# Software Design and Implementation

TrekStar Software System

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## Todo - *remove me before submission pls*

### User Guide

- Add back in image that shows keywords when adding a project when this is reimplemented.
- Change all figure values where text is CHANGEFIGUREVALUE once all images added.
- Resolve image issue on Edit Packaging once bugs have been fixed
- Look into new line for # # # # headers
- Add class diagram (and any other landscape picture pages) to the TOC on last save

## Contributions

### Callum Axon (N0727303) - Member A

- Class Diagram.
- One of the data structures - stack.
- A description of how cohesion and coupling have been considered in the class design.
- A justification and explanation of how cohesion and coupling have been considered in the design.
- An explanation of the planned architecture and the reason of the choices according to ATAM (follow step 4 and 5, i.e., identify possible architecture styles and choose one with respect to the identified utility tree, you need to explain the reason).
- An explanation of any design pattern used.

### Callum Carney (N0741707) - Member C

- A cover page (showing the full name and student ID of all members).
- A table of contents page and identifying who has contributed to which individual tasks.
- A general description of the system.
- Component diagrams.
- Deployment diagrams.
- An explanation of the internal data structures used and the reason of the choices.
- Examples (screen shots) of user interface.
- A user manual and instruction of the software. (regardless if your software is based on GUI or console interface).
- An explanation of any C++ library used.
- An explanation about the software testing process and metrics.
- Meeting minutes.

### Matthew Robinson (N0724629) - Member B

- A sequence diagram for a case/scenario of interest.
- State machine diagram for a class.
- One of the sorting studied during the lectures - merge sort.
- One of the searching algorithms studied during the lectures - binary search.
- A console interface that allows user to interact with the software system.
- An explanation of the search or sorting algorithm used and the reason of the choices. Explain how the algorithm will work in the system with detailed steps.

- Discussion and conclusion about your results (reflection on testing approach, reflection on performance such as computational efficiency, reliability, security, portability, maintainability, scalability, etc. design of system complexity using e.g. big O- notation).

All other contributions have been completed as part of a group effort.

## System Description

The Trekstar system has been developed in order to allow TrekStar Pictures to accomplish the following

- Create and Manage Projects including any relevant metadata
- Create and Manage Project Materials (single-sided DVDs, Blu-rays, etc)
- Create Projects that are “unreleased” and cannot be modified once created
- Include details in regards to the crew working on a Project

# Class Diagram

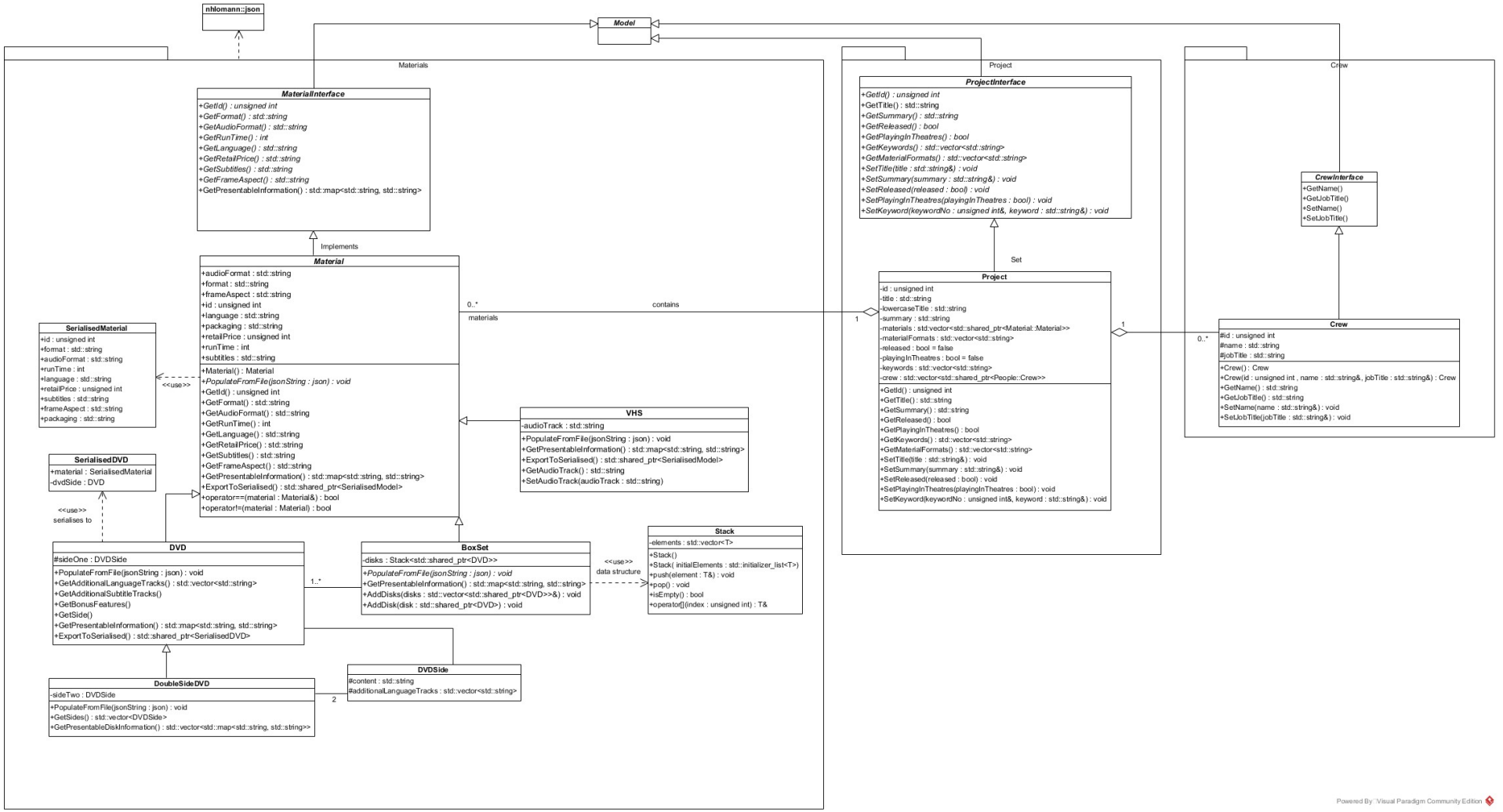


**Figure 1:** Class diagram

## Cohesion and Coupling Considerations

### Cohesion

The concept of cohesion is defined as “the degree to which all elements of a component are directed towards a single task, within a single component, or to which the responsibilities of a class are related”.

Within the design, it was important to separate out the logic for the presentation of the information from the business logic. We have achieved this using a Model - View - Controller architecture. In order for the views to gather data from the Models themselves, a large number of *so-called* getter functions are present. This is so that the models are not responsible for the presentation and **logical cohesion** does not occur. Utilising these functions also provides an example of how communicational cohesion has been considered within the design, whilst the separation of these elements has provided the situation of functional cohesion.

Another example of how **logical cohesion** has been avoided is the approach taken to importing data from files. This logic is contained within its own object and the only data which is passed into their respective objects is a *serialised* version - separating the concerns surrounding the importing of files.

Further details on cohesion, relating to specific design patterns, can be found in that section of the document.

### Coupling

Due to the relationships between different objects within the system, some coupling does occur. An example of this is that a Project has Materials associated with it - thus creating a dependency between the two objects. However, the relationships defined within the class diagram show that the two related objects don’t modify the data of eachother, but store data about eachother independently. The data between these two objects could therefore be considered to be uncoupled.

## Sequence Diagram

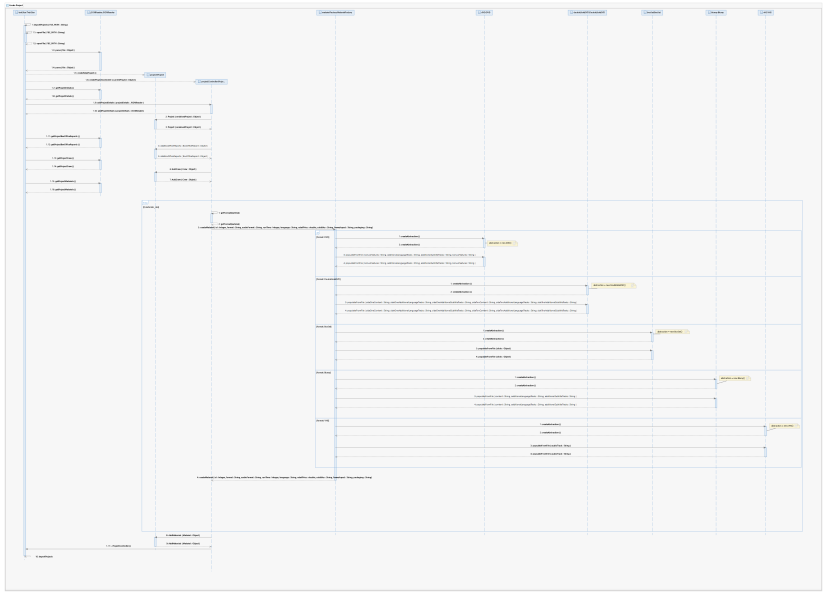

**Figure 2:** Sequence diagram

## State Diagram

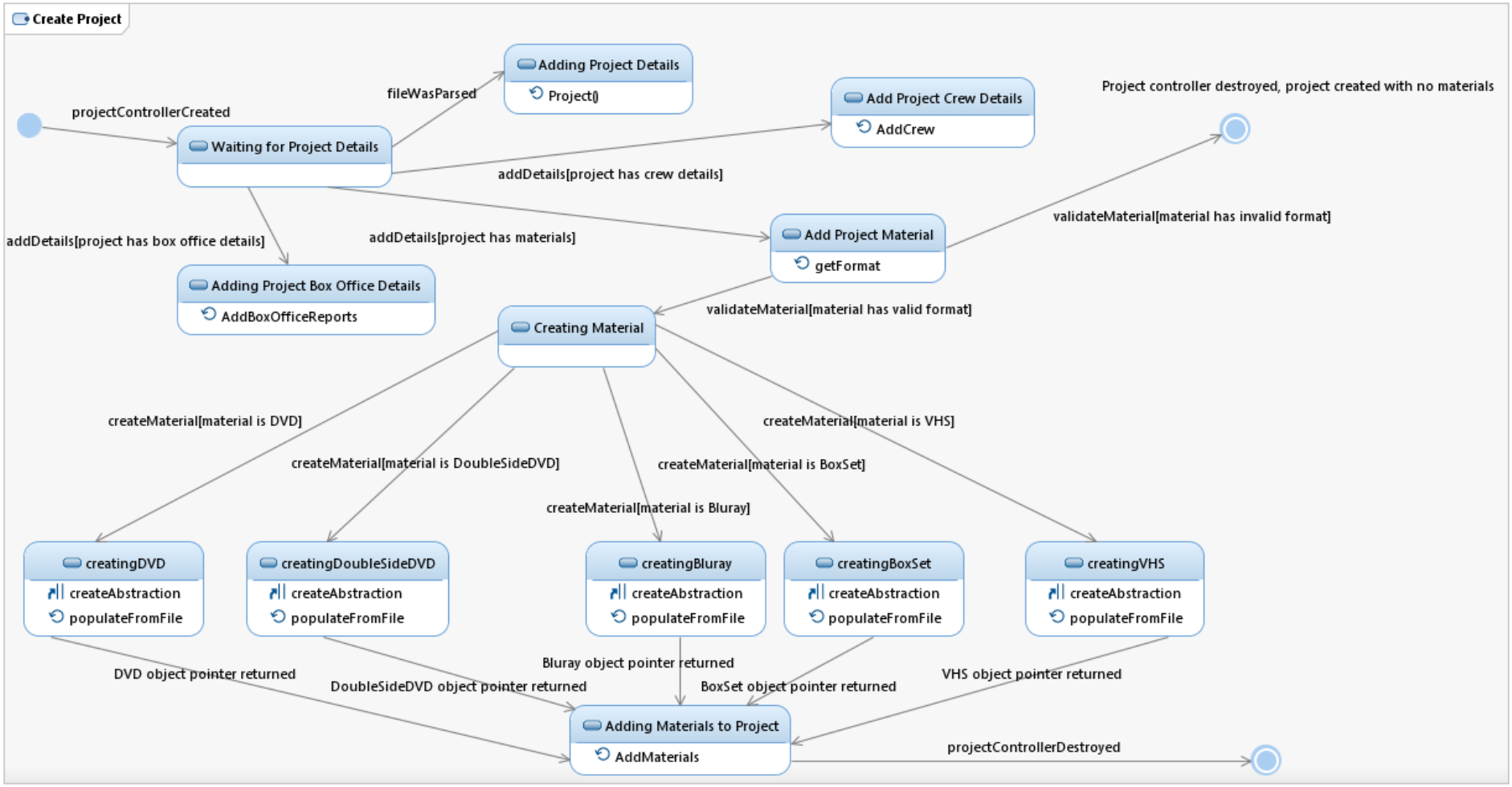


**Figure 3:** State diagram

## Component Diagram

Include component diagram here

## Deployment Diagram

There are two possible deployment scenarios for the TrekStar management system, these being:

1. An individual user will have the TrekStar project management system installed on their machine, using a locally stored JSON Database.
2. TrekStar Pictures will release the TrekStar project management system company-wide, using a shared JSON Database for each installation.

These two deployments are different due to the change in the data storage location, in which the latter will support company-wide collaboration through the application.

However, no matter where the application is installed the following Operating Systems are supported:

- Windows
- Mac OS
- Linux

On the following pages you can find a visual representation of the aforementioned Deployment scenarios.

### Individual Installation

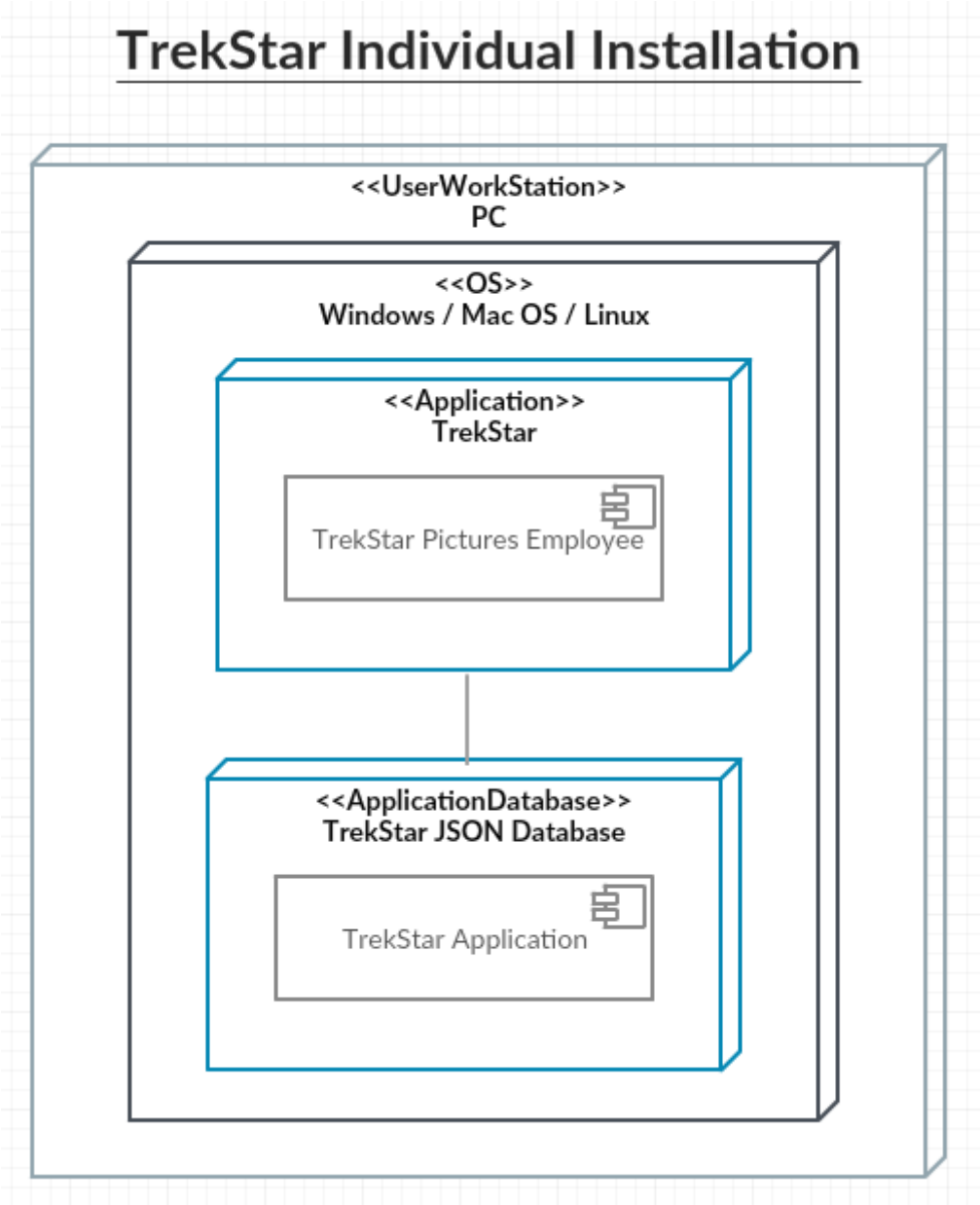


**Figure 4:** Visual Representation of Individual TrekStar installation

### Company-Wide Installation

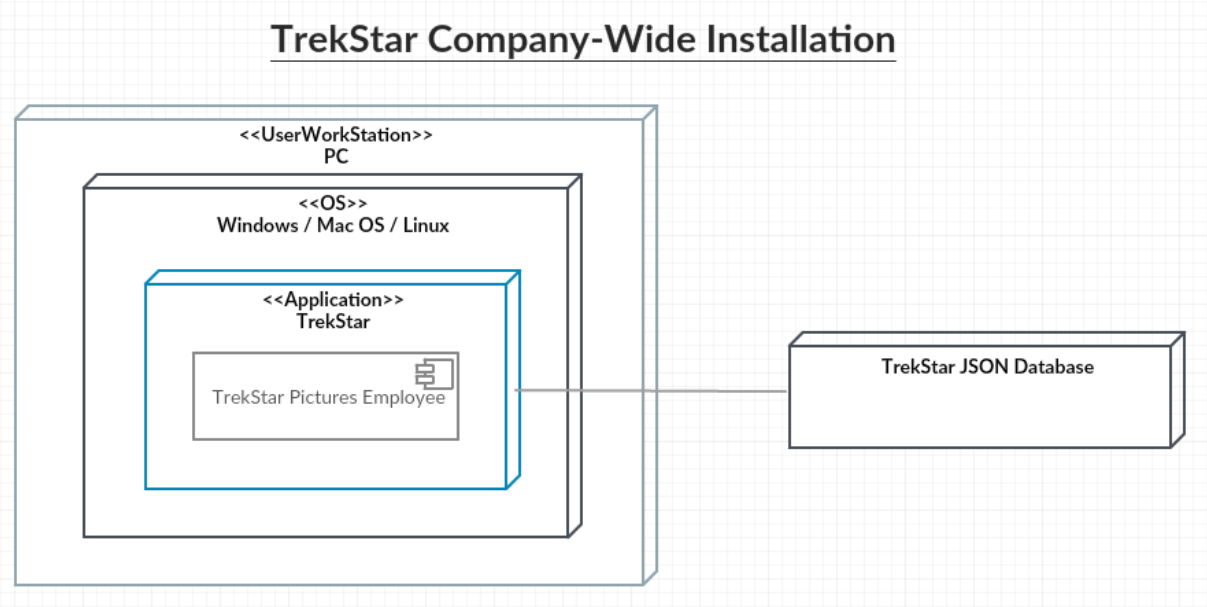


**Figure 5:** Visual Representation of Company-Wide TrekStar installation

# Design Pattern

## Factory Design Pattern

Include explanation of any design patterns used

With a large number of *materials* defined within the business rules, it was appropriate to use a **factory design pattern** to generate different material types based upon an input provided by the user. The specific implementation involved defining a return type as the base material class - allowing a covariant return type. This design pattern was possible as we have a common interface for every material. A UML representation of this pattern can be found below.

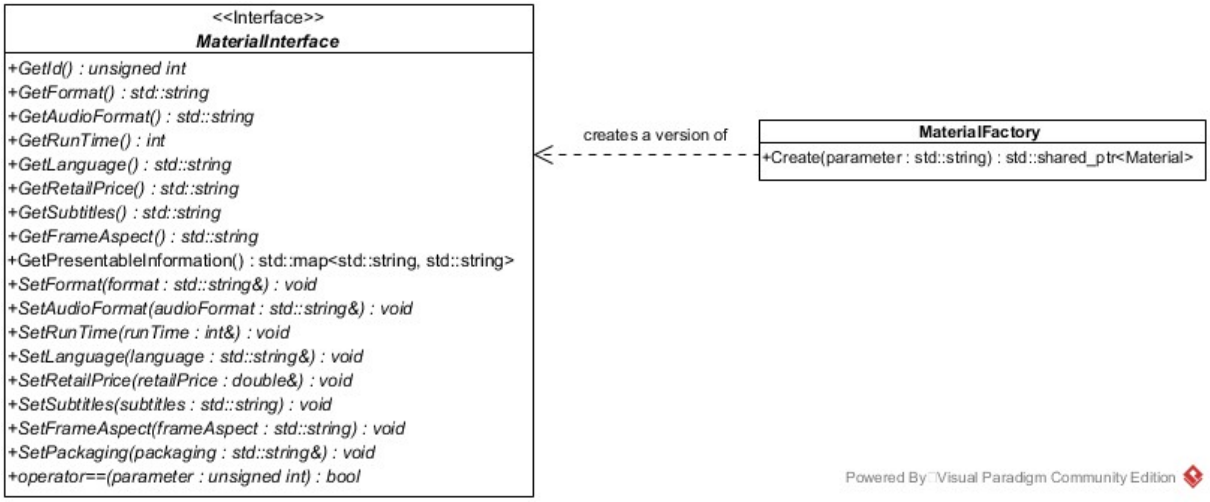


**Figure 6:** MaterialFactory UML Class Diagram

The advantages of this pattern is that new materials types can easily be added by adding a small conditional statement in this class. This provides a level of abstraction and means that this class has only a single responsibility - to construct materials - removing this logic from the consuming object. This helps with the issue of coupling as functional cohesion is achieved. Because of the abstraction, it wouldn't mean any changes would necesarily have to occur in the consuming class.

## Singleton

Through the logging library spdlog, a singleton pattern was used in order to ensure a single logging instance is present within the application. This involved creating this instance as soon as the application was launched, and then accessed (using the library) within the areas of the application logging is used e.g. in the application.

A common issue with this pattern is the issue of multithreading, particularly with respect to file handling. There could be multiple components within the application

# Planned Architecture

## Architecture Presentation

Architecture tradeoff analysis method (ATAM) was used to decide on an arcitecture which was to be followed for the development of the Trekstar Project Management System.

### Model-View-Controller

MVC is driven by interaction. The use of Views to prompt their respective controllers to modify the model and subsequently update the view in real time fits the requirements of the Trekstar system. Models act as the data store for all of the related objects within the system. Controllers manipulate the data in the models through an exposed interface on the model objects

## Utility Tree

The management of projects requires fast, realtime interaction (Top 6 Most Important Benefits of MVC Architecture, 2017). The requirements gathered from Trekstar meant that some of the data needs to be presented in a different manner (e.g. displaying the contents of a double sided DVD). Due the benefit of MVC being able to present data in multiple formats, this made it an ideal choice. One of the stretch goals of the project was to provide the user with a Graphical User Interface (GUI). By using MVC, it will be easier to produce views for a GUI rather than a console based interface as only one component of the system (the views) will need to be changed out.

As previously mentioned in other sections, separating the logic for presenting and performing the business model provides benefits with regards to de-coupling and setting clear boundaries within the system. Given that the components of the MVC architecture are independent of eachother, they can be developed in isolation. Within the context of the project, where individual members are responsible for different sections of the project - e.g. one for data structures & one for the user interface - the development of these components could happen in tandem.

## Included C++ Libraries

Within the TrekStar project management application we have used some C++ Libraries for parsing data, providing access to unit tests and including core functionality that would otherwise not be present. Below you can find an explanation of the included C++ libraries and why we chose to use them:

### JSON for C++ (GitHub Link)

It was decided to use the JSON for C++ library within the application because we are using JSON as our database to store all of the users data. The JSON for C++ library allows us to parse JSON data, request data based on certain keys within a JSON Array or Object and create new JSON Arrays or Objects to be inserted into the database. The JSON for C++ library is quite easily the most feature complete and well documented library for parsing and creating JSON in C++, this was the main driving force behind using this library as we required something that is reliable and suitable for the applications use cases.

### GTest (GitHub Link)

It was decided to use GTest as our primary unit testing library within the application, whilst we could have used Boost for unit testing, we decided that GTest had the following advantages which solidified our decision to use GTest:

- GTest is much more lightweight when compared to Boost, while GTest is specifically a testing library, Boost has more functionality that also needs to be imported to allow for the Unit Testing section of the library to function, consequently making it larger and less lightweight.
- When compared to other Unit Testing libraries there are more features that we can make use of in the project within GTest, for example, we can use GTests ability to mock objects, this is useful when we need to test the interaction between objects as we can achieve this more efficiently when compared to other libraries. We can also avoid duplication of test setup (creating objects, etc) within each unit test by specifying test fixtures which can be referenced within the unit tests.

### spdlog (GitHub Link)

It was decided to use spdlog for our logger library, when compared to other libraries spdlog is lightweight, fast and only requires header imports to get started. spdlog also supports all of the operating systems that our application has been developed to work on, which is an important feature to have.

spdlog also allows us to easily generate the required daily reports based on the data we pass from the JSON database, the simplicity of this library was an important consideration as it allows future developers to quickly understand how this function works incase a new feature or bug needs to be added/fixed.

## Internal Data Structures

During the design phase of the TrekStar project management application it was decided that an internal data structure of Stack would be used. While there are pros and cons to each data structure, ultimately it was decided that the Stack data structure fit the best with the requirements of our application, you can find the in-depth reasoning behind the decision to use Stack below:

- The Stack data structure allows for the sequential ordering of disks, and make sense within our use cases. For example, if you have a box set of 4 disks and you would like to add a new disk, its likely that the new disk will be the latest episode, therefore it will be inserted sequentially at the end of the list. Another example would be when a user would like to remove a disk from a boxset, it is unlikely that you will want to remove the 3rd episode within the boxset, however if the 3rd episode was to be removed then the 4th episode (the last one in the underlying vector) can be removed allowing for the 3rd episode to then be removed, therefore the Stack data structure is still appropriate.
- Another advantage to the Stack data structure is that data can be accessed quicker sequentially, this is because you can iterate though the underlying vectors data finding items that a requested.
- A final advantage to the Stack data structure is that it uses general programming through the use of templating, as a consequence to this, the Stack data structure supports multiple types.

# Search/Sorting Algorithm

## Merge Sort

### Explaination

The merge sort algorithm was used to sort a list of projects based on their title.

Merge sort is a divide and conquer sorting algorithm where the list recursively partitioned in to halves, until each sublist is of length one, and therefore sorted by definition as the single project is the smallest and the largest in that sublist. The sublists are then sorted and merged into larger sublists until they are recombined into a single sorted list.

The list of projects is split into two halves. Each half then goes through a similar process whereby the halves are repeatedly split until they are of length one, which is, by definition, a sorted list.

The sublists in each half are then merged together by following this process until all projects are in the merged list: * compare the first project in the left half with the first project in the right half; * if the project in the left half is less than the project in the right half, add the project from the left half to the merged list and read the next project from the left half; * if the project in the right half is less than the project in the left half, add the project from the right half to the merged list and read the next project from the right half; and * once either list is empty, any remaining projects are added to the merged list.

The two halves are then merged together by following the same process above until all projects are in the merged list. As merge sort is an “in-place” sorting algorithm and the list of project was passed by reference, there is no return value. The list of projects is now sorted and can be used as such from where the merge sort function was originally called.

### Justification

The implementation of a merge sort algorithm was determined to be necessary in order to benefit from the higher efficiency of sorting using the binary search algorithm, as described below. The merge sort algorithm was used as when compared to other alternatives, such as quick sort, merge sort is more efficient on larger datasets. While the testing was completed with small numbers of projects, it is likely that, if this software was to be used in the real world, there may be hundreds of thousands of projects sorted in the projects list.

Further discussion of the time complexity of merge sort can be found in [INSERT SECTION LINK HERE].

## Binary Search

### Explaination

Binary search algorithm was used to find a project based on its title. The merge sort algorithm described above is performed before, as the binary search has a prerequisite that the list of projects be sorted.

An overload equals operator was created on the *Project* class; this was used to check if the search criteria of a project title was equal to the title attribute in the project when checking if the item at *mid* was the desired project.

The binary search algorithm requires the following variables: * an integer variable *result* set to -1; * an integer variable *low* set to 0; * an integer variable *high* set to the index of the last project in the list; and * an integer variable *mid*.

While the integer variable *result* is equal to -1 no project has been found that matches the search criteria, and the following steps should be taken repeatedly until a project is found or it has been determined that the project does not exist in the list: * calculate a midpoint by using the equation *mid = low + ((high - low) / 2)*; * if the project at the midpoint is equal to the search criteria, *result* can be set to this project; * if the project at the midpoint is less than the search criteria, set the *low* to *mid + 1*; and * if the project at the midpoint is greater than the search criteria, set the *high* to *mid – 1*.

After these stages have been completed, the value of *result* can be returned. The subsequent code can then display that the project was not found if *-1* is returned. Otherwise, the *result* can be used as an index value to access the project in the list and display its detail to the user.

### Justification

A movie company, such as TrekStar, may have a large number of projects. It is important that searching these projects is efficient; the binary search algorithm avoids checking every project in the list. This is because comparisons are made to determine which half of the list the target project resides within. As a result, on each iteration, half of the project list is discarded.

Further discussion of the time complexity of binary search can be found in [INSERT SECTION LINK HERE].

## UI Screenshots

Include screenshots of console app here.

## Software Testing Procedure

Software Testing is an important part of the SDLC and within our project we have multiple constraints in place to ensure that tested, bug-free code is committed to the GitHub repository. Committing working code to the repository is important for a number of reasons, with some of these being:

- Developers will never pull broken code that will lead to a slow down in development.
- Developers will never have to fix someone elses broken code, avoiding time wasted on parts of the application that is not allocated to that developers.
- In case of a rollback, the repository will always be in a good state, which helps to avoid further rollbacks.

Some of the constraints that we have in place are:

- Developers will only commit code that has the associated unit tests created and those unit tests must pass.
- Developers must never commit broken code that could impede the efficiency of other developers, if a commit is required a new branch should be created.
- If there are known bugs, developers must log these within the GitHub Issues to ensure that other developers know that it is know/being worked on incase they come across it.

Our group is confident that these constraints will allow us to develop the application with fewer interruptions and ensure that only high quality, tested code is being pushed to the repository.

# User Manual

## Software Introduction

The Trekstar project management application has been developed for TrekStar Pictures and allows them to create and manage Projects along with their associated product materials and metadata. This guide will cover how to use the core features of the application, which includes:

- Using the main menu
- Using view mode
- Using maintenance mode

## Using the Main Menu

To use the Main Menu, open the application and you will be presented with the following screen

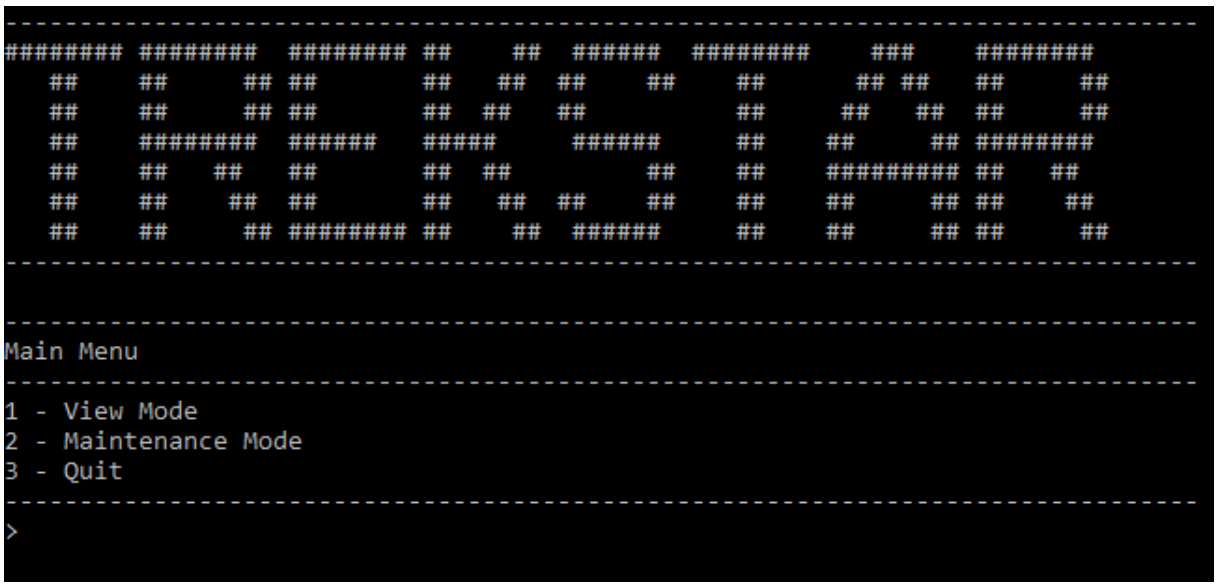


**Figure 7:** Visual representation of the Main Menu

Once on this screen, you can use the following keyboard inputs to navigate around the application, to find out more about each feature, click the associated information link.

| Input Value | Command Action | Information Link |
|---|---|---|
| 1 | Inputting this value will cause the application to enter View Mode | Using View Mode |
| 2 | Inputting this value will cause the application to enter Maintenance Mode | Using Maintenance Mode |
| 3 | Inputting this value will cause the application to safely exit | Not required |

### Using View Mode

Once you have reached the View Mode page you will be presented with the following screen

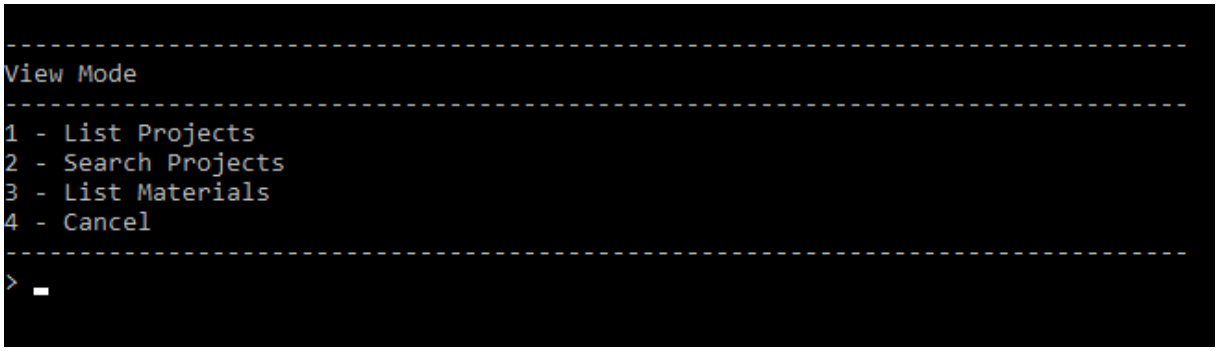


**Figure 8:** Visual representation of View Mode

Once on this screen, you can use the following keyboard inputs to navigate around view mode, to find out more about each feature, click the associated information link.

| Input Value | Command Action | Information Link |
|---|---|---|
| 1 | Inputting this value will cause the application to list projects | Listing Projects |
| 2 | Inputting this value will cause the application to enter search mode for projects | Using Search Projects |
| 3 | Inputting this value will cause the application to navigate back to the main menu | Main Menu |

### Using List Projects

Once you have entered the List Projects functionality you will be asked if you wish to sort all of the projects by their title, you can enter *y* to confirm that you wish for the projects to be order by their titles and *n* to decline.

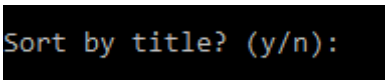


**Figure 9:** Visual representation of the application asking if you wish to sort by title

You will now see the projects that are held within your applications database, you can see an example of this below.

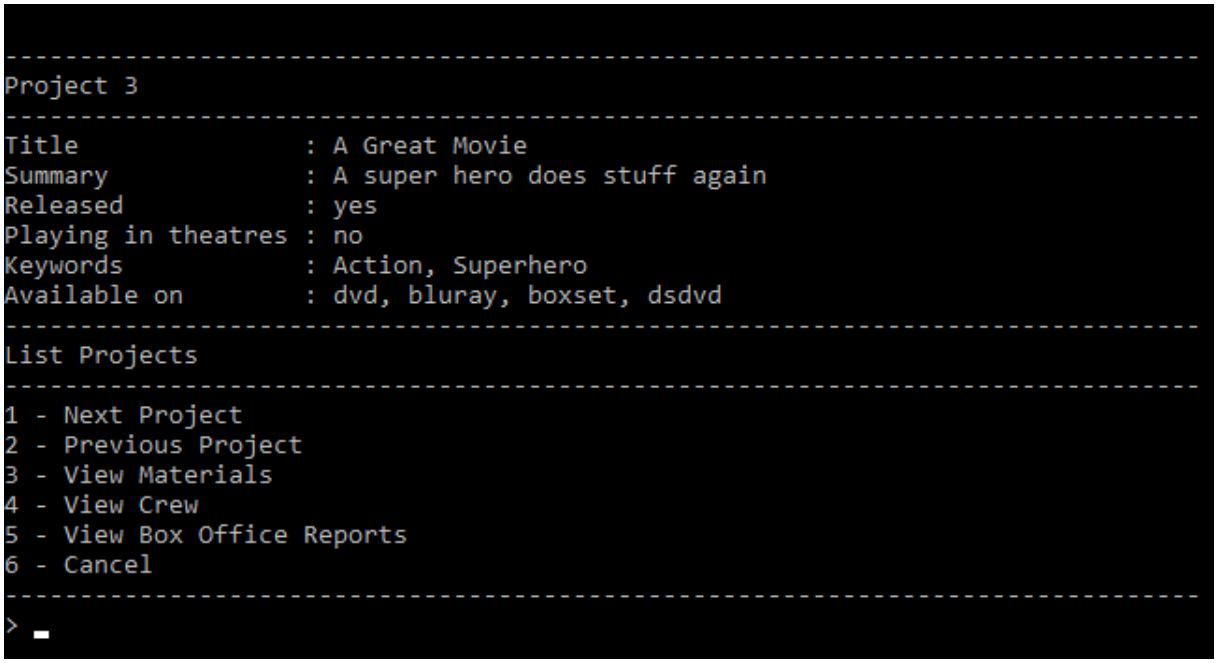


**Figure 10:** Visual representation of project listings

As you can see in Figure CHANGEFIGUREVALUE, there are more options available to you, these options allow you to navigate through the projects. You can see the associated input actions below.

| Input Value | Command Action | Information Link |
|---|---|---|
| 1 | This will cause the application to move onto the next project in the database | Not Required |

| Input Value | Command Action | Information Link |
|---|---|---|
| 2 | This will cause the application to move onto the previous project in the database | Not Required |
| 3 | This will cause the application to enter the view materials functionality | View Materials |
| 4 | This will cause the application to enter the view crew functionality | View Crew |
| 5 | This will cause the application to enter the view box office reports functionality | View Box Office Reports |
| 6 | This will cause the application to navigate back to view mode | View Mode |

### Using View Materials

Once you have reached the View Materials page you will be presented with the following screen

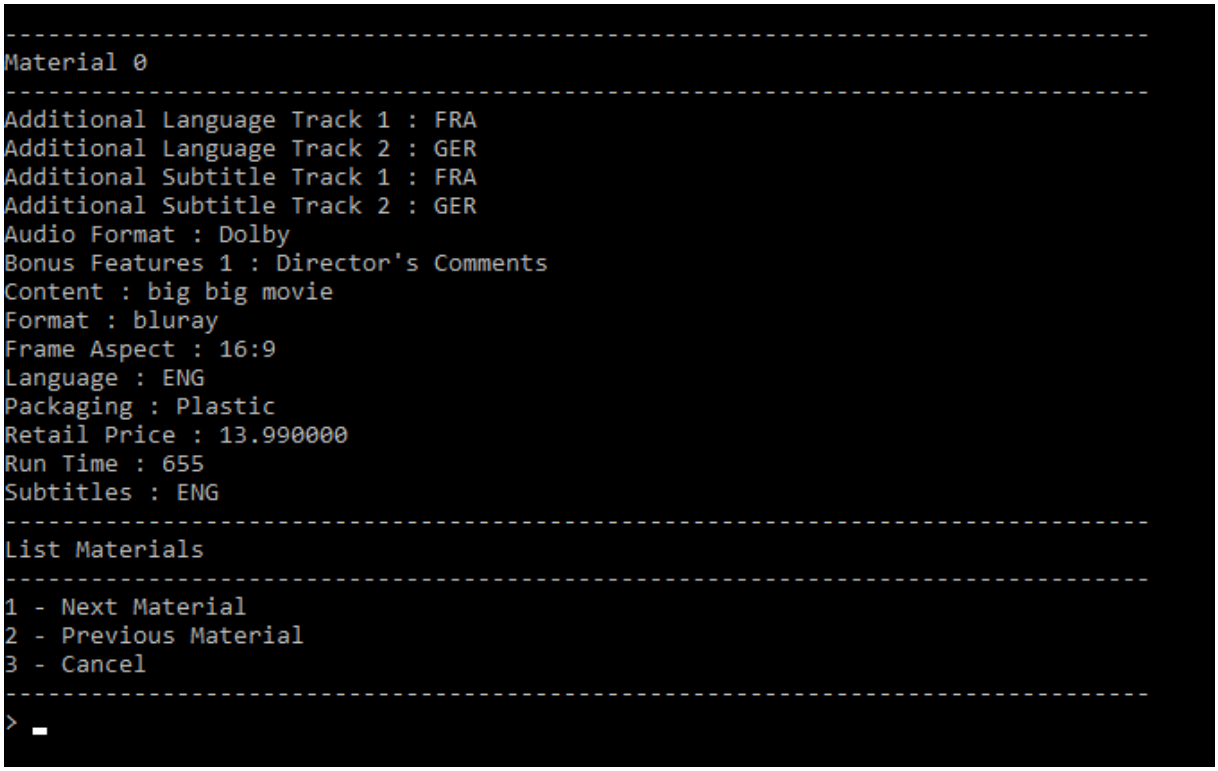


**Figure 11:** Visual representation of View Materials

Once on this screen, you can use the following keyboard inputs to navigate around view materials, to find out more about each feature, click the associated information link.

| Input Value | Command Action |
|---|---|
| 1 | This will cause the application to move onto the next material in the database |
| 2 | This will cause the application to move onto the previous material in the database |
| 3 | This will cause the application to navigate back to List Projects |

**Using View Crew**

Once you have reached the View Crew page you will be presented with the following screen

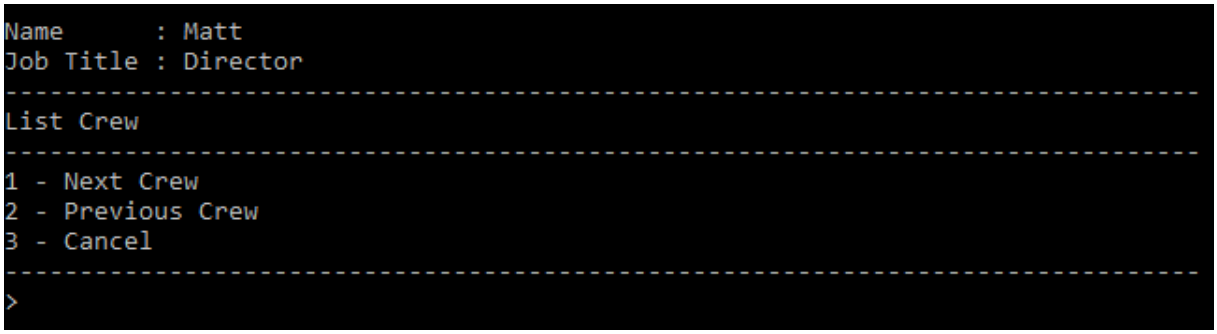


**Figure 12:** Visual representation of View Crew

Once on this screen, you can use the following keyboard inputs to navigate around view crew, to find out more about each feature, click the associated information link.

| Input Value | Command Action |
|---|---|
| 1 | This will cause the application to move onto the next crew member in the database |
| 2 | This will cause the application to move onto the previous member in the database |
| 3 | This will cause the application to navigate back to List Projects |

### Using View Box Office Reports

Once you have reached the View Box Office Reports page you will be presented with the following screen

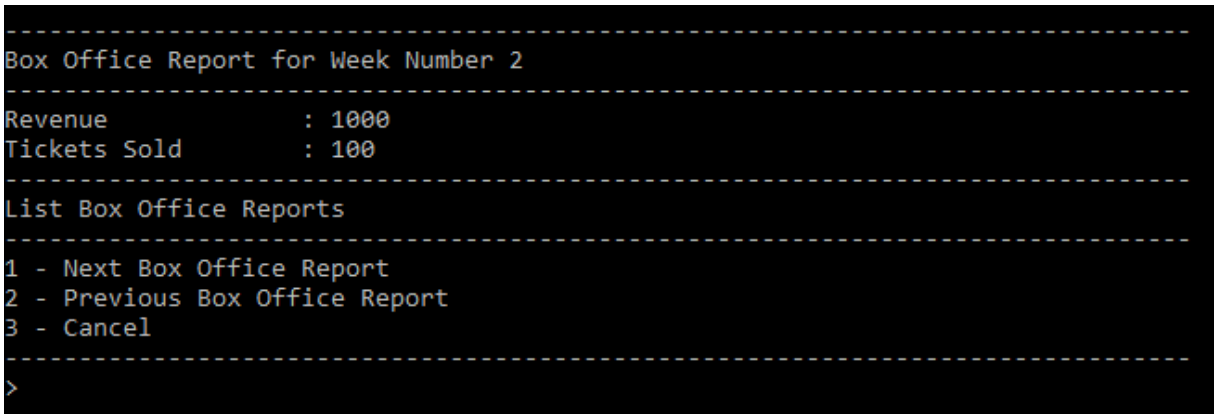


**Figure 13:** Visual representation of View Box Office Reports

Once on this screen, you can use the following keyboard inputs to navigate around view box office reports, to find out more about each feature, click the associated information link.

| Input Value | Command Action |
|---|---|
| 1 | This will cause the application to move onto the next box office report in the database |
| 2 | This will cause the application to move onto the previous box office report in the database |
| 3 | This will cause the application to navigate back to List Projects |

**Using Search Projects**

Once you have entered the Search Projects functionality you will be asked to select what search type you would like to use, the following options will be provided:

| Input Value | Command Action | Information Link |
|---|---|---|
| 1 | This will cause the application to enter the search by title functionality | Search By Title |
| 2 | This will cause the application to enter the search by actor functionality | View Crew |
| 3 | This will cause the application to navigate back to view mode | View Mode |

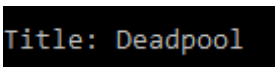


**Figure 14:** Visual representation of the application asking for a search query

**Using Search By Title** You will now see the associated projects that matched to your search query, you can see an example of this below.

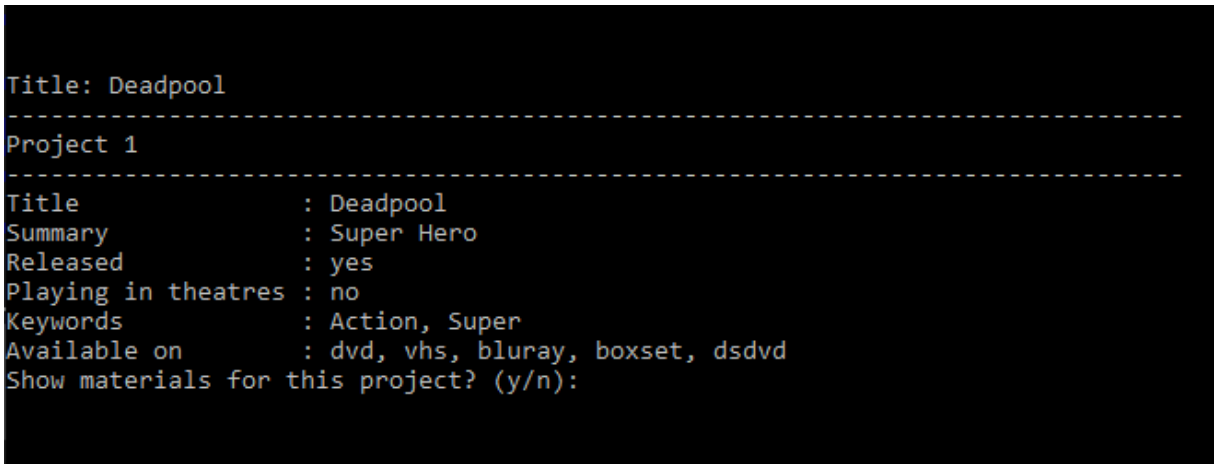


**Figure 15:** Visual representation of a project being discovered from a search query

As you can see in Figure CHANGEFIGUREVALUE, there is the option to display the associated materials for this project, you can enter *y* to confirm that you wish to view the materials for the associated project, which will bring up the following information:

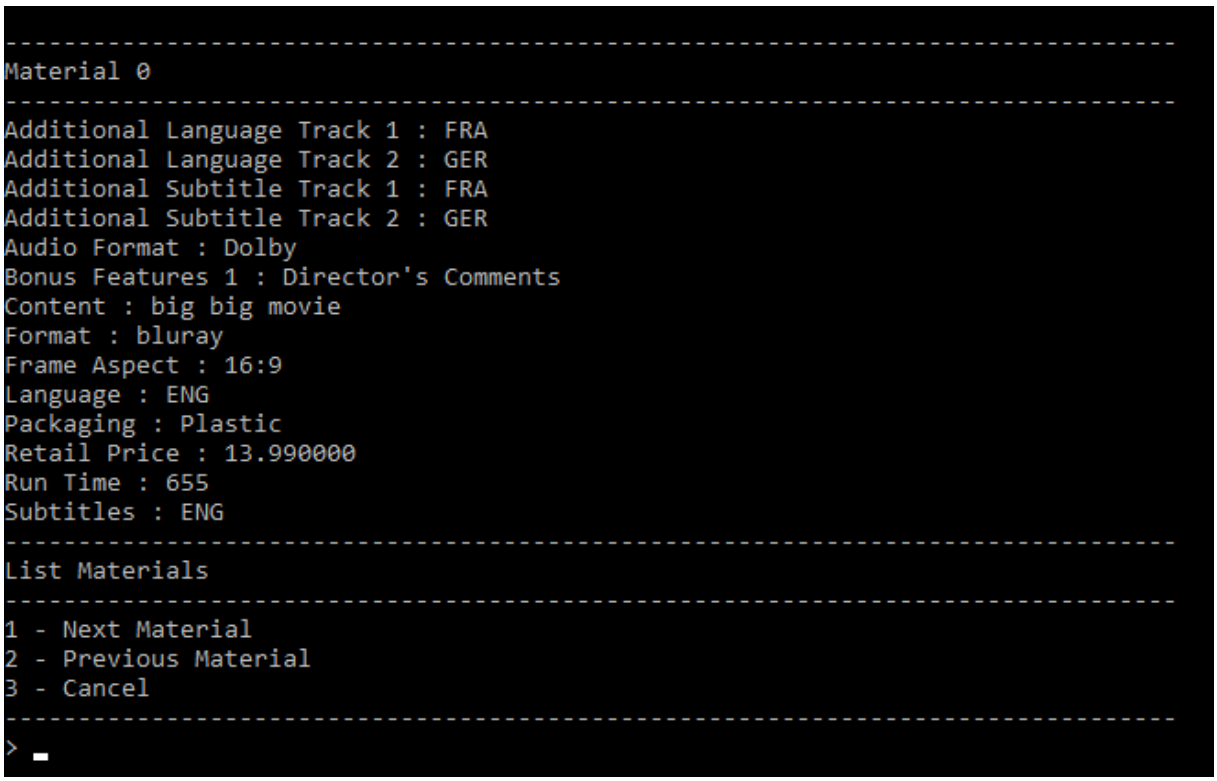


**Figure 16:** Visual representation of a projects materials being displayed

As you can see in CHANGEFIGUREVALUE, there are more options available, you can find what each command does below

You can also enter *n* to confirm that you do not want to view the materials for the associated project, which will bring up the following information:

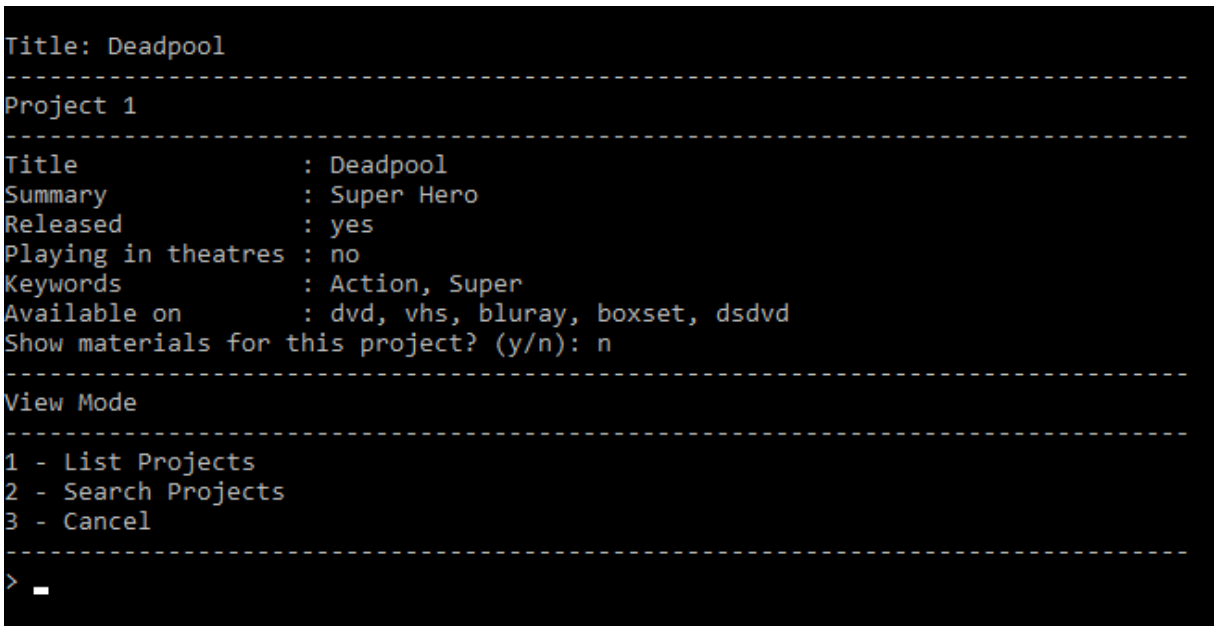


**Figure 17:** Visual representation of a projects materials not being displayed

As you can see in CHANGEFIGUREVALUE, there are more options available to you, these are the options associated with View Mode, therefore you can find more information by reading the View Mode section of this user guide.

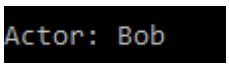


**Figure 18:** Visual representation of the application asking for a search query

**Using Search By Actor** You will now see the associated projects that matched to your search query, you can see an example of this below.

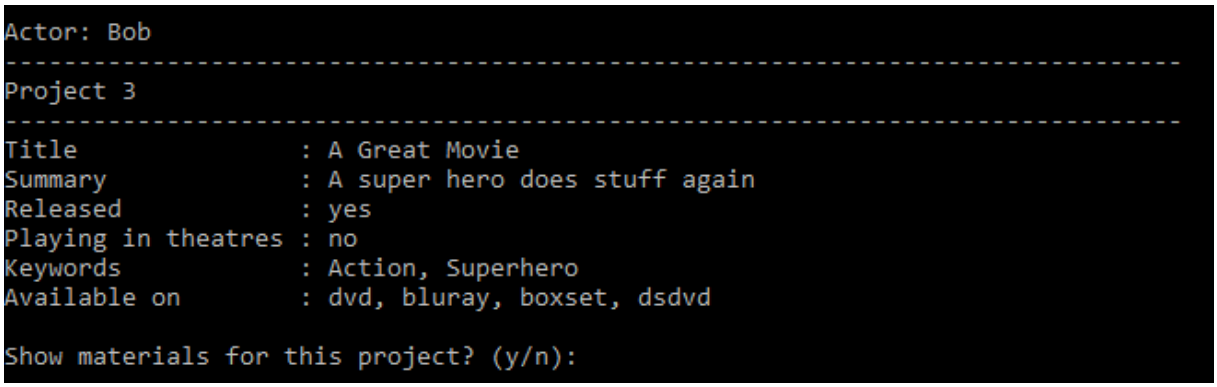


**Figure 19:** Visual representation of a project being discovered from a search query

As you can see in Figure CHANGEFIGUREVALUE, there is the option to display the associated materials for this project, you can enter *y* to confirm that you wish to view the materials for the associated project, which will bring up the following information:

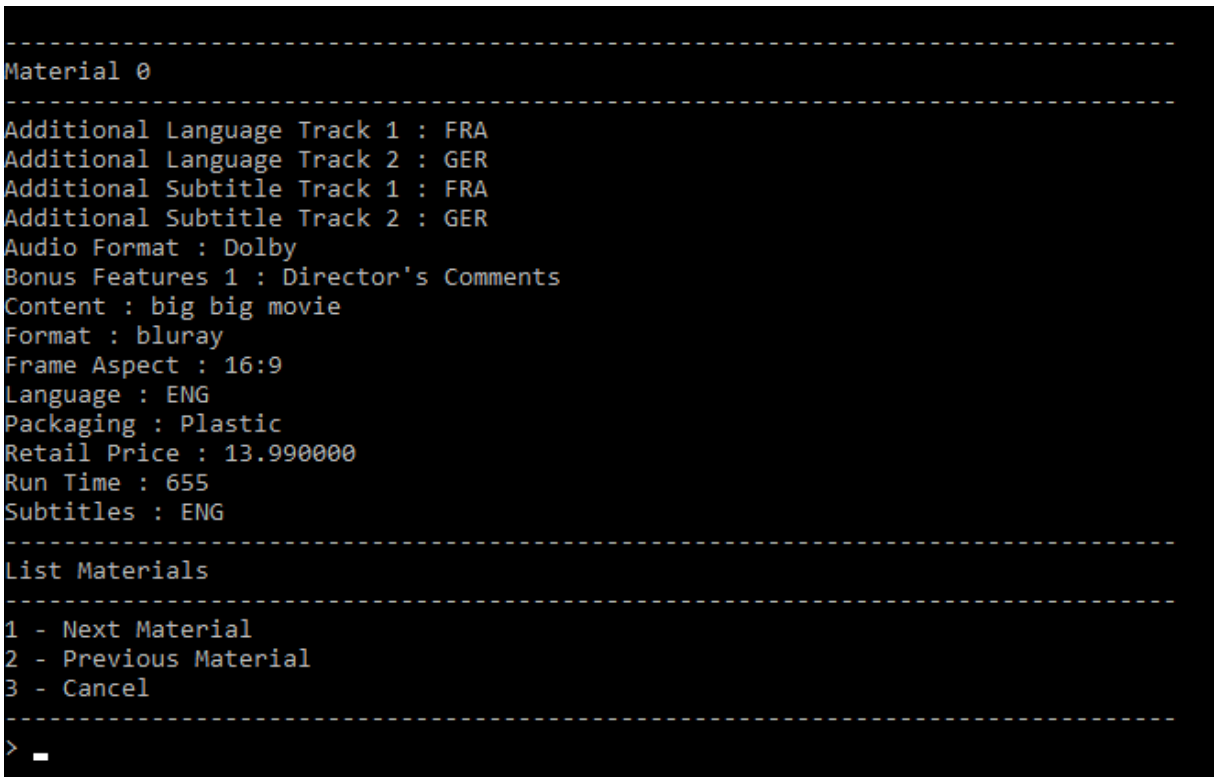


**Figure 20:** Visual representation of a projects materials being displayed

As you can see in CHANGEFIGUREVALUE, there are more options available, you can find what each command does below

| Input Value | Command Action |
|---|---|
| 1 | This will cause the application to move onto the next material in the database |
| 2 | This will cause the application to move onto the previous material in the database |
| 3 | This will cause the application to navigate back to View Mode |

You can also enter *n* to confirm that you do not want to view the materials for the associated project, which will bring up the following information:

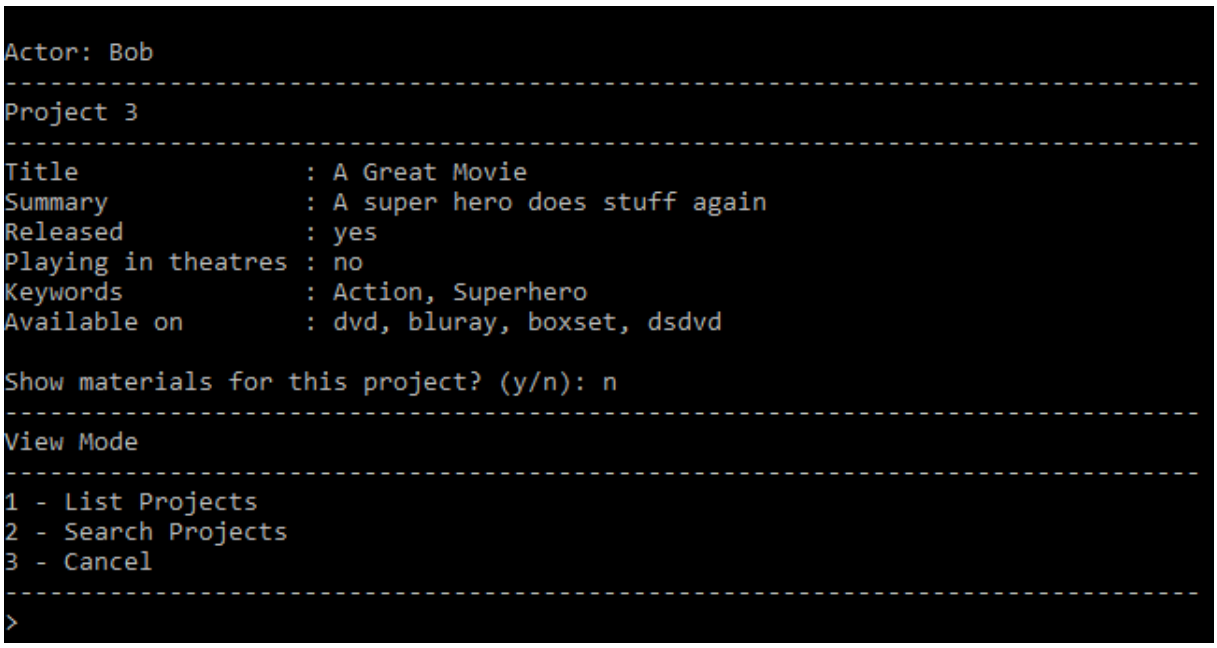


**Figure 21:** Visual representation of a projects materials not being displayed

As you can see in CHANGEFIGUREVALUE, there are more options available to you, these are the options associated with View Mode, therefore you can find more information by reading the View Mode section of this user guide.

### Using List Materials

Once you have entered the List Materials functionality you will be asked to input a Project ID, this must be a numeric value, you can find the accepted Project IDs above the input location, select an ID from this list.

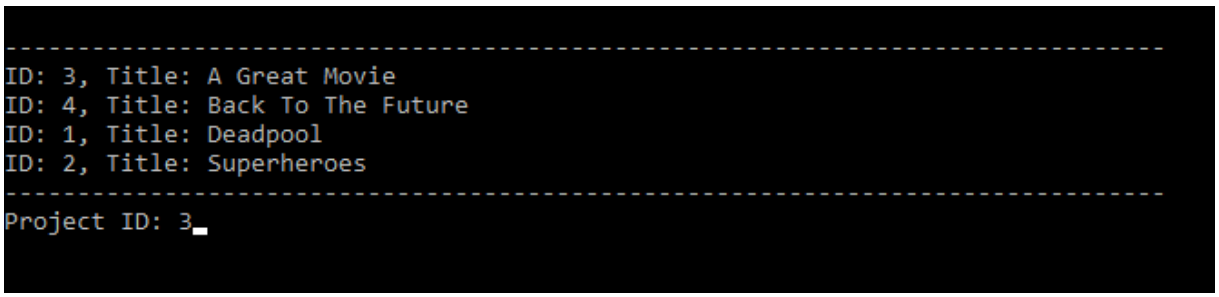


**Figure 22:** Visual representation of selecting a Project ID to list materials for

You will now see the materials linked to the requested project that are held within your applications database, you can see an example of this below.

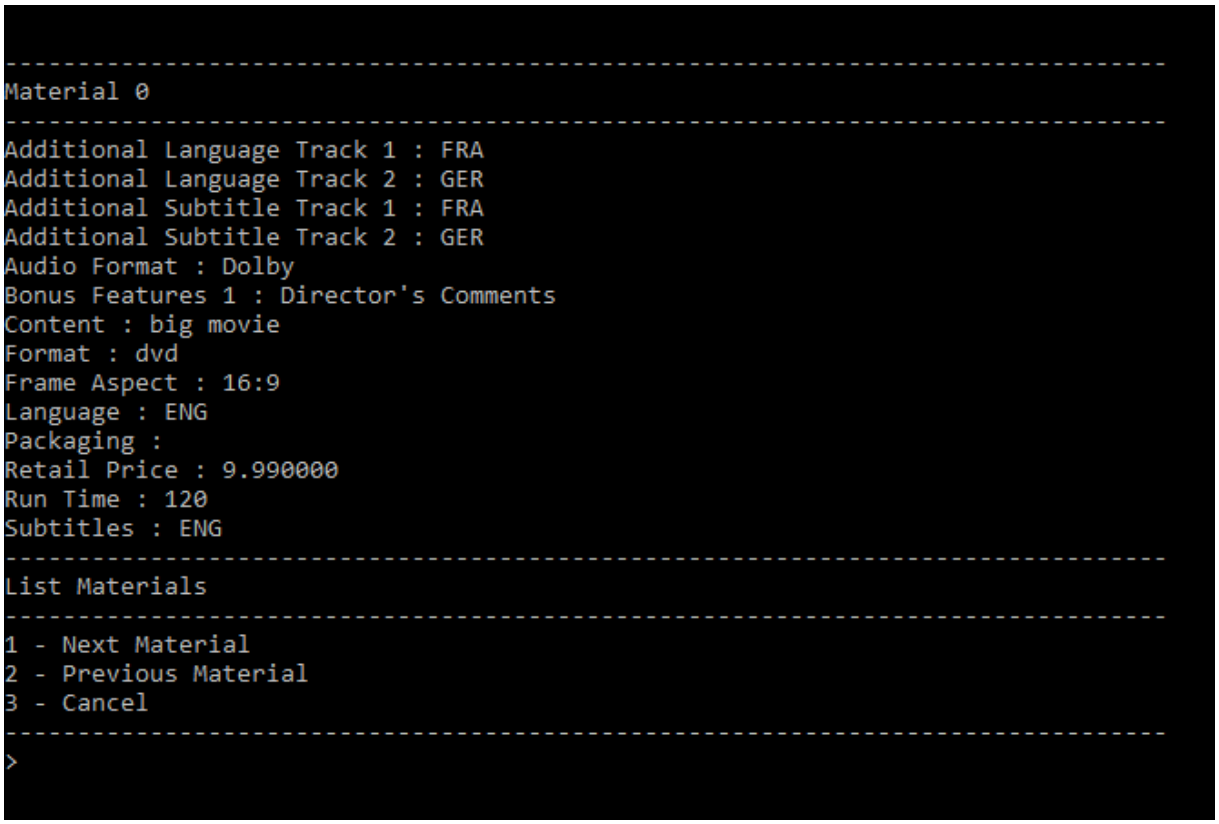


**Figure 23:** Visual representation of material listings

As you can see in Figure 10, there are more options available to you, these options allow you to navigate through the materials. You can see the associated input actions below.

| Input Value | Command Action |
|---|---|
| 1 | This will cause the application to move onto the next material in the database |
| 2 | This will cause the application to move onto the previous material in the database |
| 3 | This will cause the application to navigate back to View Mode |

### Using Maintenance Mode

Once you have reached the Maintenance Mode page you will be presented with the following screen

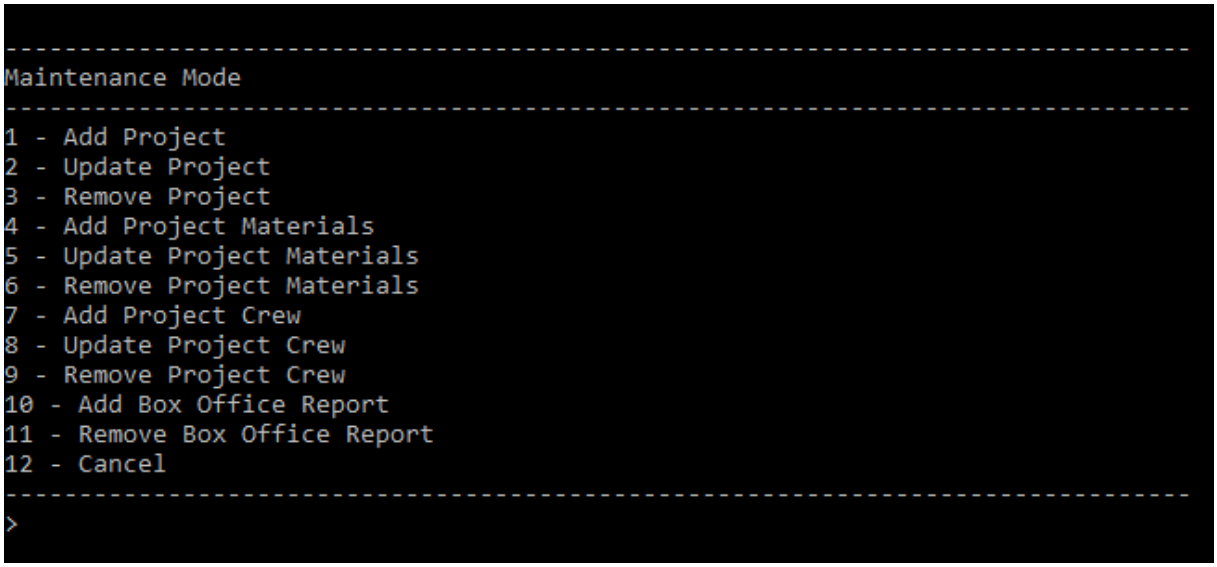


**Figure 24:** Visual representation of Maintenance Mode

Once on this screen, you can use the following keyboard inputs to navigate around maintenance mode, to find out more about each feature, click the associated information link.

| Input Value | Command Action | Information Link |
|---|---|---|
| 1 | Inputting this value will cause the application to enter add project | Adding Projects |
| 2 | Inputting this value will cause the application to enter update project | Updating Projects |
| 3 | Inputting this value will cause the application to enter remove project | Removing Projects |
| 4 | Inputting this value will cause the application to enter update project materials | Add Project Materials |
| 4 | Inputting this value will cause the application to enter update project materials | Updating Project Materials |
| 5 | Inputting this value will cause the application to enter remove project materials | Removing Project Materials |

| Input Value | Command Action | Information Link |
|---|---|---|
| 4 | Inputting this value will cause the application to enter update project materials | Add Project Crew |
| 4 | Inputting this value will cause the application to enter update project materials | Updating Project Crew |
| 5 | Inputting this value will cause the application to enter remove project materials | Removing Project Crew |
| 4 | Inputting this value will cause the application to enter update project materials | Add Box Office Report |
| 4 | Inputting this value will cause the application to enter update project materials | Updating Box Office Report |
| 6 | Inputting this value will cause the application to navigate back to the main menu | Main Menu |

### Using Add Project

Once you have entered the Add Project functionality you will be asked to enter the following information:

Firstly, you need to enter the Project Title, this is the name that you want your project to be called. Any value is accepted.

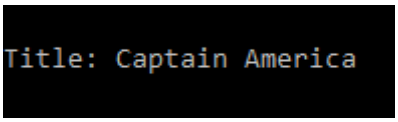


**Figure 25:** Visual representation of the application asking for a Project Title

Next, you will be asked for a project summary. Any value is accepted.

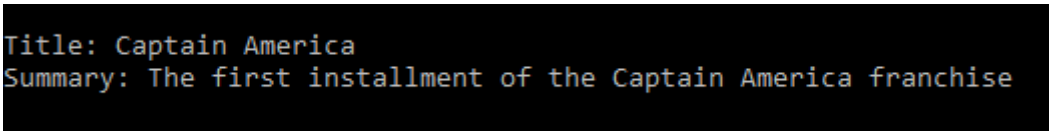


**Figure 26:** Visual representation of the application asking for Project Summary

Next, you will be asked if the project has been released. Only the values *y* and *n* are accepted. With *y* confirming that the project has been released and *n* confirming that the project has not been released.

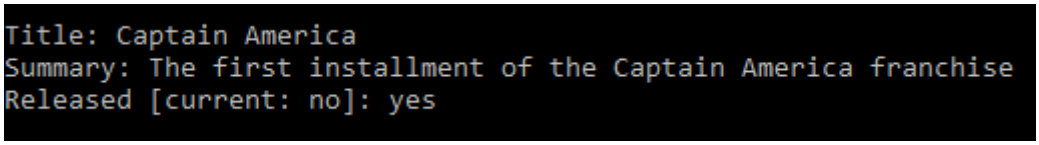


**Figure 27:** Visual representation of the application asking if the project has been released

Next, you will be asked if the project will be playing in theaters. Only the values *y* and *n* are accepted. With *y* confirming that the project will be playing in theatres and *n* confirming that the project will not be playing in theatres.

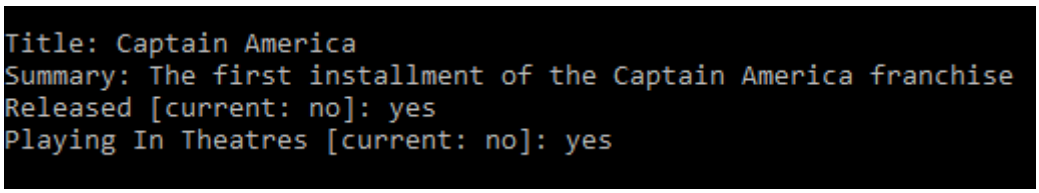


**Figure 28:** Visual representation of the application asking if the project will be playing in theatres

Next, you will be asked how many keywords you would like associating with the project. Any numeric value is accepted.

Visual representation of the application asking how many keywords should be associated with the project

Finally, you will be asked what keywords you would like associated with the project, the amount of keyword requests depends on the previously entered numeric value. Any value is accepted.

Visual representation of the application asking for a keyword

As you can see in CHANGEFIGUREVALUE, there are more options available to you, these are the options associated with Maintenance Mode, therefore you can find more information by reading the Maintenance Mode section of this user guide.

### Using Update Project

Once you have entered the Update Project functionality you will be asked to enter the following information:

Firstly, you need to enter a Project ID, this must be a numeric value, you can find the accepted Project IDs above the input location, select an ID from this list.


**Figure 29:** Visual representation of selecting a Project ID to update the project for

Next, you will be presented with multiple options, you can use the following keyboard inputs to update certain aspects of the project, to find out more about each update, click the associated information link.

| Input Value | Command Action | Information Link |
|---|---|---|
| 1 | Inputting this value will cause the application to enter edit title | Edit Title |
| 2 | Inputting this value will cause the application to enter edit summary | Edit Summary |
| 3 | Inputting this value will cause the application to enter edit released | Edit Released |
| 4 | Inputting this value will cause the application to enter edit playing in theatres | Edit Playing In Theatres |
| 4 | Inputting this value will cause the application to enter edit existing keywords | Edit Existing Keywords |
| 5 | Inputting this value will cause the application to enter edit existing keywords | Edit Crew |
| 6 | Inputting this value will cause the application to navigate back to the maintenance mode menu | Maintenance Mode Menu |

**Edit Title** Once you have entered the Edit Title functionality you will be asked to enter the following information:

You need to enter the new Project Title, this is the new name that you want your project to be called. Any value is accepted.

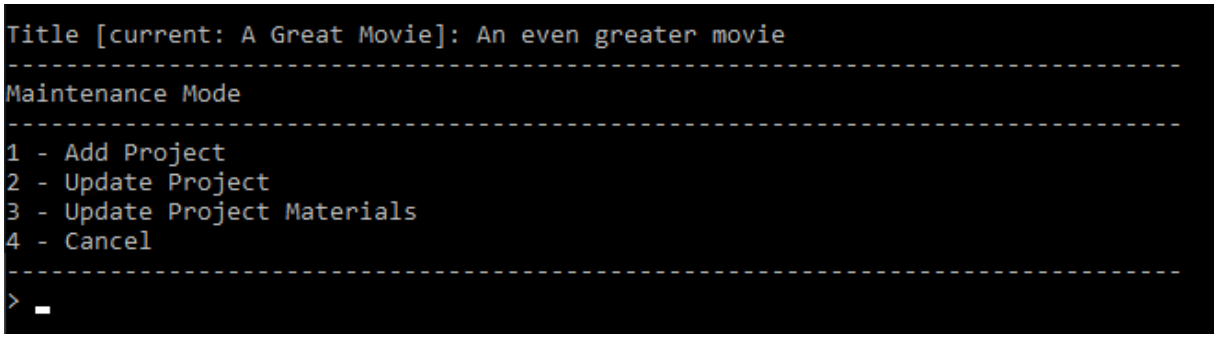


**Figure 30:** Visual representation of the application asking for a new Project Title

As you can see in Figure CHANGEFIGUREVALUE, there are more options available to you, these are the options associated with Maintenance Mode, therefore you can find more information by reading the Maintenance Mode section of this user guide.

**Edit Summary** Once you have entered the Edit Summary functionality you will be asked to enter the following information:

You need to enter the new Project Summary, this is the new summary that you want your project to have. Any value is accepted.

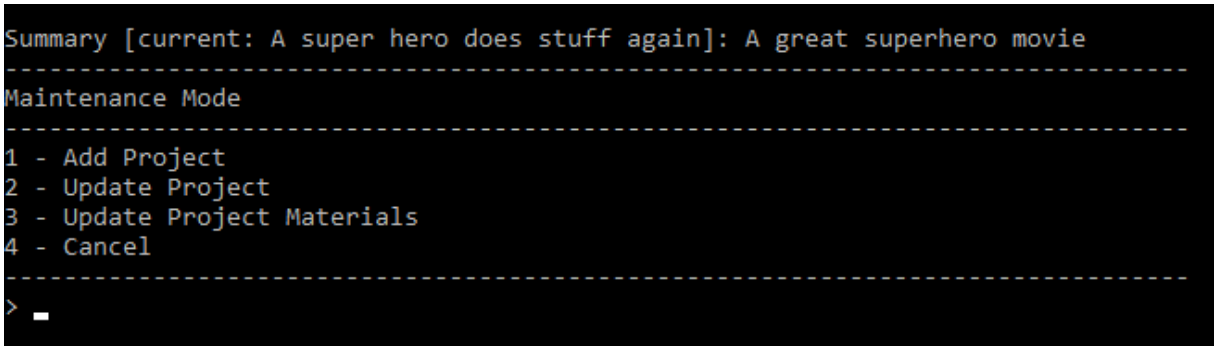


**Figure 31:** Visual representation of the application asking for a new Project Summary

As you can see in Figure CHANGEFIGUREVALUE, there are more options available to you, these are the options associated with Maintenance Mode, therefore you can find more information by reading the Maintenance Mode section of this user guide.

**Edit Released** Once you have entered the Edit Released functionality you will be asked to enter the following information:

You need to enter the new Released value, this is the new released state that you want your project to have. Only the values *y* and *n* are accepted. With *y* confirming that the project is released and *n* confirming that the project is not released.

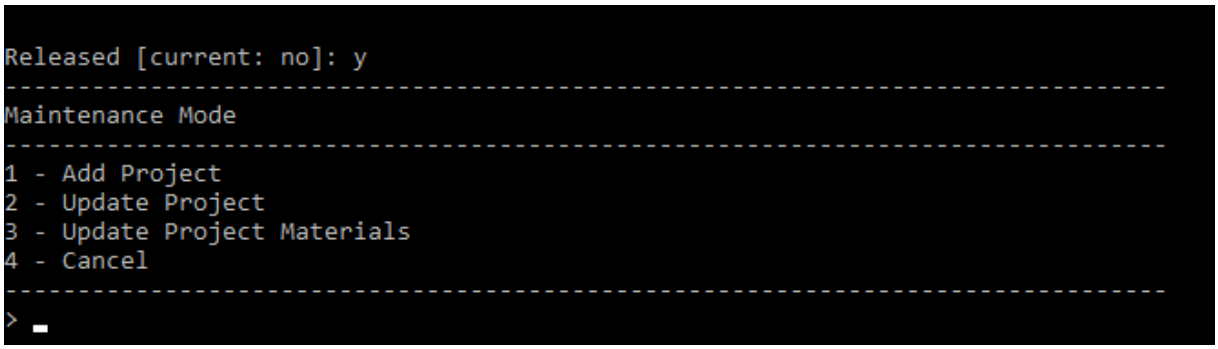


**Figure 32:** Visual representation of the application asking for a new Released value

As you can see in Figure CHANGEFIGUREVALUE, there are more options available to you, these are the options associated with Maintenance Mode, therefore you can find more information by reading the Maintenance Mode section of this user guide.

**Edit Playing In Theaters** Once you have entered the Edit Playing In Theaters functionality you will be asked to enter the following information:

You need to enter the new playing in theatres value, this is the new playing in theaters state that you want your project to have. Only the values *y* and *n* are accepted. With *y* confirming that the project will be playing in theatres and *n* confirming that the project will not be playing in theatres.

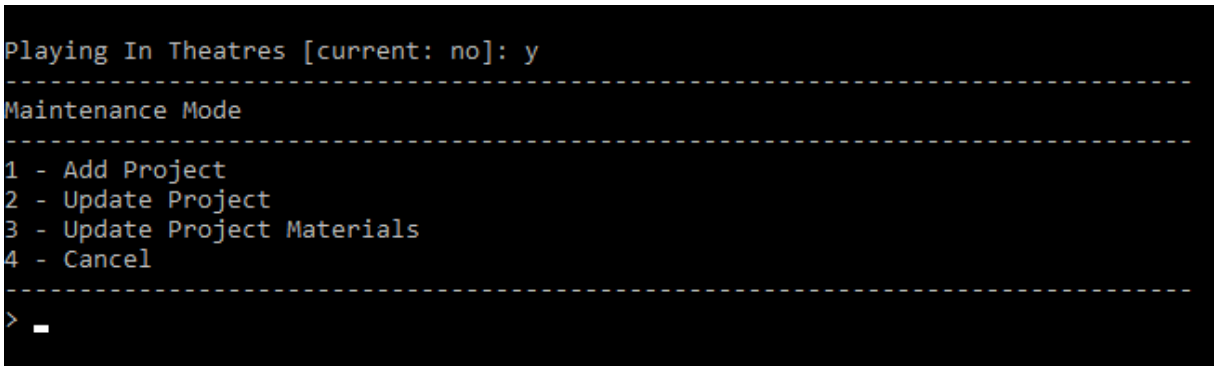


**Figure 33:** Visual representation of the application asking for a new Project Title

As you can see in Figure CHANGEFIGUREVALUE, there are more options available to you, these are the options associated with Maintenance Mode, therefore you can find more information by reading the Maintenance Mode section of this user guide.

**Edit Existing Keywords** Once you have entered the Edit Existing Keywords functionality you will be asked to enter the following information:

You need to enter the keyword identifier you wish to update, you can find the identifier in the provided list, an example of this can be seen below:

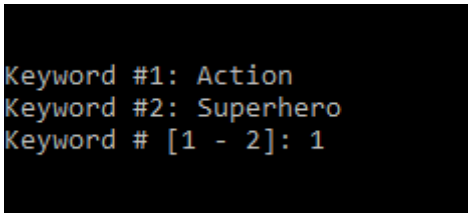


**Figure 34:** Visual representation of the application showing the current Keyword identifiers

Once you have inputted a valid keyword identifier you will be asked to enter your new Keyword, any value is accepted.

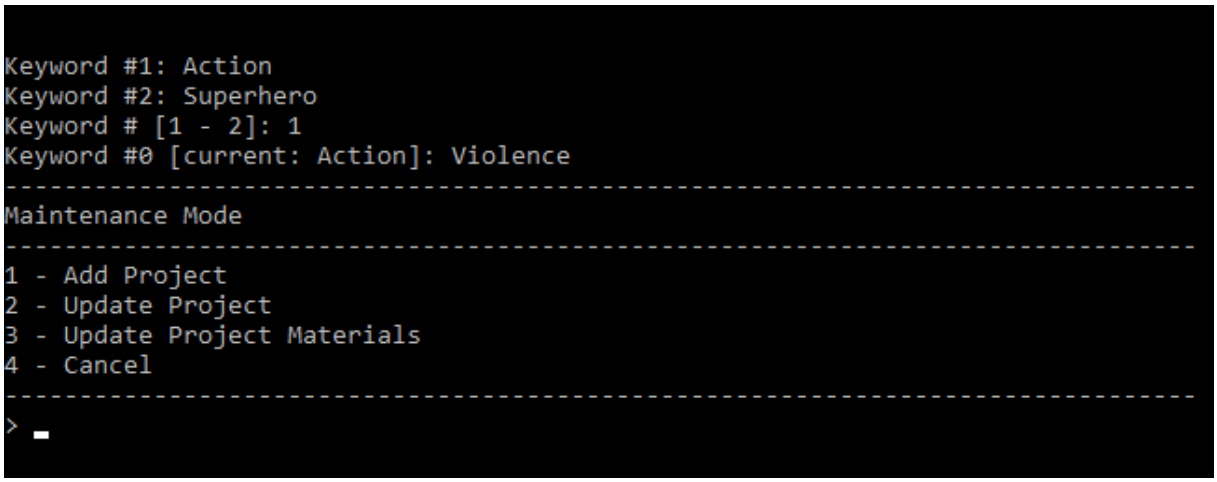


**Figure 35:** Visual representation of the application asking for a new keyword

As you can see in Figure CHANGEFIGUREVALUE, there are more options available to you, these are the options associated with Maintenance Mode, therefore you can find more information by reading the Maintenance Mode section of this user guide.

**Edit Crew** Once you have entered the Edit Crew functionality you will be asked to enter the following information:

You need to enter the crew identifier you wish to update, you can find the identifier in the provided list, an example of this can be seen below:

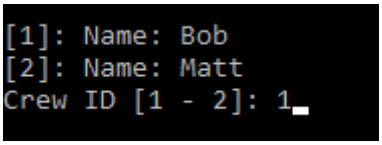


**Figure 36:** Visual representation of the application showing the current Crew identifiers

Once you have inputted a valid keyword identifier you will be asked to enter the type of data you would like to update, you can find the associated values below, to find out more about each function, click the associated information link.

| Input Value | Command Action | Information Link |
|---|---|---|
| 1 | Inputting this value will cause the application to enter update crew name | Edit Name |
| 2 | Inputting this value will cause the application to enter update crew job title | Edit Job Title |
| 3 | Inputting this value will cause the application to navigate back to the maintenance mode menu | Maintenance Mode Menu |

**Edit Crew Name** Once you have entered the Edit Crew Name functionality you will be asked to enter the following information:

You need to enter the new Crew Name, this is the new name for the crew member that you selected. Any value is accepted.

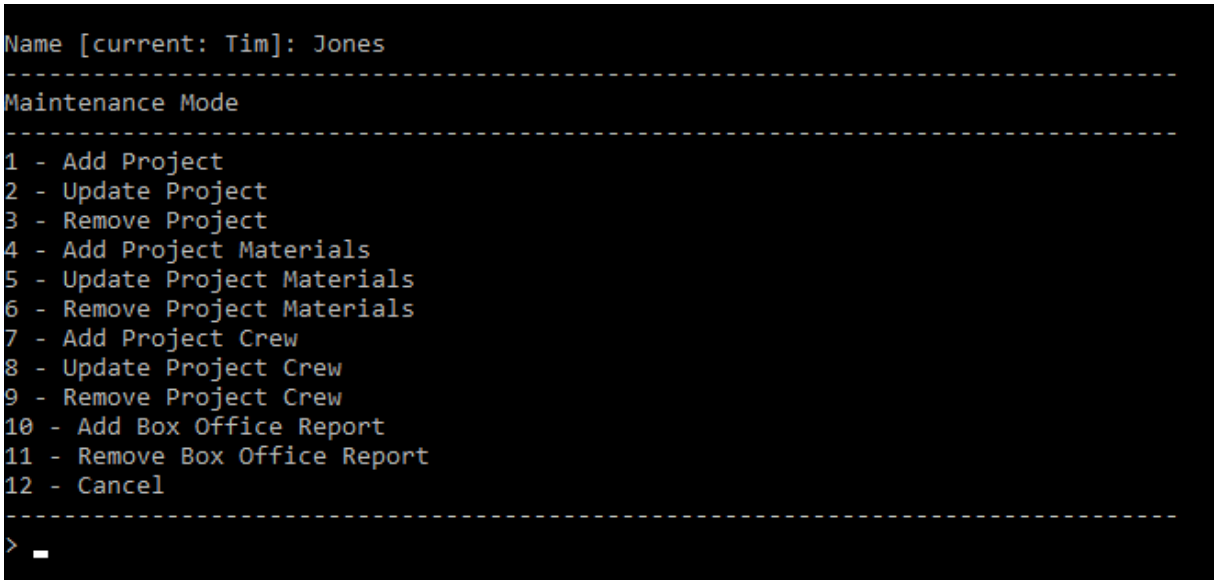


**Figure 37:** Visual representation of the application asking for a new Crew Name

As you can see in Figure CHANGEFIGUREVALUE, there are more options available to you, these are the options associated with Maintenance Mode, therefore you can find more information by reading the Maintenance Mode section of this user guide.

**Edit Crew Job Title** Once you have entered the Edit Crew Job Title functionality you will be asked to enter the following information:

You need to enter the new Crew Job Title, this is the new job title for the crew member that you selected. Any value is accepted.

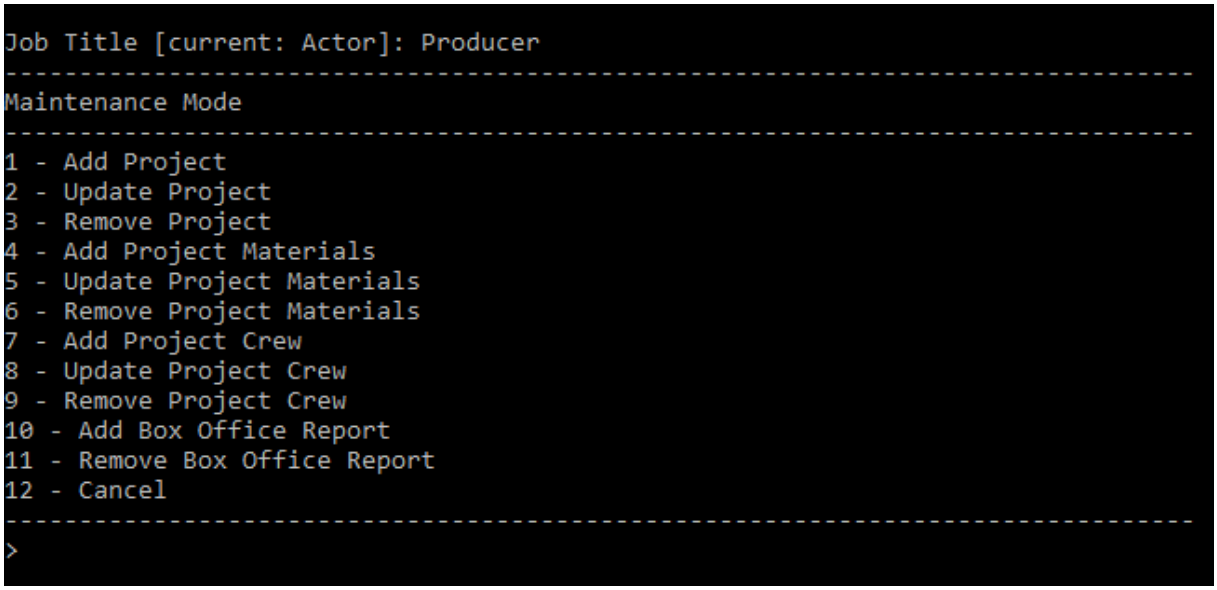


**Figure 38:** Visual representation of the application asking for a new Crew Name

As you can see in Figure CHANGEFIGUREVALUE, there are more options available to you, these are the options associated with Maintenance Mode, therefore you can find more information by reading the Maintenance Mode section of this user guide.

**Using Remove Project**

Once you have entered the Remove Project functionality you will be asked to enter the following information:

You only need to enter a Project ID, this must be a numeric value, you can find the accepted Project IDs above the input location, select an ID from this list.

Once you submit this Project ID it will be removed from the database.

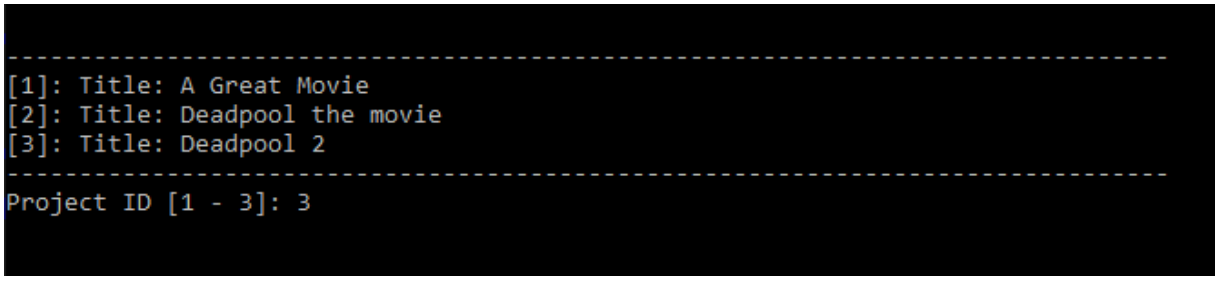


**Figure 39:** Visual representation of selecting a Project ID to update the project for

As you can see in Figure CHANGEFIGUREVALUE, there are more options available to you, these are the options associated with Maintenance Mode, therefore you can find more information by reading the Maintenance Mode section of this user guide.

### Using Add Project Materials

Once you have entered the Add Project Materials functionality you will be asked to enter the following information:

Firstly, you need to enter a Project ID, this must be a numeric value, you can find the accepted Project IDs above the input location, select an ID from this list.

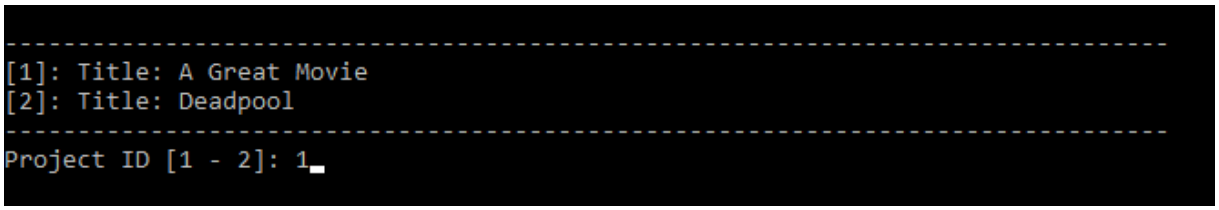


**Figure 40:** Visual representation of selecting a Project ID to proceed with selecting a project to add a material to

Next, you will be asked to enter the material format identifer you wish to add within the previously selected project, you can find the identifier in the provided list, an example of this can be found below:

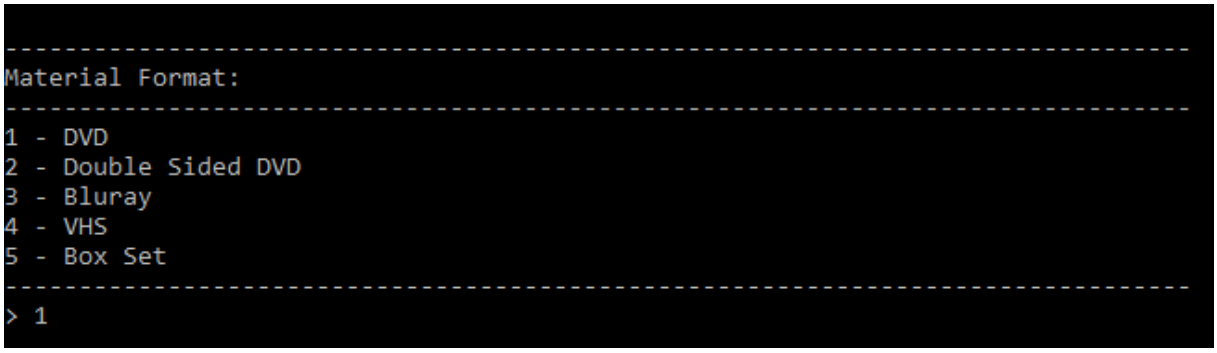


**Figure 41:** Visual representation of selecting a Material Format ID to add to the project

Once you have selected a Material Format ID you will be asked to enter the following information:

Next, you need to enter the Audio Format, this is the audio format that you want your material to have. Any value is accepted.

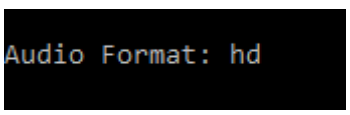


**Figure 42:** Visual representation of the application asking for a Project Title

Next, you will be asked for the material run time. Any numeric value is accepted.

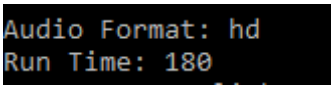


**Figure 43:** Visual representation of the application asking for the material Run Time

Next, you will be asked for the material language. Any value is accepted.

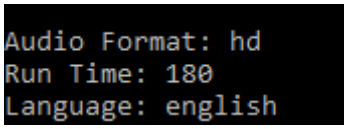


**Figure 44:** Visual representation of the application asking for the material Language

Next, you will be asked for the material retail price. Any numeric value is accepted.

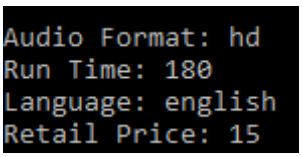


**Figure 45:** Visual representation of the application asking for the material Retail Price

Next, you will be asked for the material subtitles. Any value is accepted.

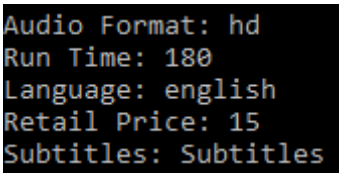


**Figure 46:** Visual representation of the application asking for the material Subtitles

Next, you will be asked for the material frame aspect. Any value is accepted.

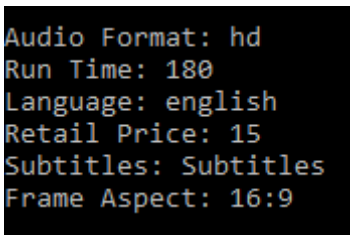


**Figure 47:** Visual representation of the application asking for the material Frame Aspect

Next, you will be asked for the material content. Any value is accepted.

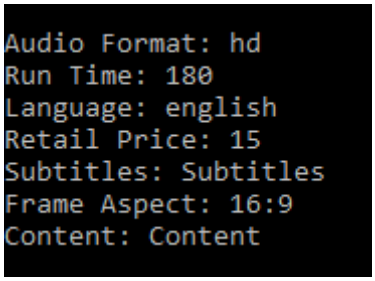


**Figure 48:** Visual representation of the application asking for the material Content

Next, you will be asked if the material has any additional language tracks. Any value is accepted, if you enter anything other than 0 you will be asked for the Additional Language track otherwise you can move onto the next input.

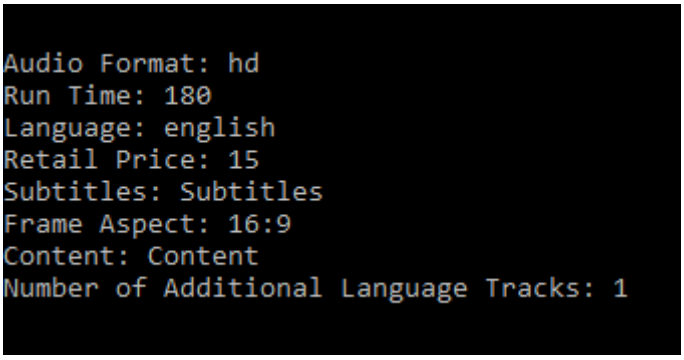


**Figure 49:** Visual representation of the application asking if the material has any additional language tracks

If you entered more than 0 the application will ask you to enter the following information for the amount of language tracks added.

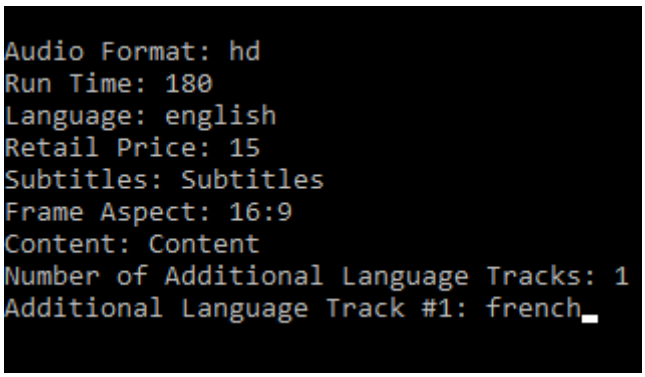


**Figure 50:** Visual representation of the application asking for material additional language track information

Next, you will be asked if the material has any additional subtitle tracks. Any value is accepted, if you enter anything other than 0 you will be asked for the Additional Subtitle track otherwise you can move onto the next input.

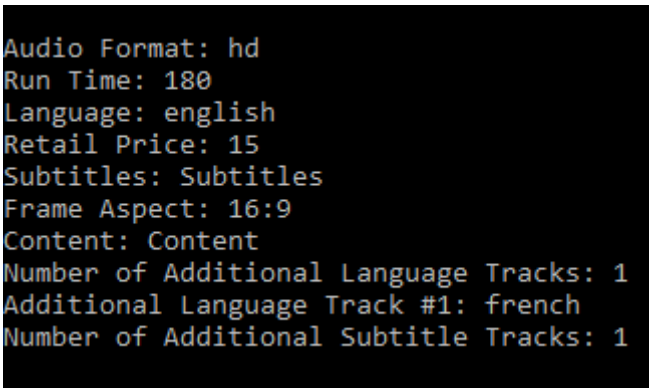


**Figure 51:** Visual representation of the application asking if the material has any additional subtitle tracks

If you entered more than 0 the application will ask you to enter the following information for the amount of subtitle tracks added.

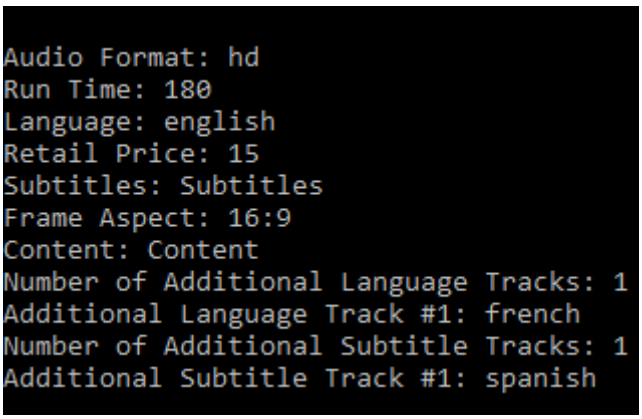


**Figure 52:** Visual representation of the application asking for material additional subtitle track information

Finally, you will be asked if the material has any additional bonus features. Any value is accepted, if you enter anything other than 0 you will be asked for the Bonus Feature otherwise you can move onto the next input.

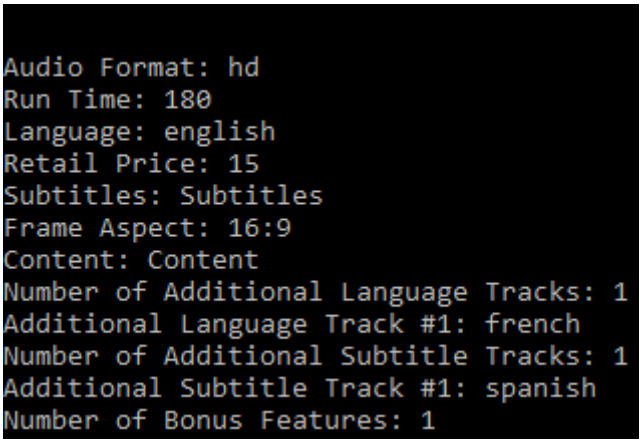


**Figure 53:** Visual representation of the application asking if the material has any bonus features

If you entered more than 0 the application will ask you to enter the following information for the amount of bonus features added.

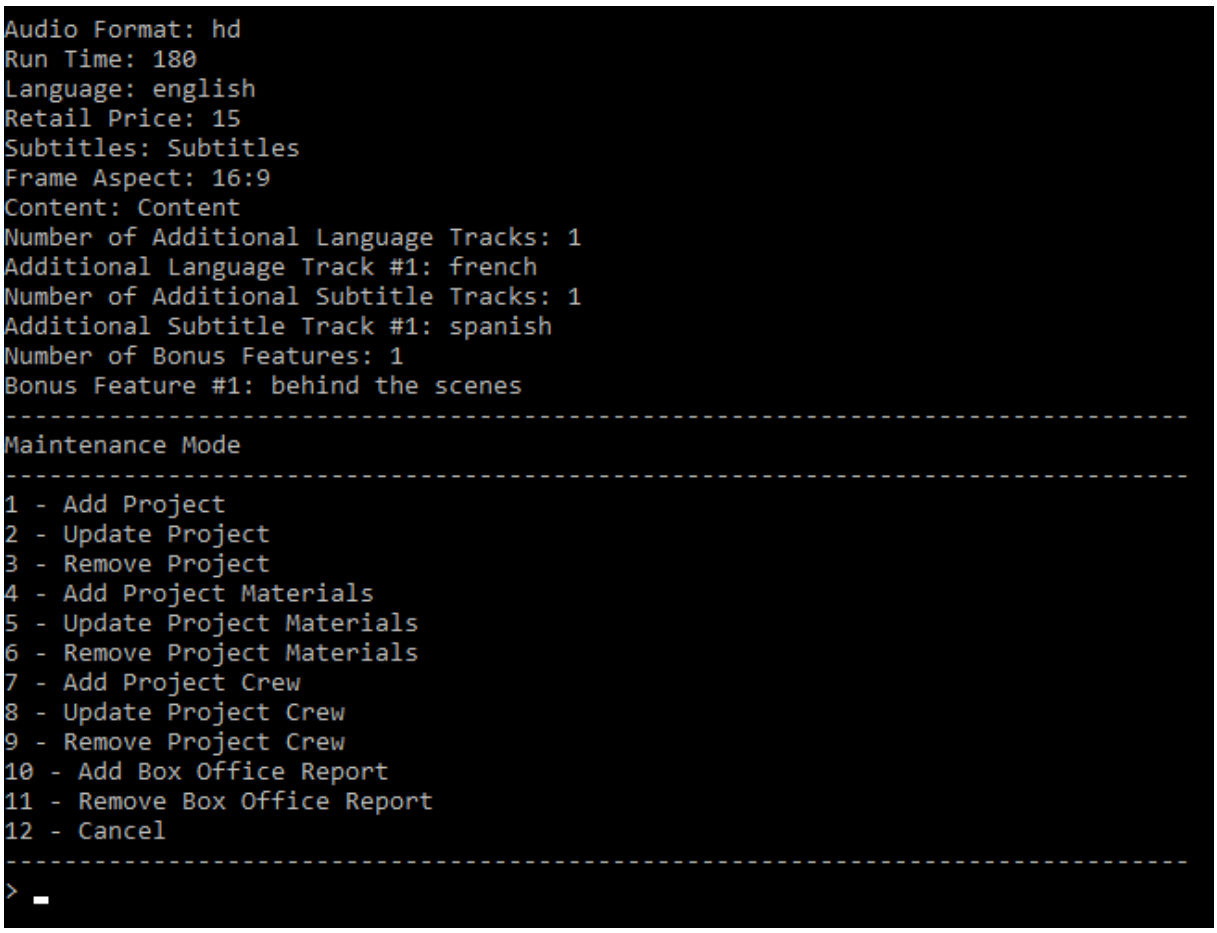


**Figure 54:** Visual representation of the application asking for material bonus feature information

As you can see in CHANGEFIGUREVALUE, there are more options available to you, these are the options associated with Maintenance Mode, therefore you can find more information by reading the Maintenance Mode section of this user guide.

### Using Update Project Materials

Once you have entered the Update Project Materials functionality you will be asked to enter the following information:

Firstly, you need to enter a Project ID, this must be a numeric value, you can find the accepted Project IDs above the input location, select an ID from this list.


**Figure 55:** Visual representation of selecting a Project ID to proceed with selecting a material to update

Next, you will be asked to enter the material identifer you wish to update within the previously selected project, you can find the identifier in the provided list, an example of this can be found below:

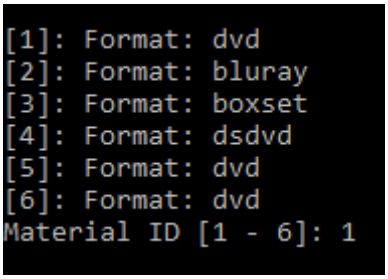


**Figure 56:** Visual representation of selecting a Material ID to update the material for

Next, you will be presented with multiple options, you can use the following keyboard inputs to update certain aspects of the material, to find out more about each update, click the associated information link.

| Input Value | Command Action | Information Link |
|---|---|---|
| 1 | Inputting this value will cause the application to enter edit audio format | Edit Audio Format |
| 2 | Inputting this value will cause the application to enter edit run time | Edit Run Time |
| 3 | Inputting this value will cause the application to enter edit language | Edit Language |

| Input Value | Command Action | Information Link |
|---|---|---|
| 4 | Inputting this value will cause the application to enter edit retail price | Edit Retail Price |
| 5 | Inputting this value will cause the application to enter edit subtitles | Edit Subtitles |
| 6 | Inputting this value will cause the application to enter edit frame aspect | Edit Frame Aspect |
| 7 | Inputting this value will cause the application to enter edit content | Edit Content |
| 8 | Inputting this value will cause the application to enter edit additional language tracks | Edit Additional Language Tracks |
| 9 | Inputting this value will cause the application to enter edit additional subtitle tracks | Edit Additional Subtitle Tracks |
| 10 | Inputting this value will cause the application to enter edit bonus features | Edit Bonus Features |
| 11 | Inputting this value will cause the application to navigate back to the maintenance mode menu | Maintenance Mode Menu |

If you selected VHS, you will see the following options.

| Input Value | Command Action | Information Link |
|---|---|---|
| 1 | Inputting this value will cause the application to enter edit audio format | Edit Audio Format |
| 2 | Inputting this value will cause the application to enter edit run time | Edit Run Time |
| 3 | Inputting this value will cause the application to enter edit language | Edit Language |
| 4 | Inputting this value will cause the application to enter edit retail price | Edit Retail Price |
| 5 | Inputting this value will cause the application to enter edit subtitles | Edit Subtitles |

| Input Value | Command Action | Information Link |
|---|---|---|
| 6 | Inputting this value will cause the application to enter edit frame aspect | Edit Frame Aspect |
| 7 | Inputting this value will cause the application to enter edit packaging | Edit Packaging |
| 8 | Inputting this value will cause the application to enter edit audio track | Edit Audio Track |
| 9 | Inputting this value will cause the application to navigate back to the maintenance mode menu | Maintenance Mode Menu |

**Edit Audio Format** Once you have entered the Audio Format functionality you will be asked to enter the following information:

You need to enter the new Audio Format, this is the new audio format that you want your material to have. Any value is accepted.

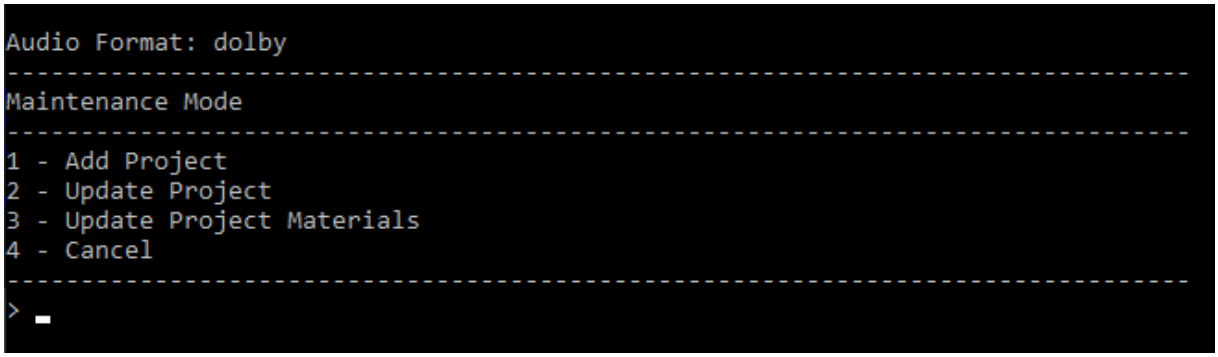


**Figure 57:** Visual representation of the application asking for a new Audio Format

As you can see in Figure CHANGEFIGUREVALUE, there are more options available to you, these are the options associated with Maintenance Mode, therefore you can find more information by reading the Maintenance Mode section of this user guide.

**Edit Run Time** Once you have entered the Edit Run Time functionality you will be asked to enter the following information:

You need to enter the new Run Time, this is the new run time that you want your material to have. Any numeric value is accepted.

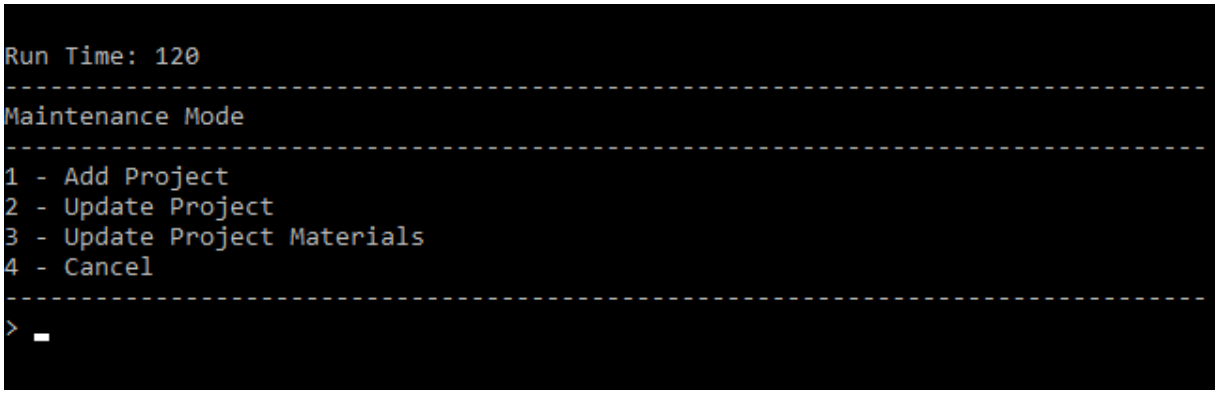


**Figure 58:** Visual representation of the application asking for a new Run Time

As you can see in Figure CHANGEFIGUREVALUE, there are more options available to you, these are the options associated with Maintenance Mode, therefore you can find more information by reading the Maintenance Mode section of this user guide.

**Edit Language** Once you have entered the Edit Language functionality you will be asked to enter the following information:

You need to enter the new Language, this is the new language that you want your material to have. Any value is accepted.

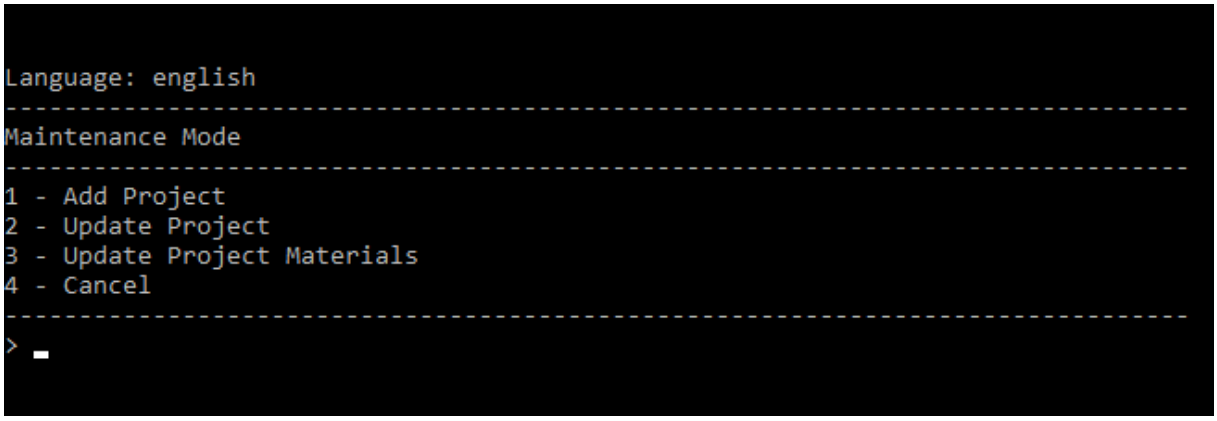


**Figure 59:** Visual representation of the application asking for a new Language

As you can see in Figure CHANGEFIGUREVALUE, there are more options available to you, these are the options associated with Maintenance Mode, therefore you can find more information by reading the Maintenance Mode section of this user guide.

**Edit Retail Price** Once you have entered the Edit Retail Price functionality you will be asked to enter the following information:

You need to enter the new Retail Price, this is the new retail price that you want your material to have. Any numeric value is accepted.

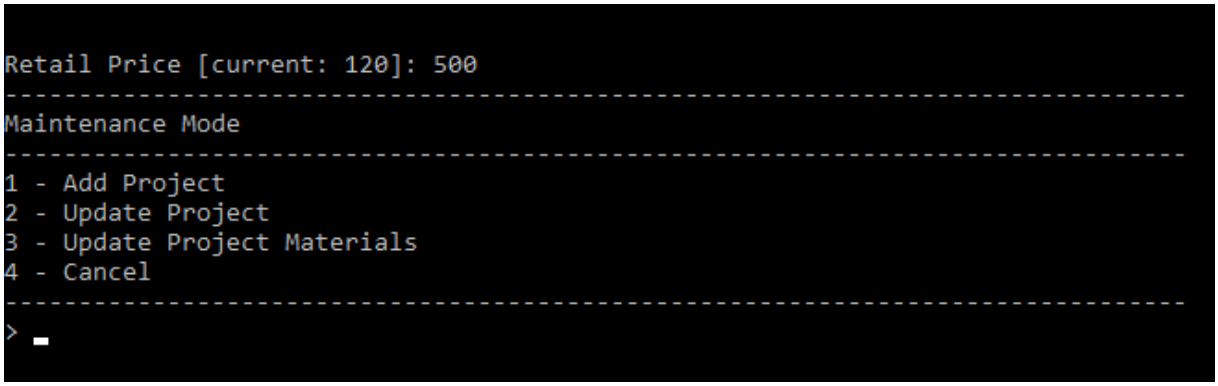


**Figure 60:** Visual representation of the application asking for a new Retail Price

As you can see in Figure CHANGEFIGUREVALUE, there are more options available to you, these are the options associated with Maintenance Mode, therefore you can find more information by reading the Maintenance Mode section of this user guide.

**Edit Subtitles** Once you have entered the Edit Subtitles functionality you will be asked to enter the following information:

You need to enter the new Subtitles, this is the new subtitles that you want your material to have. Any value is accepted.

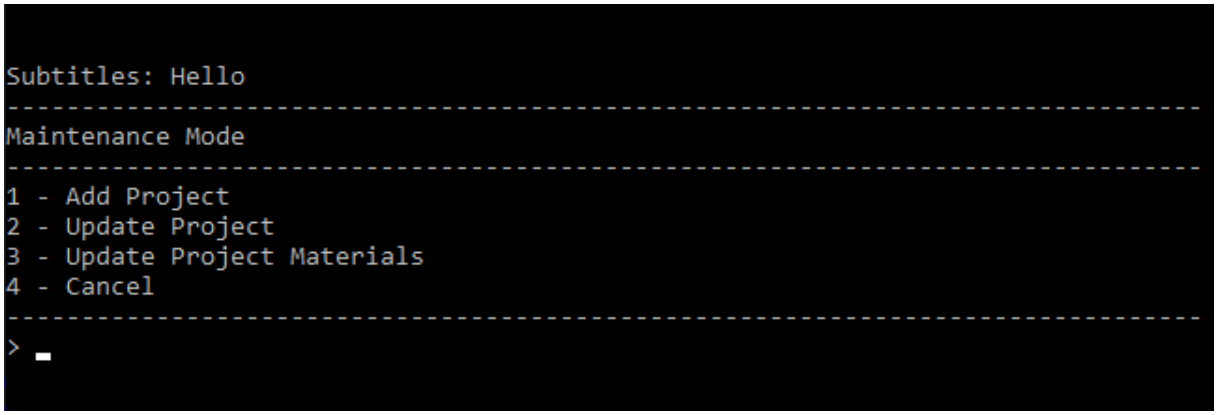


**Figure 61:** Visual representation of the application asking for new Subtitles

As you can see in Figure CHANGEFIGUREVALUE, there are more options available to you, these are the options associated with Maintenance Mode, therefore you can find more information by reading the Maintenance Mode section of this user guide.

**Edit Frame Aspect** Once you have entered the Edit Frame Aspect functionality you will be asked to enter the following information:

You need to enter the new Frame Aspect, this is the new frame aspect that you want your material to have. Any value is accepted.

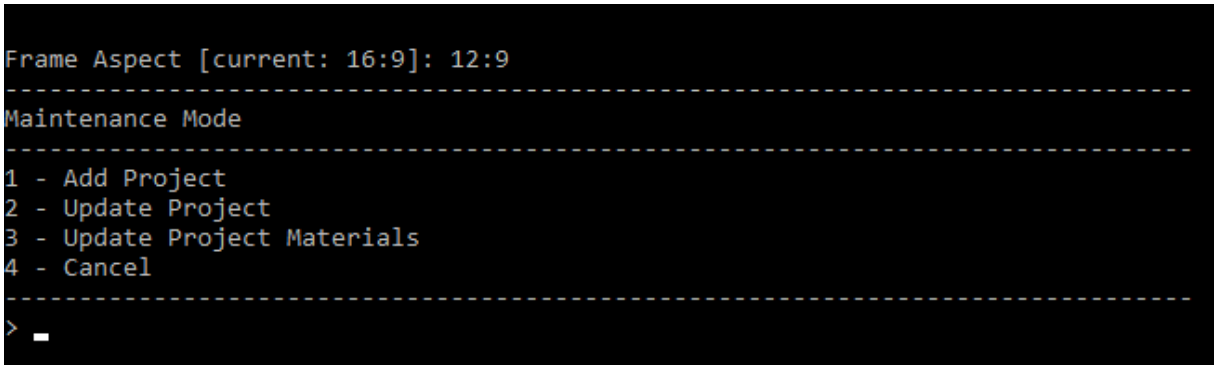


**Figure 62:** Visual representation of the application asking for a new Frame Aspect

As you can see in Figure CHANGEFIGUREVALUE, there are more options available to you, these are the options associated with Maintenance Mode, therefore you can find more information by reading the Maintenance Mode section of this user guide.

**Edit Packaging** Once you have entered the Edit Packaging functionality you will be asked to enter the following information:

You need to select from the list of packaging types, this is the new packaging type that you want your material to have. Any value from 1-2 is accepted.

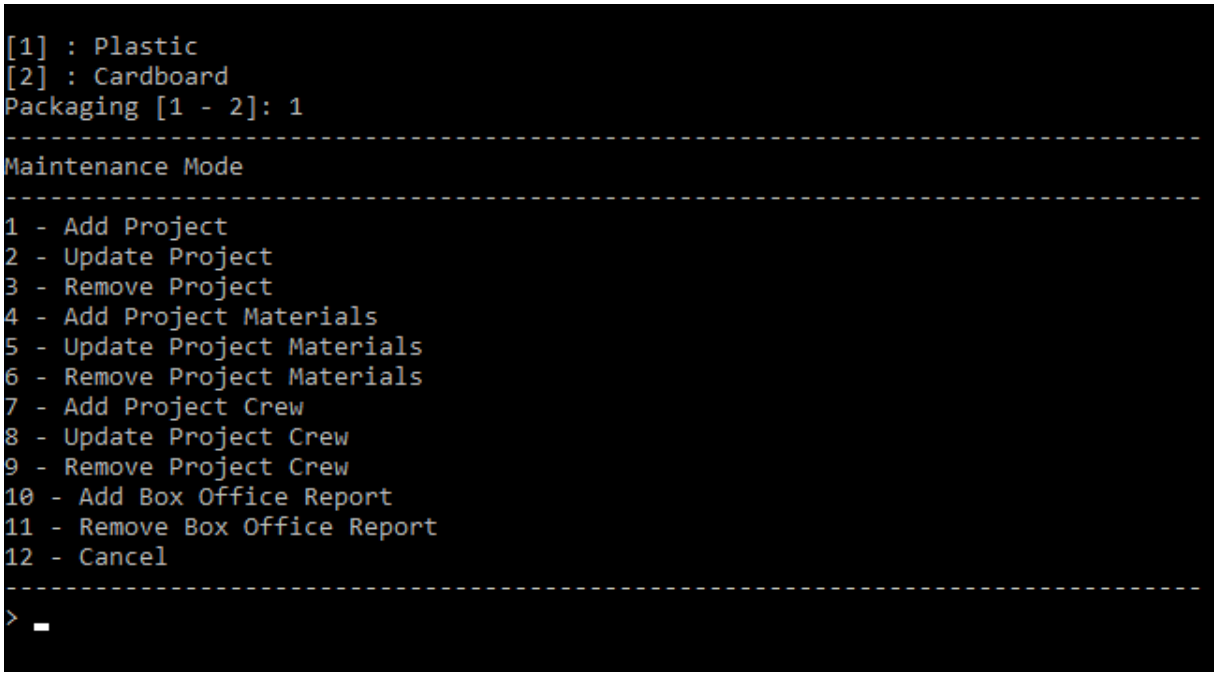


**Figure 63:** Visual representation of the application asking for new Packaging information

As you can see in Figure CHANGEFIGUREVALUE, there are more options available to you, these are the options associated with Maintenance Mode, therefore you can find more information by reading the Maintenance Mode section of this user guide.

**Edit Content** Once you have entered the Edit Content functionality you will be asked to enter the following information:

You need to enter the new Content details, this is the new content information that you want your material to have. Any value is accepted.

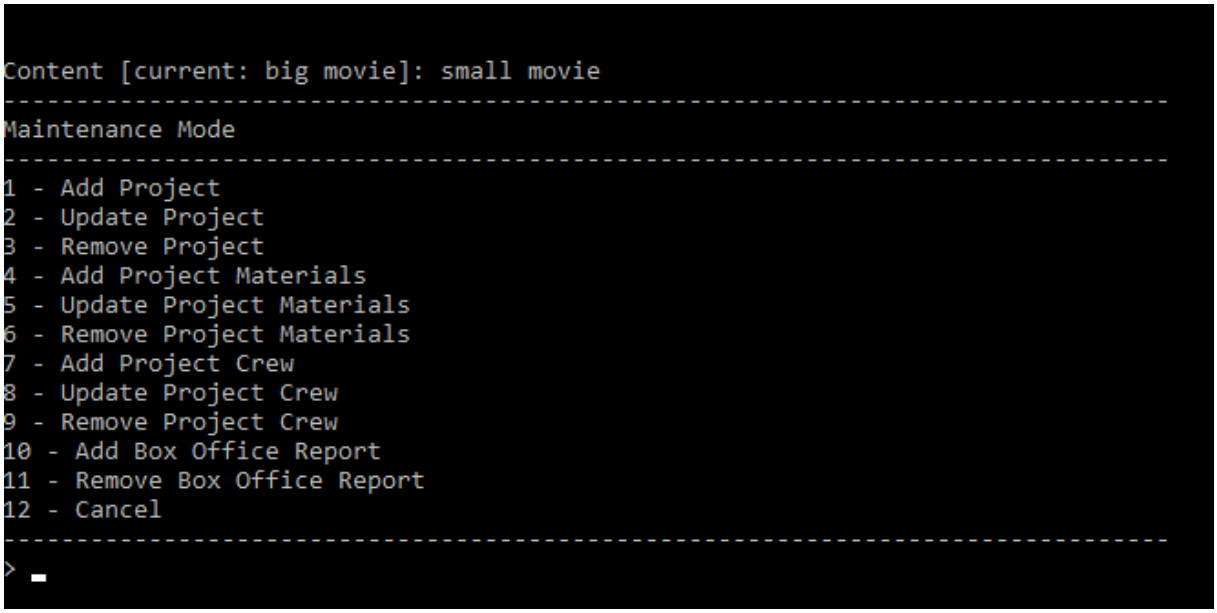


**Figure 64:** Visual representation of the application asking for new Content information

As you can see in Figure CHANGEFIGUREVALUE, there are more options available to you, these are the options associated with Maintenance Mode, therefore you can find more information by reading the Maintenance Mode section of this user guide.

**Edit Additional Language Tracks** Once you have entered the Edit Additional Language Tracks functionality you will be asked to enter the following information

You need to enter the Additional Language Track identifier you wish to update, you can find the identifier in the provided list, an example of this can be seen below:

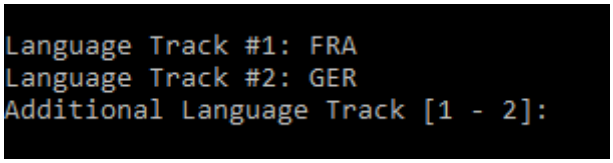


**Figure 65:** Visual representation of the application showing the current Additional Language Track identifiers

You need to enter the new Additional Language Tracks details, this is the new additional language tracks information that you want your material to have. Any value is accepted.

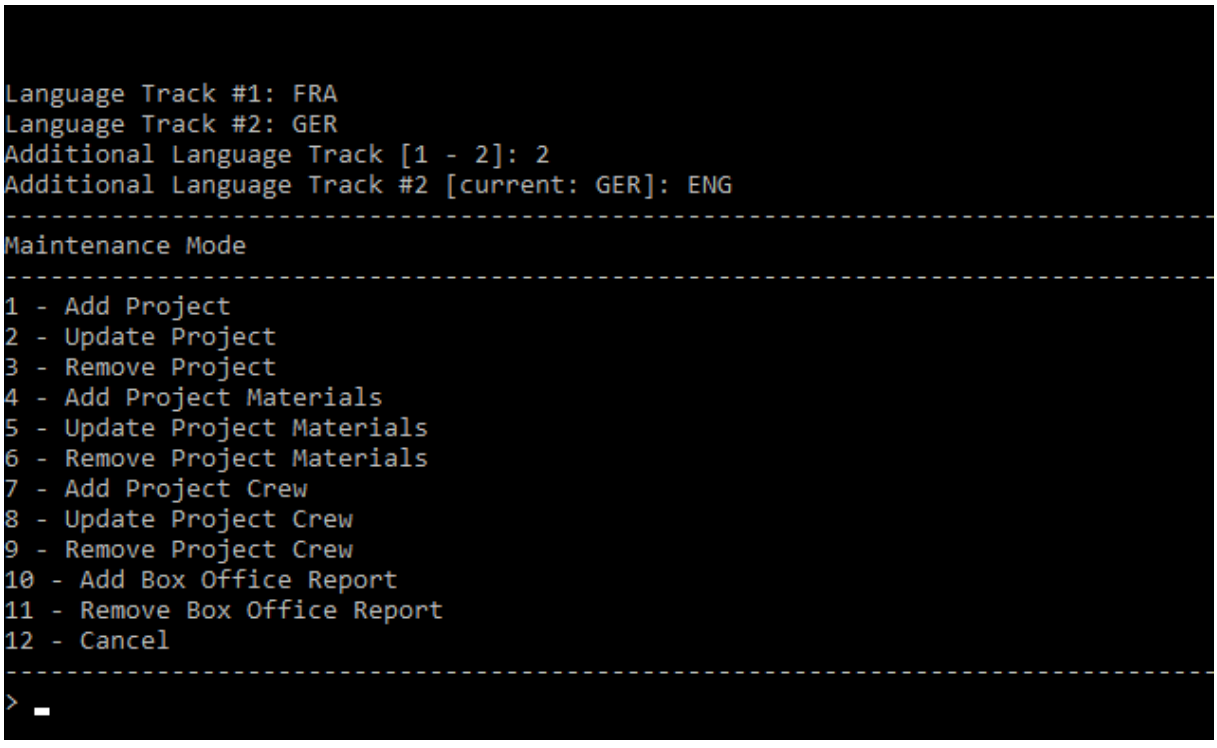


**Figure 66:** Visual representation of the application asking for new Additional Language Tracks information

As you can see in Figure CHANGEFIGUREVALUE, there are more options available to you, these are the options associated with Maintenance Mode, therefore you can find more information by reading the

Maintenance Mode section of this user guide.

**Edit Additional Subtitle Tracks** Once you have entered the Edit Subtitle Language Tracks functionality you will be asked to enter the following information

You need to enter the Subtitle Language Track identifier you wish to update, you can find the identifier in the provided list, an example of this can be seen below:

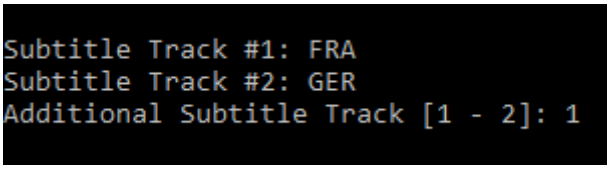


**Figure 67:** Visual representation of the application showing the current Additional Subtitle Track identifiers

You need to enter the new Additional Subtitle Tracks details, this is the new additional subtitle tracks information that you want your material to have. Any value is accepted.

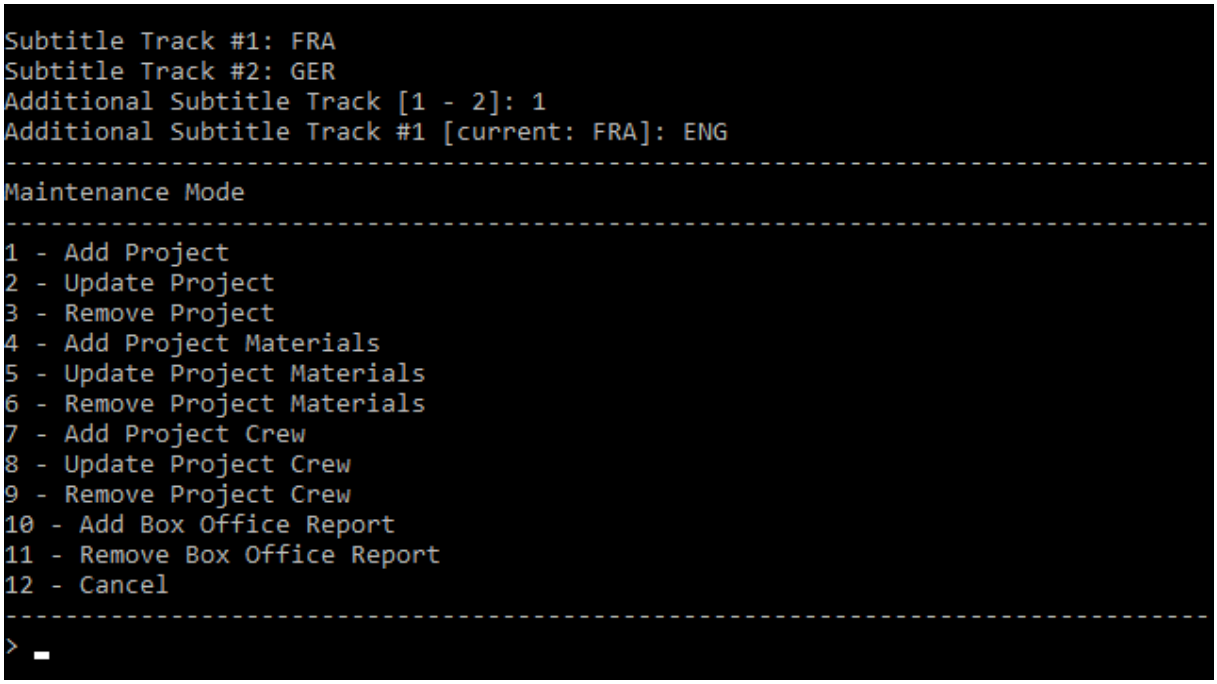


**Figure 68:** Visual representation of the application asking for new Additional Subtitle Tracks information

As you can see in Figure CHANGEFIGUREVALUE, there are more options available to you, these are the options associated with Maintenance Mode, therefore you can find more information by reading the Maintenance Mode section of this user guide.

**Edit Bonus Features** Once you have entered the Edit Bonus Features Tracks functionality you will be asked to enter the following information

You need to enter the Bonus Features identifier you wish to update, you can find the identifier in the provided list, an example of this can be seen below:

```
Bonus Feature #1: Director's Comments
Bonus Feature [1 - 2]:
```

**Figure 69:** Visual representation of the application showing the current Bonus Features identifiers

You need to enter the new Bonus Features details, this is the new bonus feature information that you want your material to have. Any value is accepted.

```
Bonus Feature #1: Director's Comments
Bonus Feature [1 - 2]: 1
Bonus Feature #1 [current: Director's Comments]: Directors Cut
--------------------------------------------------------------------------------
Maintenance Mode
--------------------------------------------------------------------------------
1 - Add Project
2 - Update Project
3 - Remove Project
4 - Add Project Materials
5 - Update Project Materials
6 - Remove Project Materials
7 - Add Project Crew
8 - Update Project Crew
9 - Remove Project Crew
10 - Add Box Office Report
11 - Remove Box Office Report
12 - Cancel
--------------------------------------------------------------------------------
>
```

**Figure 70:** Visual representation of the application asking for new Bonus Features information

As you can see in Figure CHANGEFIGUREVALUE, there are more options available to you, these are the options associated with Maintenance Mode, therefore you can find more information by reading the Maintenance Mode section of this user guide.

**Edit Audio Track** Once you have entered the Edit Audio Track functionality you will be asked to enter the following information:

You need to enter the new Audio Track details, this is the new audio track that you want your material to have. Any value is accepted.


**Figure 71:** Visual representation of the application asking for new Audio Track information

As you can see in Figure CHANGEFIGUREVALUE, there are more options available to you, these are the options associated with Maintenance Mode, therefore you can find more information by reading the Maintenance Mode section of this user guide.

**Using Remove Project Materials**

Once you have entered the Remove Project functionality you will be asked to enter the following information:

Firstly, you need to enter a Project ID, this must be a numeric value, you can find the accepted Project IDs above the input location, select an ID from this list.


**Figure 72:** Visual representation of selecting a Project ID to remove Materials for

Once you have selected a Project ID you will be presented with the associated Material IDs, you need to now select a Material ID from this list and it must be a numeric value.

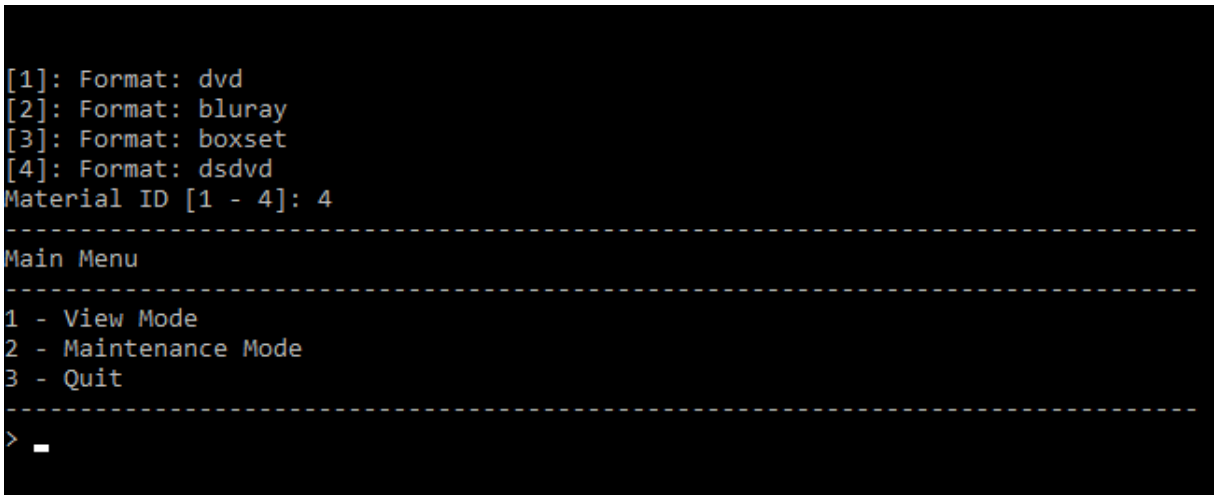


**Figure 73:** Visual representation of selecting a MaterialID to delete

As you can see in Figure CHANGEFIGUREVALUE, there are more options available to you, these are the options associated with Maintenance Mode, therefore you can find more information by reading the Maintenance Mode section of this user guide.

### Using Add Crew

Once you have entered the Add Crew functionality you will be asked to enter the following information:

Firstly, you need to enter a Project ID, this must be a numeric value, you can find the accepted Project IDs above the input location, select an ID from this list.


**Figure 74:** Visual representation of selecting a Project ID to proceed with selecting a project to add crew to

Next, you need to enter the Name of the crew member. Any value is accepted.


**Figure 75:** Visual representation of the application asking for a Crew members name

Next, you need to enter the Job Title of the crew member. Any value is accepted.

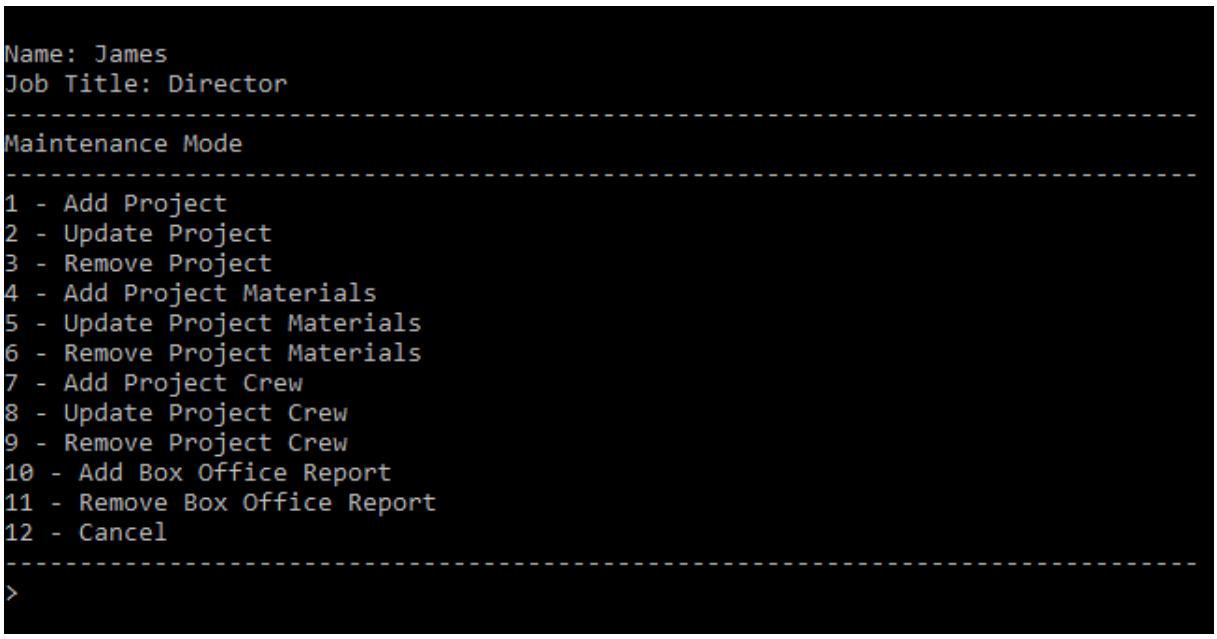


**Figure 76:** Visual representation of the application asking for a Crew members job title

As you can see in CHANGEFIGUREVALUE, there are more options available to you, these are the options associated with Maintenance Mode, therefore you can find more information by reading the Maintenance Mode section of this user guide.

#### Using Update Crew

Once you have entered the Update Crew functionality you will be asked to enter the following information:

Firstly, you need to enter a Project ID, this must be a numeric value, you can find the accepted Project IDs above the input location, select an ID from this list.

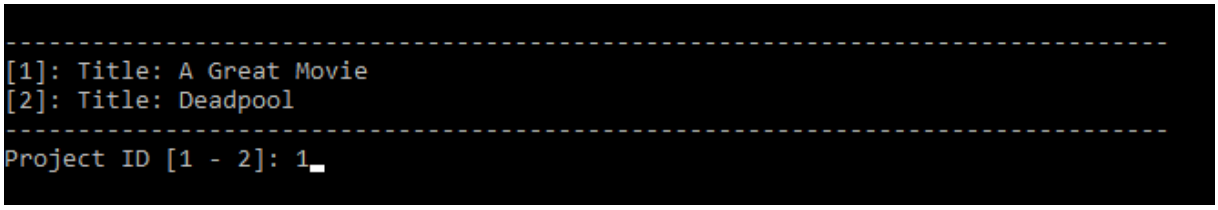


**Figure 77:** Visual representation of selecting a Project ID to proceed with selecting a crew member to update

Next, you will be asked to enter the crew identifer you wish to update within the previously selected

project, you can find the identifier in the provided list, an example of this can be found below:

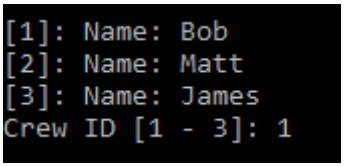


**Figure 78:** Visual representation of selecting a Crew ID to update the information for

Next, you will be presented with multiple options, you can use the following keyboard inputs to update certain aspects of the material, to find out more about each update, click the associated information link.

| Input Value | Command Action | Information Link |
|---|---|---|
| 1 | Inputting this value will cause the application to enter edit crew name | Edit Crew Name |
| 2 | Inputting this value will cause the application to enter edit crew job title | Edit Crew Job Title |
| 3 | Inputting this value will cause the application to navigate back to the maintenance mode menu | Maintenance Mode Menu |

**Edit Crew Name** Once you have entered the Edit Crew Name functionality you will be asked to enter the following information:

You need to enter the new Crew Name, this is the new name that you want your crew member to have. Any value is accepted.

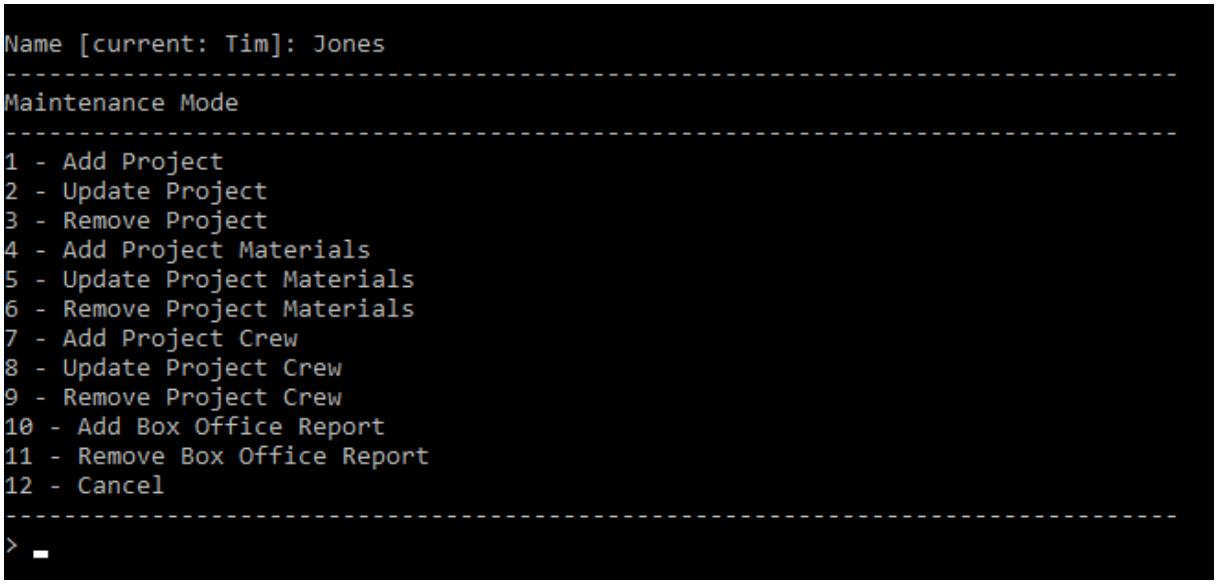


**Figure 79:** Visual representation of the application asking for a new Crew Name

As you can see in Figure CHANGEFIGUREVALUE, there are more options available to you, these are the options associated with Maintenance Mode, therefore you can find more information by reading the Maintenance Mode section of this user guide.

**Edit Crew Job Title** Once you have entered the Edit Crew Job Title functionality you will be asked to enter the following information:

You need to enter the new Crew Job Title, this is the new job title that you want your crew member to have. Any value is accepted.

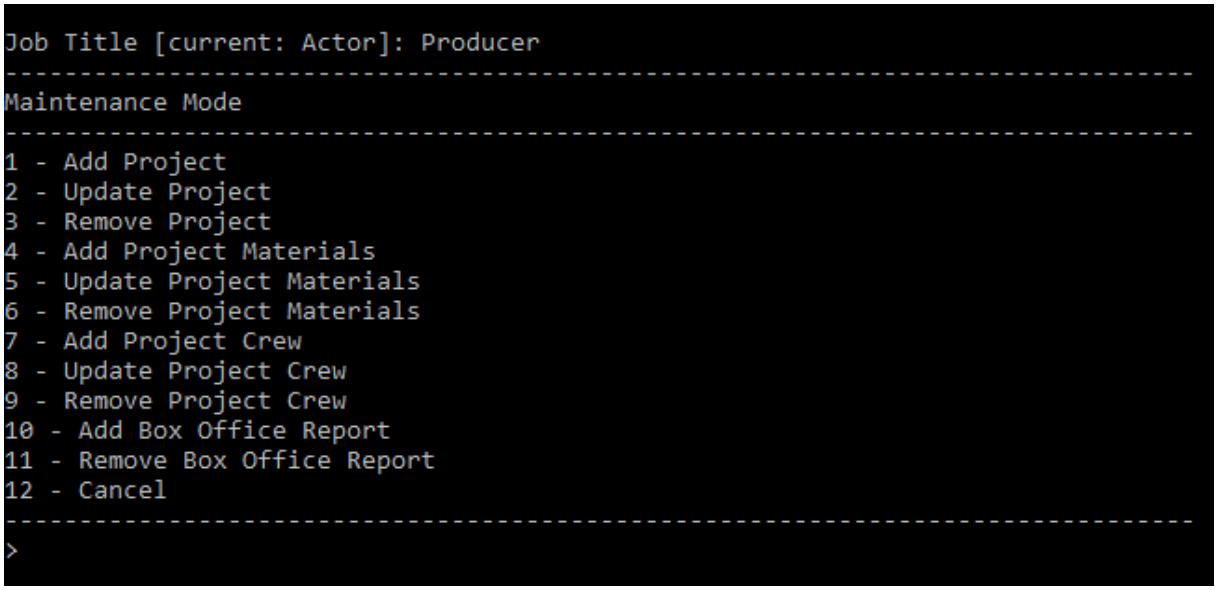


**Figure 80:** Visual representation of the application asking for a new Crew Job Title

As you can see in Figure CHANGEFIGUREVALUE, there are more options available to you, these are the options associated with Maintenance Mode, therefore you can find more information by reading the Maintenance Mode section of this user guide.

**Using Remove Crew**

Once you have entered the Remove Crew functionality you will be asked to enter the following information:

Firstly, you need to enter a Project ID, this must be a numeric value, you can find the accepted Project IDs above the input location, select an ID from this list.

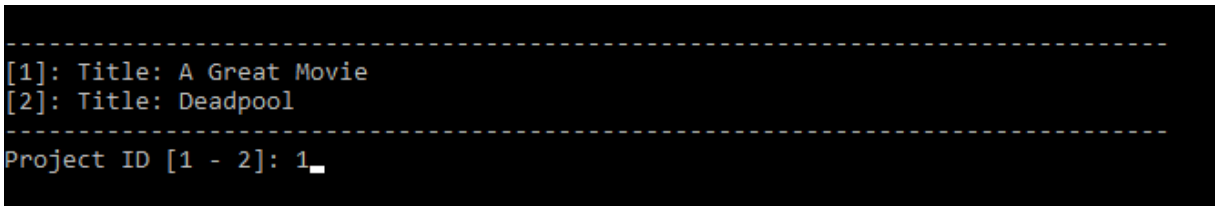


**Figure 81:** Visual representation of selecting a Project ID to proceed with deleting a crew member

Once you submit this Project ID you will need to select the Crew Member to select from the list of IDs above the input location, select an ID from this list.

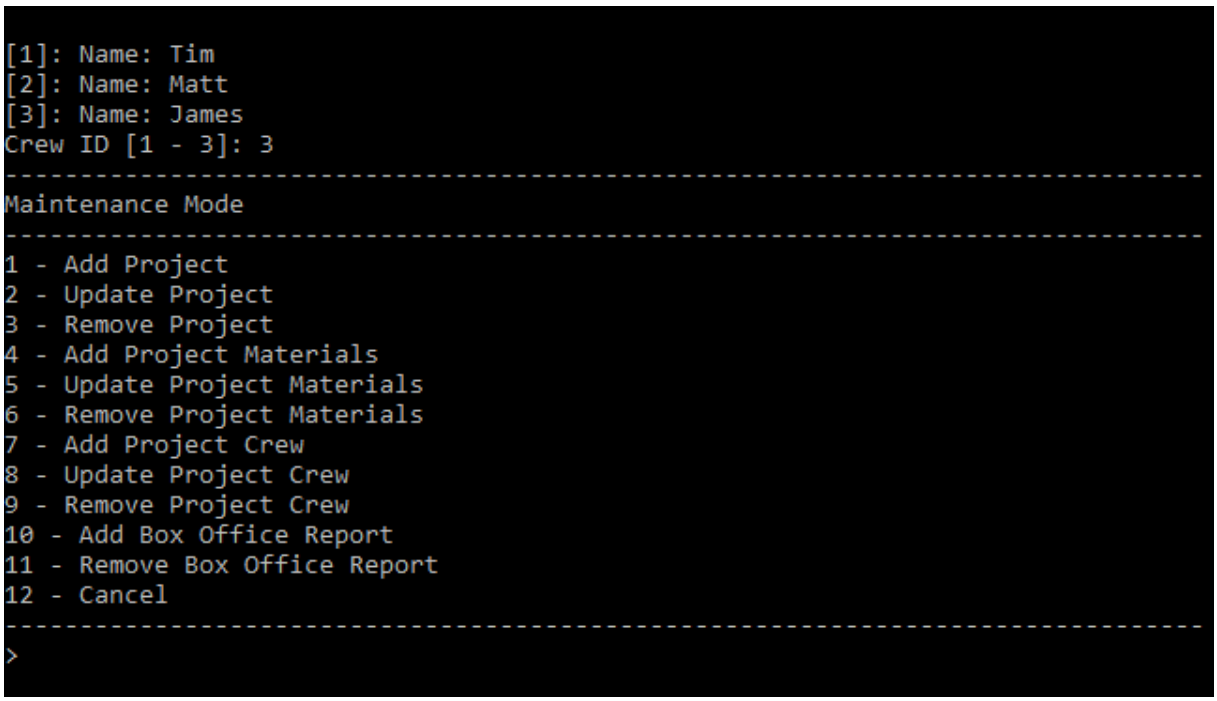


**Figure 82:** Visual representation of selecting a Project ID to update the project for

As you can see in Figure CHANGEFIGUREVALUE, there are more options available to you, these are the options associated with Maintenance Mode, therefore you can find more information by reading the

Maintenance Mode section of this user guide.

**Using Add Box Office Report**

Once you have entered the Add Box Office Report functionality you will be asked to enter the following information:

Firstly, you need to enter a Project ID, this must be a numeric value, you can find the accepted Project IDs above the input location, select an ID from this list.


**Figure 83:** Visual representation of selecting a Project ID to proceed with selecting a crew member to update

Once you have selected a Project ID you will be asked to enter the following information:

Next, you need to enter the Week Number, this is the week number that you want your box office report to relate to. Any numeric value is accepted.

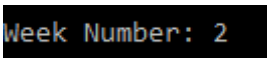


**Figure 84:** Visual representation of the application asking for a Week Number

Next, you need to enter the Revenue, this is how much money was made during the entered week. Any numeric value is accepted.

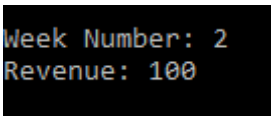


**Figure 85:** Visual representation of the application asking for a Revenue value

Next, you need to enter the Tickets Sold, this is the amount of tickets sold in the entered week. Any numeric value is accepted.

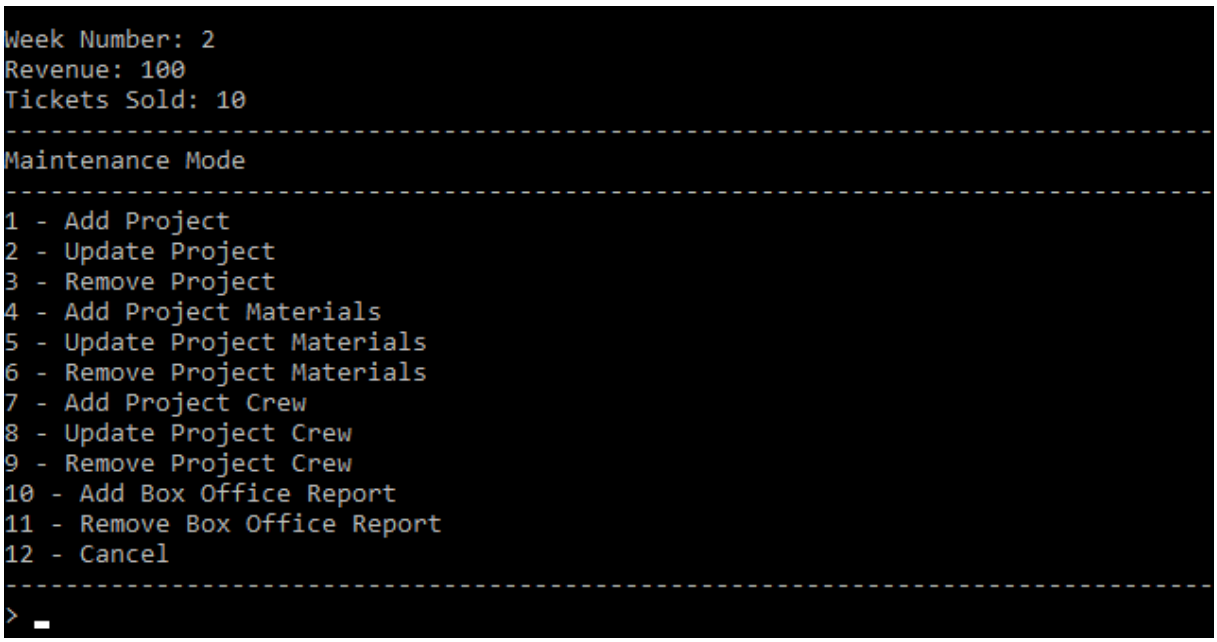


**Figure 86:** Visual representation of the application asking for a Tickets Sold value

As you can see in Figure CHANGEFIGUREVALUE, there are more options available to you, these are the options associated with Maintenance Mode, therefore you can find more information by reading the Maintenance Mode section of this user guide.

**Using Remove Box Office Report**

Once you have entered the Remove Box Office Report functionality you will be asked to enter the following information:

Firstly, you need to enter a Project ID, this must be a numeric value, you can find the accepted Project IDs above the input location, select an ID from this list.


**Figure 87:** Visual representation of selecting a Project ID to remove a Box Office Report for

Once you have selected a Project ID you will be presented with the associated Week IDs, you need to now select a Week ID from this list and it must be a numeric value.

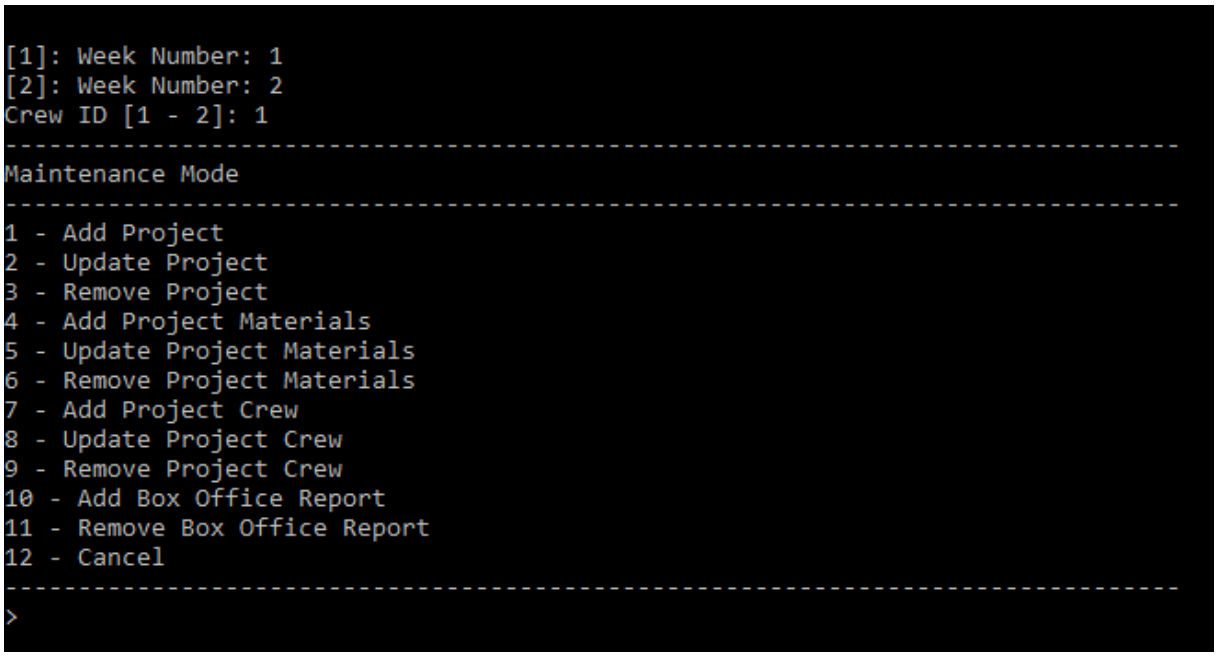


**Figure 88:** Visual representation of selecting a Box Office Report to delete

As you can see in Figure CHANGEFIGUREVALUE, there are more options available to you, these are the

options associated with Maintenance Mode, therefore you can find more information by reading the Maintenance Mode section of this user guide.

## Conclusion

Discussion and conclusion about your results (reflection on testing approach, reflection on performance such as computational efficiency, reliability, security, portability, maintainability, scalability, etc. design of system complexity using e.g. big O- notation).

# Appendix

## Managing group work

Whilst working on this project our group used a multitude of methods to ensure that we were collaborating efficiently and getting the most amount of work completed as possible, these methods included, but are not limited to:

- Using Facebook Messenger to converse with other group members about certain aspects of the program or documentation, this allowed us to keep in touch and ensure we were on track with the workload.
- Using GitHub to its full potential, this includes the use of GitHub Issues and Pull Requests in conjunction with code reviews for each major feature. Whenever a bug or issue was discovered the group member that uncovered the issue would create a GitHub issue. If the bug was within another group members individual work then that member would be added as a participant so that they could fix the issue. Once large features were added to the program, pull requests were used with each group member being requested to review the code before merging into the master branch.

Overall, our experience of working as a group has been productive and enjoyable, being able to distribute the workload across group members was an important aspect to the project and allowed us to complete it efficiently. We have all taken learning points from this experience that could be applied to the workplace, or even in our upcoming placements. For example:

- The use of GitHub's features (such as pull requests, issues and code reviewing) will be an excellent skill to have within the workplace, as more often than not, organisations will have some sort of code review system/Quality Assurance (QA) procedure in place and being able to understand how this all works without training will show that you are a competent employee.
- The use of a messaging platform was also important, sometimes organisations have employees working across the globe and having the ability to efficiently collaborate on messaging systems (such as Slack) is an important skill to have.

## Meeting Minutes

During group meetings a member was nominated to write minutes, these minutes were an important factor during the development of the application as they allowed us to go back and check what work we have all be allocated. On the following pages you can find the minutes for the aforementioned meetings.

# SDI Strand Group Meeting 1 | MINUTES

Meeting date | time 4th February | 11:00am | Meeting location Pavilion

Type of meeting: Introduction

Callum Axon (CA)
Callum Carney (CC)
Matthew Robinson (MR)

## AGENDA TOPICS

Time allotted | 10 minutes | Agenda topic SDI Introduction & Setup |

**It has been agreed by members that Software Design & Implementation Meetings are going to take place before the lecture which takes place on Mondays between 13:00pm and 14:00pm.** These meetings are likely to last up to an hour.

CA to create the GitHub repository that will hold all of the code for the project and documentation.

MR to create the project and commit the basic files to GitHub in which CA & CC can then clone the repo.

Time allotted | 5 minutes | Agenda topic Documentation formatting |

CA brings up the point of using LaTex instead of Microsoft Word for creating the documentation, CC & MR agree with CA.

CC brings up the possibility of using Pandoc with a LaTex template that will allow us to easily display code and documentation content easily as Markdown is supported.

CA and MR agree, CC to create the base documentation files and commit to git.

| Action items | Person responsible | Deadline |
|---|---|---|
| Create GitHub Repository | CA | ASAP |
| Create project and commit basic files | MR | ASAP |
| Create LaTex documentation files | CC | ASAP |

Meeting closed at 11:15 am.

**Figure 89:** Meeting 1 - Minutes

# SDI Strand Group Meeting 2 | MINUTES

Meeting date | time *18th February* | *11:00am* | Meeting location *Pavilion*

Type of meeting Progress Check

Callum Axon (CA)
Callum Carney (CC)
Matthew Robinson (MR)

## AGENDA TOPICS

Time allotted | *15 minutes* | Agenda topic *Progress of previous meetings action items* |

CA confirms that the GitHub repository has been created and our accounts have been added as collaborators.

MR confirms that the project files have been created and committed to git. MR shows CA & CC the structure of the project files.

CC confirms that the LaTeX files have been created and points CA & MR to a guide created by CC on how to setup LaTeX on their local machine in order to edit the documentation.

Time allotted | *5 minutes* | Agenda topic *Member allocations* |

CA states that we need to allocate member letters in accordance with the Spec.

CA agrees to be Member A, CC agrees to be Member C, MR agrees to be Member B

All members agree that we should start working on our individual tasks.

CC states that he will create a Facebook Messenger group chat in order for us to collaborate more efficiently.

| Action items | Person responsible | Deadline |
|---|---|---|
| Create Facebook Messenger group | CC | ASAP |
| Work on associated individual tasks | All | ASAP |

Meeting closed at 11:20 am.

**Figure 90:** Meeting 2 - Minutes

# SDI Strand Group Meeting 3 | MINUTES

Meeting date | time 4th March | 11:00am | Meeting location Pavilion

Type of meeting Progress Check

Callum Axon (CA)
Callum Carney (CC)
Matthew Robinson (MR)

## AGENDA TOPICS

Time allotted | 10 minutes | Agenda topic Checkup |

CC created the group chat and all group members have been collaborating.

MR shows the progress on his individual tasks, so do CA & CC.

All group members are happy with the current progress.

| Action items | Person responsible | Deadline |
|---|---|---|
| Work on associated individual tasks | All | ASAP |

Meeting closed at 11:10 am.

**Figure 91:** Meeting 3 - Minutes

# SDI Strand Group Meeting 4 | MINUTES

Meeting date | time 18th March | 11:00am | Meeting location Pavilion

Type of meeting Progress Check

Callum Axon (CA)
Callum Carney (CC)
Matthew Robinson (MR)

## AGENDA TOPICS

Time allotted | 10 minutes | Agenda topic Checkup |

CA shows the progress on his individual tasks, so do CC & MR.

All group members are still happy with the current progress and no interventions need to be made.

MR thinks that the group no longer needs to convene, unless the rate of progression decreases. CA & CC agree. Group meetings will no longer occur on Mondays.

| Action items | Person responsible | Deadline |
|---|---|---|
| Work on associated individual tasks | All | ASAP |

Meeting closed at 11:10 am.

**Figure 92:** Meeting 4 - Minutes

# SDI Strand Group Meeting 5 | MINUTES

Meeting date | time 8th April | 14:00pm | Meeting location Skype

Type of meeting Discussion

Callum Axon (CA)
Callum Carney (CC)
Matthew Robinson (MR)

## AGENDA TOPICS

Time allotted | 45 minutes | Agenda topic GUI discussion |

The group felt it necessary to convene in order to discuss the point of having a GUI versus a Command Line Interface.

The group discusses the possibility of using Qt for the GUI, amongst other potential GUI libraries.

MR brings up the point of the GUI being an optional point and that we should focus on other tasks before considering the implementation of a GUI.

CA & CC agree, CC brings up that the Specification states that for a first the application must have an "Detailed user interface and its instruction", this does not state Graphical User Interface. Therefore the group can still achieve a first without the implementation of a GUI.

All group members agree that a GUI should be held off and reconsidered later.

| Action items | Person responsible | Deadline |
|---|---|---|
| Work on associated individual tasks | All | ASAP |

Meeting closed at 14:45 pm.

**Figure 93:** Meeting 5 - Minutes

# SDI Strand Group Meeting 6 | MINUTES

Meeting date | time 23rd April | 10:00am | Meeting location Skype

Type of meeting Quality Assurance

Callum Axon (CA)
Callum Carney (CC)
Matthew Robinson (MR)

## AGENDA TOPICS

Time allotted | 7 hours 32 minutes | Agenda topic Quality Assurance |

The group felt it necessary to convene in order to perform the final checks on the completed Application and Documentation.

During this time some bugs were discovered and resolved and the final aspects of the documentation were put together and proofread by group members.

| Action items | Person responsible | Deadline |
|---|---|---|
| N/A | N/A | N/A |

Meeting closed at 5:32 pm.

**Figure 94:** Meeting 6 - Minutes

## References

("Top 6 Most Important Benefits of Mvc Architecture for Web Application Development Process" 2017)

"Top 6 Most Important Benefits of Mvc Architecture for Web Application Development Process." 2017. *Siya Infotech*. http://siyainfo.com/2017/01/16/top-6-important-benefits-mvc-architecture-web-application-development-process/.