



Malware Inc.

School of Engineering, Computing, and Mathematics

PRCO304 Final Stage Computing Project 2019/2020

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# Statement of Word Count

# Project Links

All code written will be submitted to the final submission point. If for whatever reason it is unavailable, the software is available via my GitHub repository linked below. Included is also a link of my trello board for the project:

Trello: <https://trello.com/b/dhhDBJbr/malware-inc>

GitHub: <https://github.com/JayKay202/Malware_Inc>

# Introduction

This project is based on the popular mobile game Plague Inc which allows the player to develop their own virus and to facilitate its spread across the world, but the idea in this case is to spread malware rather than a virus. Just like in Plague Inc, the user will be able to develop their malware so that it can be spread using different formats (e.g. app stores, emails, etc.) and different devices (operating systems) that it can infect. From the originating country, other countries could potentially be infected by using email, the app store, etc, but this will not be the case for countries that have restricted internet access. This can be seen in Economy, E. (2018) that mentions that ‘China is one of the many countries with Internet restrictions that is separate to what we class as the Internet’. Therefore, in the game the malware will only be able to infect these countries by physically transporting (plains/boats) the malware. The more people in a country with infected devices, the more likely that the infection will spread electronically and/or make it onto a plane or boat into a “restricted country”. Once the device has reached the restricted country and connects to the internet, then the malware can start to spread on the restricted Internet. The user will also be able to evolve the malware so that it becomes a different type of malware, making it difficult to track and eradicate. At the start it could be adware and by the end it could have evolved into ransomware and so generate a cash windfall for the creator. The reason that ransomware is the final evolution of the malware, as in Cisco. (2016) it states that ‘ransomware is a very “effective money-maker”’. Like the game, you will have the ability to speed up time and which will advance the game quicker and so reduce the time taken to earn the money needed to buy enhancements to your malware. Once a certain number of days has passed, countries will start researching a solution to the malware and which will result in the malware being eradicated once the research reaches one hundred percent complete. If the malware spreads far enough and can infect modern operating systems, then it will start to infect devices being used to eradicate the malware and slow down their progress.

# Research

Before I decide to take on this tutor suggested project I decided to do some research to see if anyone had created a similar game using C# and also playing the game this project is based on to get some idea of the features that the game contains. There was a similar project at Codereview (2014) who is doing a similar project but using python. They started six years ago and only did work on the countries in the form of a dict class. In this post they stated they “do it stage by stage” but have not posted on the project since. This gave me a starting point for my project which I then converted to C# and then modified, as the countries need two population so one could stay fix so the game can compare the infected vs the over population and in the case of my game whether the country had restricted Internet access. However, this code gave me the start that I need to create the reset of the game that had not been done by this creator.

I reason that I replayed Plague Inc. was to refresh my knowledge of the feature of the game. Given the last time I played this game was back when it released in 2012, I had forgotten some of the feature of the game. Furthermore, since playing back then I have improved my knowledge of game logic and playing through allowed me to understand the logic of what was happening. Therefore, during my play throughs I made notes of the logic that I would need to use to make my game work in a similar way as to Plague Inc. The reason I say similar is that it is impossible to create a bit for bit copy of the code unless I had a copy of the original code for the game, therefore there are some progression differences and internal logic.

# Project outcome

The purpose of this project is to demonstrate how much we rely on technology and how one piece of malware can affect all of our lives. This should encourage people to go into cyber security roles to try and prevent these sorts of organizations from creating these pieces of malware. As this is an app there is also the potential for monetary gain in the form of pay once or with ads or with addition content that is hidden with a pay wall (freemium content). The purpose of this game is to therefore develop the users strategizing and resource management skills, while providing an enjoyable gaming experience.

Strategizing Skills: should they focus on making the malware produce more money or make the malware more infectious. This is used in business to try get completive advantage over business that are in the same sector. They do this by looking at something in the long run and not just on the immediate impact of the company. This form of thinking can be the difference between a successful business or an unsuccessful one. Therefore, by allowing people to improve their strategizing skill we will make them more likely to succeed in their business ventures or in their career.

Resource management skills: as they will have to consider what advancements to make with their malware and the impacts/benefits of each change made this will be improving how they manage their resources. These skills are vital in the workplace with project managers having to make sure they do not over allocate a certain resource and making sure that they do not go over the budget that they have been given for the project.

Although there is no given client for this project, the possibility to sell this application to an app developer is a possibility. Which will either lead to a payment or a percentage of all earnings from the sale of the game. This will only be looked at once the final product has been completed (after testing), so the client does not get shown an incomplete product that might ruin are reputation in the mobile game sector.

# Processes:

## Trello Board:

This will be where all tasks that make up the project will be displayed and will be organised into three different categories. The first category is the backlog which is where all tasks for the project start. Once a task has been started it will be moved to the in-progress category, this is so you can see how many tasks are currently being worked on. Once a task has been complete it will be categorized as complete so that it is not mistaken as being in another category. All Trello boards can be found later in this report to demonstrate the project development over the weeks.

## GitHub:

This is how we will be facilitating are change management and are backups. This will allow for me to see how my application has change from previous pushes to GitHub. Therefore, if the application stop working after a change, we can look back at what exactly was changed and take the correct items to resolve the issue. As the application will additionally be stored online, if the machine that the application is being developed on is destroyed or lost. Then the application can be downloaded onto another machine, if you remember the username and password for the GitHub account. Although it is a requirement for this module, I would have used still used GitHub for these advantages even if it was not mentioned as a requirement for the end of year project.

## Supervisor Meetings:

The supervisor meeting is done in order to cover scrum meeting, which is needed given that we are doing agile project management. During these meeting we will be covering what we have done in the prior week and what we plan to do in the coming week. This will also allow for other students and supervisor to give advice on what feature can be add to the project and possible solutions to issues that I am experiencing with the project.

# Legal, Social, Ethical and Professional Issues

## Data Protection:

As We will not be storing any of the user’s information and all the information is stored locally and will not therefor be stored on any of our servers. Meaning that we will not have to worry about data protection when it comes to this project and can spend more time on other issues. The only locally stored data is that of the statistics of the games the user has won, and this only consists of the Name, Infection Level, Income Level, in game time to complete and the difficulty level. Therefore, there is no personal about the user being stored and therefore there is no information that can be stolen if someone manages to steal their device.

## Ethical Issues:

In terms of testing for this project the idea was to get students that are part of the supervisor group I am in to test which would result in no ethical issues. But because of the current situation of coronavirus, this has led to all university facilities being shut down and all teaching being transferred to online learning. Therefore, there is no easy way to get the students to test out the game. This is why the university is in the process of allowing students to get their friends and family to take part in there testing, without having to go through the ethical application process. Therefore, I will still be able to get face to face feedback from my testers, which will allow for more open feedback then from a form. I have done an ethic application form as I was advised that I may get a quicker response then waiting for the university to make the amendment.

## Intellectual Property:

All code is written by me as the only member of the project and therefore all code/intellectual property belongs to me. If the program is sold to an organization then they are the owners of the code in question and will fold all rights. Given that this game is based on a pre-existing game there is the issue with copy right. But Plague Inc was created by Ndemic Creations and there is a similar game known as Infection Bio War created by Fun Games For Free, which has the exact same game play as Plague Inc and no legal action has been take against Fun Games For Free.

# Method of Approach

Given the requirements of this cause the project is being managed using agile methodology with a scrum framework. Using Plague Inc feature a backlog of tasks that need to be complete in sprints. GitHub was used in order to do version control, which is in line with agile sprint to provide backups and evidence of sprints undertaken. In order to keep track of the progress of the project trello was used in order to see which task had or hadn’t been completed. The development can additional be tracked using the change logs generated with each change done to the GitHub repository. This will allow for changes that might have caused an issue.

# Objective

Theses unlike the tasks in the trello board are larger goal that are to reflect the entire project and will be review to see if there were achieved and how I can improve on theses objective to help me when it comes to my next project, whether it is a business environment or another project for another education qualification.

Keeping up with all the backlog task to make sure that they are all completed by the end of the project.

Get a wide range of testers to test the game so that I can get a variety of different feedback on how the game can be improved.

Make sure that by the end of the project that there is a working prototype that can be demonstrated.

# Technologies:

This program will be done with the use of C# windows forms, this is mainly as it is the solution that I am most familiar. There are some restrictions with using this technology like the fact I will not be able to have a graphics of the world with changing colours to show the spread of the virus. But I believe that this will be the technology that will allow for the greatest chance of project success given the limited time and limited resources (manpower). This was further reinforced in an interview with Winter, C. (2020) who said, ‘do not make it to complicated and to make sure that you can achieve the goal’. This made me certain that by using C# which I am already comfortable with that I could achieve my goal. All other functionality will be achievable and the main display for the spread will be the world and countries summaries, that is included in Plague Inc. as a secondary means of checking the spread of the virus. With the readymade assets (buttons, datagrids, etc.) this will reduce the amount of time need to create the interface and therefore allow for more time to be spent working on the logic behind the interface. This will also allow for more features that are not specifically require, but will improve it function, to be more likely to be completed before the end of the project.

I have not used a database as this would require the application to be connect to the internet. As Plague Inc. is what my project is based upon, I have done testing to see what functionality it has. One such feature is that it does not require an internet connection to run. Therefore, I have stored the countries information within the code so that the user can still use the application when not connected to the internet. This is also the simplest solution as we will not have to work on connecting the program to the database and work on resetting the data when a new game is started.

In order to backup and change manage the project all files are stored on GitHub, which will allow for changes made to be pushed to the master copy on the GitHub server. There is the device with all files goes missing or damaged all of the data can be recovered by downloading it from GitHub. There is also a log of all of the changes made to the program over the time of the project. If there was an error that was not present during the last chunk of code, you can check the log to see what has changed since the last instant and use that to narrow down the cause of the error.

# Release/Compatible Operating Systems:

As of the development of the game, it can run on windows 7 and higher. When it comes to public release of the game it will be done on both iOS and android mobile devices, which is because the majority of mobile devices use these operating systems. Therefore, we will have more potential customers who are likely to download the app, compared to if it was just release on Windows. There could also later be the possibility to later produce a console edition of the game, which will be decided after seeing the success of the mobile version of the game. This is done so we are not developing a console version for the game if the mobile version is unsuccess and results in bad review from users. Therefore, resulting in console users avoiding the console version because of the reviews/ratings from the mobile version, therefore resulting in greater lost compared to only having developed the mobile version.

# Risk Assessment:

## Risk Matrix:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Description | Likelihood | Impact | Overall Risk | Level | Action (if needed) |
| 1 | Requirements for the project change. | 1 | 7 | 7 | Ignore | N/A. This is because this project is based on an application that already exist and changing it to be malware rather than a virus. Also, as I do not have a client for this project, there is no possibility of them changing their mind. |
| 2 | Holidays and sickness. | 4 | 4 | 16 | Consider | Mitigation: The impact of this can be mitigated by ensuring that we account for extra time during the development of the game. |
| 3 | Coding delays caused by inaccurate estimates. | 6 | 6 | 36 | Consider | Mitigation: We can account for this by building in a degree of flexibility in the timings. |
| 4 | Errors discovered in module testing. | 3 | 8 | 24 | Consider | Mitigation: We can mitigate this by running tests throughout the project and so ensure that small errors do not become big errors. This will also make the error easier to locate as you will know that it is something you did after the previous test. |
| 5 | Having to change technologies mid project. | 6 | 10 | 60 | Take Action | This can be mitigated by researching beforehand to ensure that the technologies will be suitable for the project and allow for the project to be completed on time. |
| 6 | Loss of data/progress | 1 | 10 | 10 | Ignore | N/A. The reason the probability of this happening is so low is that the project is additionally stored on GitHub. All changes are pushed to GitHub, so if something happens to the device being used the code can be downloaded onto another machine. |

Although it was not an expect risk, I still find that the need to mention the risk that has occurred in the form of Covid19. As an international student, this did cause me to lose a few days of work but as I was a few days ahead it was not a significant impact. The action take is more on the University side with the planning of the module. With all the face to face events (supervisor meeting, demonstration and show case) now being done digital. If this were a project in a workplace environment the action take would be that the staff would be asked to work from home and use cloud-based tools to collaborate with one another.

## Summary:

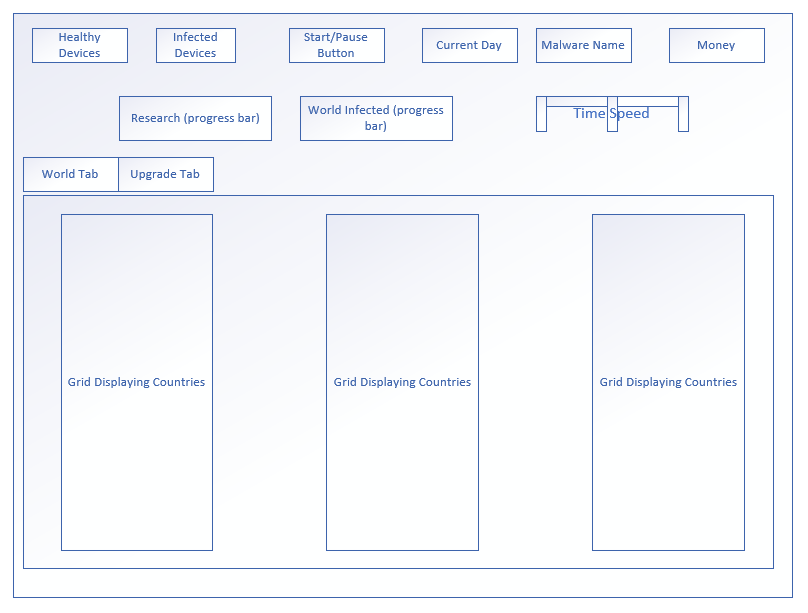
There may be risks that have been missed, but without some outside expect, these risks may not be discovered until they have taken affect. Which is why it is important to have contingencies in place to make sure that any unknown risks have a reduced impact. But the risks that we have currently identified are not major and having identified them we should not have any issues with them occurring and if they do, we will know how to deal with them using the knowledge of foresight.

# Diagrams:

## Interfaces:

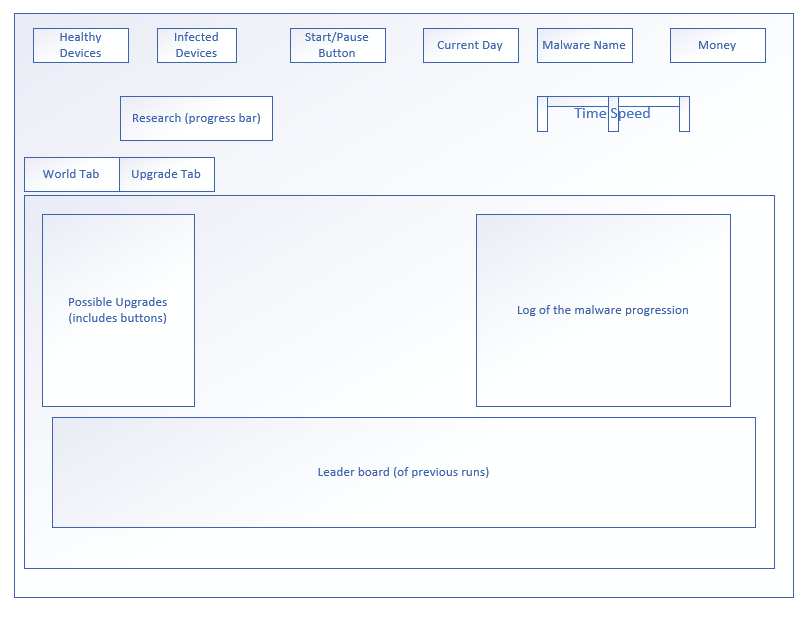
### Interface Design (World Tab):

All information that is related to the game will be displayed on the main interface. This is done so even when the user change to a different tab the information can still be seen. At all times the user will be able to see the overall healthy and infected devices, allowing them to make decisions of how to proceed given the information. The user can also pause the game at any point to allow for better strategizing. In the World Tab it contains lists of all of the countries and everyday (in game) updates the lists to show how many devices are currently not infected. Therefore, allowing the player to see how far they have until they have completed the game. The player can also see how



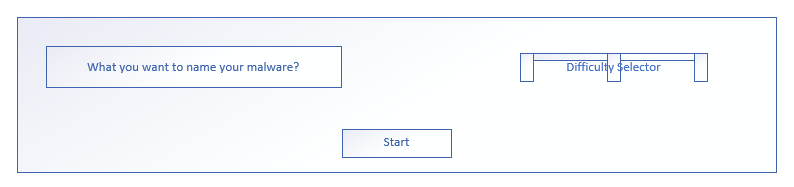
### Interface Design (Upgrade Tab):

Once the user has change to this tab the game will automatically pauses, so that the user does not have to worry about how the malware is progressing while upgrading the malware. This will also include the leader board, so the user can see how they are currently doing compare to previous runs. Once the user has selected an upgrade it will be display in the upgrade log and will include a description of how the malware upgrade, this is to educate the user of the type of malware and how it can get onto your devices.



### Start Page Design:

This page is where the user will make their decisions for the game they are playing. In order to start the game, the user needs to select their difficulty (Casual, Normal, Hard) and the name that they want to call their malware.



### Instruction/Help Design and content:



The Instruction page for will contain a short paragraph that instructs the user how to play the game and what the overall objective is. This is so the user will have the basic knowledge that will allow them to play the game, the types of strategies they will use will be learned by trial and error to allow them to make discovers that will make the game more exciting from there point of view. Below is a copy of what is included in the form:

The virus will progress without the user’s involvement, the user is responsible for upgrading the virus to make sure that it has a better chance of succeeding. This is done through the upgrades can and a variety of properties: Infection Rate, Income Rate, Possible Infectable Devices and Research Rate Difficulty.

Infection rate will determine the minimum and maximum amount of device that can be infected in a country every day.

Income rate will determine how much money is generated per infected device.

Not every device is infectable at the start, this is to represent operating system limitation on the virus. By upgrading the possible infectable devices the virus can infect more advanced operating systems.

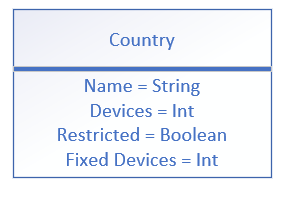
By upgrading the research rate difficulty this will make the research take a long period of time, allowing for the virus to have more time to spend.

Objective:

Infect every device in the world with your virus and aim for the shortest time possible.

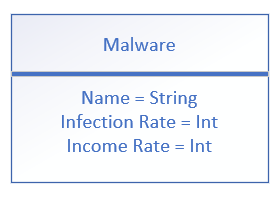
## Class Diagrams

### Country Class



At the start of the game the fixed device and the devices are the exact same values. The value of which was take from Worldometers (2020) to gather ‘accurate population for the countries’. During the game the devices will reduce as they become infected by the malware. The purpose of the fixed device is for the operating system restricts. As we need to know how many there were original for how many can be infected with the current restrictions of operating systems. The restricted variable is to determine which countries have restricted internet access and will be change to false once a certain condition has been met, at which time the country will start losing devices. The name will contain the countries name so that the name of the country can be seen in the data grid with the number of the devices.

### Malware Class



The malwares name is stored so that if a leader board is implemented, it will be a method for the user to identify which play through is what entry. The infection and income rate will increase as the user upgrades the virus. As the infection rate increases so will the number of devices infected per day and as the income rate increases so will the amount of money generated per day (this will also increases based on the number of devices that have been infected).

### ReadWrite Class:

This class is used in order to facilitate the leader board. It contains the code that will allowed for the malware of the game to be added to the text file which contains previous malwares from other run throughs of the game and when the application loads or reloads the information is read by the application and displayed on the data grid located in the upgrade section.

## Logic Design:

### Infecting Devices and Unrestricting Countries:



This logic demonstrates how the program determines where or not to infect devices in a country and if so, how many countries. If a country cannot be infected and the world percent is above a certain value, it will run code that will randomly generate a number and if it generates a certain value it will un-restrict that country and therefore allow for the devices in the country to be infected.

### Upgrade Buttons (logic for both income and infection upgrades):



This code works by running through each of the possible outcomes of pressing the button until one is either met or it has reached the last possible outcome. As the only reason the button would not do anything is if the user has not got the money necessary for the upgrade. Once the code has decided which upgrade the user is buying the level is increased and the money for that upgrade is deducted. In case the user the user presses the button once they have fully upgraded a pop up will display to tell them they have already fully upgrade.

# Task Run Down

This is a rundown of all of the tasks (backlog) that have to be done in order to ensure that the project is completed on time. All of these task are present in the [trello board](#_Trello_Boards:), the process of how the tasks where completed can be seen at the link.

## Interface:

The user will be interacting with three forms when using this app. The first is the Malware Creation form, which will allow the user to come up with a name for their virus and the difficulty of the game. The second interface is the main game menu which will have multiple tabs, so the user does not have to keep opening different forms. The first tab will be an overview of how the virus is spreading and the second tab will be a management interface to upgrade the virus. The last interface will be an instruction page which will be displayed before the users starts the game or if the user selects the help button.

## Classes:

One of the features of C# is that it allows for the coder to create their own class in order to store data, this is mainly to make the code easier to read and to also reduce the number of individual classes. This is because without classes each country would need four separate classes that would take up more line of codes, compared to having classes that only consume one line.

### Countries Class:

All countries are made up of the name of the country, how many devices are within each country, how many are health and if the country is restricted. The value of healthy devices will reduce as the virus spreads. All this information is then saved to a list and displayed in a data grid. Further information can be found in the [design](#Country_Class) section of this document.

### Malware Class:

Although there is only one malware that will be created, I still thought that creating its own class for the malware would allow for the code to be more readable and easier to understand. The malware is made of it name, which is displayed in on the interface. It will also be used later in the leader board in order to identify which virus is which. It also includes an income and infection level, which are the type integer. These will affect how many devices are infected per day and how much money the virus also produces during the day. Further information can be found in the [design](#Malware_Class) section of this document.

### ReadWrite Class:

This class will allow for the leader board to operate, it does this by reading the contents of a text document and displaying it on the DataGrid (leader board). Then when the user wins a game the data will be written to the text document and will be displayed the next time the game is loaded.

## Timers:

There are two timers that are responsible for the majority of the applications functionality. The first timer (timer1) is responsible for the processes that take place during each simulated day in the applications. This involves how many devices are infected and how much currency was generated. The number of infected devices is randomly generated using the malware infection level to determine the minimum and maximum and use that to generate a number in between the highest and lowest. The income is determined by the number of infected devices overall and then multiplying that by a different value depending on the income level of the virus. The data grids containing the countries is also updated to show the changes and so is the label displaying the user’s total money.

The second timer (timer2) is responsible for the pausing and unpausing of timer1 when the user goes to the upgrade tab or open the instructions forms. This is accomplished by checking what tab is currently selected and if the upgrade tab is currently selected or the instruction form is open then timer1 is disabled and if the world tab is selected or the instruction form is closed it reactivates timer1 allowing for the game to continue. It will not reactivate time1 if the play before switching tabs or opened the instruction form paused the game manual, in which case they will have to manually uncaused the game. This is caused by the manual pause disabling both timer1 and timer2, so timer2 cannot check what tab the user is on or if the instruction form is open. This is done on purpose, so if the user wanted to go to the instruction form and upgrade without having to worry about the time restarting if they go back to the world tab by accident.

## Win and Lose Scenario:

Theses scenario’s will only happen if either the research or the infection has reached one hundred percent, therefore meaning that the user has ever won or lost the game. In both scenario’s the user will either be congratulated for their win or condoned for their lose. If the user wins the stats for the game will be save in the leader board so the user can look back on their most successful games. Once the game has ended the interface will refresh and the user will be given the option to start a new game.

## Income and Infection rate upgrades:

Upgrading the income and the infection rate are done in the same way, by the user pressing the upgrade button for the specific thing they want to upgrade. Once the button is pressed the game will check what level the stat is currently and how much the next upgrade cost. If the user has the correct amount of currency, then that stat of the malware will increase, and the appropriate amount of currency will be deducted from the players total. As mentioned prior in classes as the stats increases so will either the currency generated per day or the number of devices infected per day.

## Difficulty Levels:

The level that the user selects will change the conditions that cause research to commence and how quickly it is completed by default. There are three different difficulty levels which are Casual, Normal and Hard. The user can select the difficulty when they start the game and enter a name for the malware. This information will also be present on the leader board, so they can see what their best score was for each level of difficulty.

### Casual:

For this difficulty level research will start as soon as days has reached 400 or the user has upgraded the malware infection level to reached 6 or income level to 5 and then generates a random number, which will be how long till research starts. Once research has started it will increase by 0.01% per day and this may change if the user upgrades the virus to make it harder to research. Each upgrade to this stat will divide the rate of research by 1.2. Therefore, making the research rate slower, giving the users malware more time to complete its goal.

### Normal:

For this difficulty level research will start as soon as either days has reached 300 or the user has upgraded the malware income or infection to level 4 and then generates a random number, which will be how long till research starts. Once research has started it will increase by 0.05% per day and this may change if the user upgrades the virus to make it harder to research. Each upgrade to this stat will divide the rate of research by 1.2. Therefore, making the research rate slower, giving the users malware more time to complete its goal.

### Hard:

For this difficulty level research will start as soon as either days has reached 50 or the user has upgraded the malware income or infection to level 3 and then generates a random number, which will be how long till research starts. Once research has started it will increase by 0.075% per day and this may change if the user upgrades the virus to make it harder to research. Each upgrade to this stat will divide the rate of research by 1.2. Therefore, making the research rate slower, giving the users malware more time to complete its goal.

## Infecting Restricted Countries:

As there are some countries in the world that have restricted internet access, in order to make the game more challenging these countries cannot be infected until a certain condition has been met. This condition is that one percent of all device in the world have been infected. Once that condition has been met each day there is a 1 in 10 chance that a restricted country will be infected by the malware. The countries that will be restricted are shown in USA Today. (2014) which provides ‘a list of the top 10 restricted countries for Internet accesses. So, there will be a total of ten counties that will have these restrictions.

## Leader board:

Once the user has won a game the data from that malware will be save and display on a leader board. This will include the name, infection level, income level, date and the difficult. This is so that the user can review their previous games and see how they can improve. This leader board will be in the upgrades tab, so that they can reflect on previous games while they are upgrading their malware for the current game. This is not a vital part of the project and will only be done if the time remaining allows for the leader board to be implemented.

## Operating System Restrictions:

Not all malware is effective against every type of device, which is why the user will have to upgrade what devices they can infected. At the start of the game the user can only infect fifteen percent of all devices and by upgrading they will be able to infect all operating systems (one hundred percent). Each upgrade will increase the percentage of devices that the user can infect, until the percentage of the devices that the malware can infect is one hundred percent. The user will have to full upgrade the operating systems they can infect, as they will not be able to accomplish the goal of the game to infect all the device in the world and therefore win the game.

# Supervisor Meeting Summaries:

The purpose of this section is to document all of the process and ideas that were generated during these meeting. This includes updates to the module and on what is expected of us to create in order to complete the module.

## Week 1:

During this meeting all participants of the meeting introduced themselves and what they are creating for their final year project. This session was more of an introduction with are supervisor and what we had to do for the start of the project (e.g. share trello and add them as a user to GitHub repository).

## Week 2:

This week involved the group sharing what we have accomplished during the following week and what we plan to do during the coming week. When it came to my plan for the coming week there were no suggestion as to do anything differently. We also discussed the layout of the report and what sort of content should be included.

## Week 3:

During this meeting it was suggested that I implement operating systems into my program, so that the virus is limited by what device it can infect until it unlocks other operating systems. This was a good suggestion so I have now added it to my trello board and will be testing to see how exactly I will go ahead with this new feature.

## Week 4:

During this meeting it was brought up about games and the need for persistent data. It was decided that if it is not necessary for you game then it is not required to have a database in place to store any data. This meant that my current work done on my project did not need to be changed so that it used a database for the malware and country classes. This therefore allowed me to spend more time on other aspects of my project and increased the likelihood that I would have time to do some of the feature that I was only going to do if I had time (e.g. leader board).

## Week 5:

This meeting we covered what we had done over the last two weeks, as meetings are now every other week. The summary of the meeting this was that the plan of work for the coming weeks was acceptable and that are supervisor would find more information about the requirements of the poster, as there is limited information about what information must be included on the poster.

## Week 6:

This week’s meeting has been cancelled due to the closure of the campus, which is a result of the coronavirus. This has led to Face to Face supervisor meeting not taking place and the implementation of virtual meeting taking place. All aspect of the showcase and the viva have been changed to allow for them to be done virtual. The showcase will now be replaced by the poster, which will now be a digital poster and will act as a gateway for business professional to explore your project. They will be able to see the GitHub repository of the project and a video walkthrough, to replace the hands-on experience at the showcase.

## Week 7:

This was the first online meeting using Zoom to discuss all of the changes that have been made to the module to accommodate for the lack of being able to do face to face activities that were previously planned. Although this was mention in an email are supervisor found it would be better to go through to make sure that we were clear about what we are now expected to deliver. Furthermore, it was mentioned that we can use a dynamic QR code in the poster to include the link for the walkthrough video. This is because the poster is due before the video, so the link for the video would not have been created until the video had been completed.

## Week 8:

During this meeting it was discussed that as there has been no news on the ethics application amendments, that I should just go ahead with the user testing. It was also discussed that the viva demonstration might just be the walkthrough or a zoom chat. The supervisor said that they will look into this to get a answer as to which one is going to be used.

## Week 9:

# Brochure and Poster Design

## Logo

The logo is a traditional danger of infection logo, but with the yellow background removed and replacing the curves of the sign with lines.

A picture containing clipart

Description automatically generated

## Video Walkthrough

The purpose of this video will be to give viewers an experience of how the game operates. This is due to the project showcase being change to a digital format, due to the campus being shut down because of the coronavirus. The video will be replacing the people trying the software at the event and will allow for the business profession and next year student to still have a look at what the final year students have created, without having to through a physical event. A link to the walkthrough will be include in the post, as this will act as the gateway to all the material that we would have shown to the guest at the showcase.

In order to create this walkthrough, I will be using screencast-o-matic screen recorder. As it will allow for use to capture the game play on the screen and do some of the editing before it is saved and published. It also allows for voice testing and screen adjustments before recording, to make sure that we don’t have to mess around with setting while recording. Screen adjustments will be used given that my application does to use the who of the screen, so the capture video can be limited to just the application without having to edit the video and potential reduce the resolution.

# Trello Boards:

The trello board is used to keep track of how the project is progressing, by seeing what tasks have been completed, in progress or have yet to be started. This means that as the end of the project grows nearer, we will be able to see how many tasks we have left and tell if we will be able to complete all the tasks or if the project will run over. As the project is part of a university module, there is no possibility of getting an extension for the project and therefore high priority tasks must be priorities and then low priority tasks will then be looked at.

## Trello Board 1:

A screenshot of a cell phone

Description automatically generated

## Trello Board 2:

A screenshot of a cell phone

Description automatically generated

## Trello Board 3:

A screenshot of a cell phone

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## Trello Board 4:

A screenshot of a cell phone

Description automatically generated

## Trello Board 5:

A screenshot of a cell phone

Description automatically generated

## Trello Board 6:

A screenshot of a cell phone

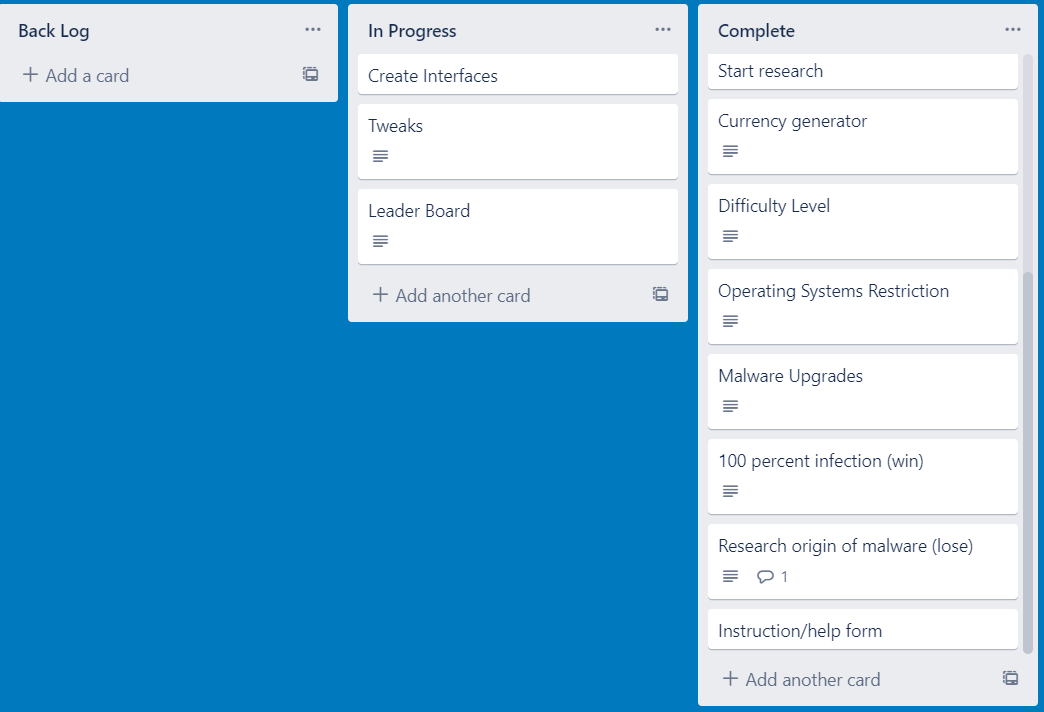
Description automatically generated

## Trello Board 7:

A screenshot of a cell phone

Description automatically generated

## Trello Board 8:



## Trello Board 9:

# Testing:

## User Testing

By getting other users to test the game we will be able to find error and get their feedback on how to improve the application. In an ideal environment where you have plenty of time you would do one round of user testing and see what needs to be improved upon. Once all of the improvements have been looked at (to see if they are necessary) and then implemented. We would when get another round of user test, this cycle will continue until either the testers cannot come up with more improvements or the project manage believes that the testing has revealed enough improvement and that any further improvements can be made once the project has been implement at users requests. Furthermore, this will also reveal potential bugs that may not have been discovered during development, this is commonly as the developer know how the game works and testers are not familiar with the game and may do something, they may cause the game to break. Therefore, the bugs that are discovered can be resolved before the project is implemented, and therefore not result in the client/customer being frustrated that we provided them with buggy software.

## Suggested Alterations:

## Summary:

Although there were a few suggestions, no bugs where discovered during the testing process. All suggestions will be considered later and will most likely be implemented after the module is complete, therefore theses suggestion will not be present in the walk thought or demonstrations.

# Project Post-Mortem:

Objectives Review:

The purpose of this section is to look at the original objectives of the project and review how we believed we did and then review what I have learned from the objective that will improve later projects.

Keeping up with all the backlog task to make sure that they are all completed by the end of the project.

In the end I managed to complete all of the task that I had in my backlog before the end of the project, but I believe that I should have left more time to review each of the task once they were complete. This can be resolved by allowing more time for later project so all of the sections can be reviewed, this could not be organised for this project given the time restraints of the course.

Get a wide range of testers to test the game so that I can get a variety of different feedback on how the game can be improved.

Given the current situation the possibility to get a wide range of testers was not possible. But the benefits to having a wide variety of testers has now become apparent to me having only had a limited tester pool for this project. I will therefore make sure that for the next project I partake in, that we manage to get a wide variety of users with different backgrounds when it comes to their knowledge of technology.

Make sure that by the end of the project that there is a working prototype that can be demonstrated.

This goal was accomplished and as stated it was to get a running protype, there are still things that will need to be added to make it a final product. All the suggestion from the user testing will have to be implemented which will be done after the prototype. This goal was to make sure that their was something that could be shown at the demonstration.

## What Went Well:

## Future Improvement:

It has always been my intention to improve on the user interface, so that it more resembles the Plague Inc interface. This would involve using the data already display and using it to determine how red that part of the world is corresponding with the number of infected devices. The reason this was not original done was because this was a proof of concept project and the interface was not as much of a priority, instead the logic behind the application was prioritized. Once this project has received interest from an app developer, then the interface will be given the mentioned improvements.

# Conclusion:

To conclude I feel like the project was successful, given the time restraints on the project because of the time scale of the module that the project was done for. It has been shown that there are some features and design that could have been improved on, shown by the user feedback. All of the objectives for the project where a success, with the exception of getting a wide variety of users to test the game. This objective failure could not have been avoided given the current circumstance, it did reinforce my opinion that getting a wide variety of user to test is vital for the project’s overall success in the long run.

In summary, the project was a success, all goals that could be achieved where and all proposed functionality was accomplished. The only change that will be made at a later date is the inclusion of a map to show the distribution of the malware.

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