more information about drone flight and weight and how solar power may have helped. In other words, the applicant could have linked their aim more closely to the engineering lessons learnt.

APPLICANT 2 – A VEX ROBOT

What does/did your project aim to achieve? **Please write up to a maximum of 300 characters**
The goal was to build a robot to fit a range of criteria from previous and future vex competitions. For example, the robot needed to make tight turns, pick up/flip game pieces, knock off/place pieces on poles, fire balls at targets and support its own weight. The kit came with instructions for a basic design which was used as a starting point (square base, four wheels, arm and claw). All further features had to be designed, tested and implemented.

Please describe and explain your project making clear and direct reference to your supporting documentation. **Please write up to a maximum of 1000 characters**
Including a mechanism to fire balls (see image 1-3): In the original design, the arm was at the back of the robot, and brain was in the centre, blocking any further additions. The arm was moved to the centre of the robot so that there was space at the rear, but stability wasn't compromised. I designed a treadmill device with flexible paddles to collect and fire ping pong-sized balls, and I repositioned the brain and battery to act as walls to contain the ball.

What have been the successes and failures of you project so far? **Please write up to a maximum of 500 characters**
Determining options for the robot to lift itself off the ground: We considered a single lever hook above the ball firing mechanism that would latch onto a horizontal bar, but I determined that the gearing and power required to rotate and lift the robot around the pivot would be too great. I am designing a scissor lift using steel c-channels, because the movement will be directly vertical and not require rotation. We also need to add gearing to the treadmill to increase the firing range.

What lessons of an engineering nature have you learnt from working on this project? **Please write up to a maximum of 500 characters**
I have learned how to continuously test and develop designs to achieve multiple goals and make most efficient and effective use the physical structure and the electronic control systems. I have also learned how to adapt my thinking to accommodate limited resources and physical/technical restraints (i.e., gearing ratios). I have thoroughly enjoyed exploring the depth of precision and complexity of new components and technology that allow fine-tuned processes, even in a relatively simple project.

VISUAL EVIDENCE

Image 1

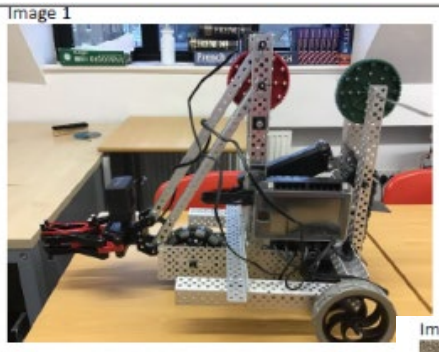


Image 3

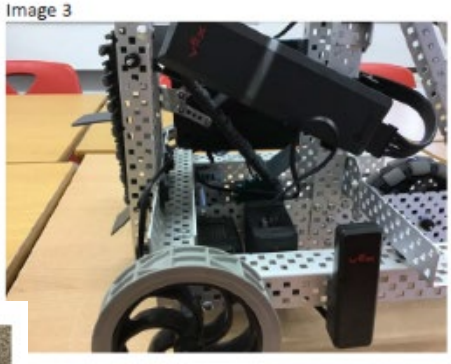
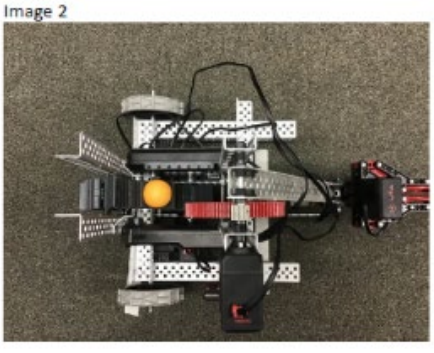


Image 2



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MARKER'S COMMENTS

Vex robots are becoming increasingly popular in schools and can be a good (group) project to write about. However, it is critical that it is made absolutely clear which aspects of the project – both design and practical - you have worked on. This candidate has written very well but it is not clear exactly which aspects of the robot the applicant was responsible for. The aim of this project, which is "…to fit a range of criteria…" is not clear. If it had been, then the last section – lessons learnt – could have been more focused and relevant.
Vex robot kits are relatively easy to construct so the emphasis of the writeup should possibly focus more on the engineering aspects of the project, such as mechanisms; motorisation; control; etc.