Immersive Experiences for Zoos and Aquariums

Design Document

sdmay21-02

Client

True360

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Executive Summary

This document provides the overall design and plan that the group *sdmay21-02* will have taken in order to complete the project for our client, *True360*. The document is split up into six different sections, and each section describes a specific part of the project. The sections are as follows:

1. *Introduction* - This section introduces the project, explaining what it is, why it is needed, and what is required of our group.
2. *Project Plan* - This section describes how we go about completing the project during our second semester of Senior Design.
3. *Design* - This section illustrates the design of our project, both on the software side, and the visual side.
4. *Software Testing* - This section describes how our project is tested to ensure correct functionality, both with automated and manual testing.
5. *Development Process and Implementation* - This section describes the implementation and development of what we created during the spring 2021 semester. It also entails how the design changed and evolved throughout the project lifecycle.
6. *Closing Material* - This section ties all the previous sections together, and includes any miscellaneous information that did not fit in any other sections.

Development Standards & Practices Used

Technology used in this project:

- Node.js
- Electron
- React
- Registry Editing
- Mocha/Sinon/Chai
- Python unittest module
- Postgres Database
- Spectron
- Postman
- Django

Engineering Practices:

- Follow all best practices for security, ensuring that user data is secure and encrypted
- Code should be written in a way that it is easy to maintain and understand
- Test Driven Development will be conducted
- All code and changes must undergo a peer review by at least other developers

Engineering Standards:

- IEEE/ISO/IEC 24748-5-2017 - ISO/IEC/IEEE International Standard - Systems and Software Engineering--Life Cycle Management--Part 5: Software Development Planning

- IEEE/ISO/IEC 23026-2015 - ISO/IEC/IEEE International Standard - Systems and software engineering - Engineering and management of websites for systems, software, and services information
- IEEE 1016-2009 - IEEE Standard for Information Technology--Systems Design--Software Design Descriptions

Summary of Requirements

- Create a cross-platform desktop application that allows users to upload WOW! Moments to various platforms by uploading the video and accompanying information within the application.
- Create a centralized web server that allows for communication between True360 and various zoos and aquariums.

Applicable Courses from Iowa State University Curriculum

List all Iowa State University courses whose contents were applicable to your project.

- COM S 228
- COM S 252
- COM S 309
- COM S 319
- COM S 327
- COM S 329
- COM S 339
- COM S 363
- COM S 409
- CPRE 230
- CPRE 231
- COM S 491
- COM S 417

New Skills/Knowledge acquired that was not taught in courses

List all new skills/knowledge that your team acquired which was not part of your Iowa State curriculum in order to complete this project.

- Electron
- React-Bootstrap
- API Development
- Functional Testing
- Code Reviews
- Product Deployments
- Cybersecurity Practices
- Usability Testing

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Definitions:

WOW! Moments - Video moments when animals are doing something out of the ordinary in which the general public would enjoy seeing.

1 Introduction

1.1 Acknowledgement

We would like to thank the following individuals for assisting us in the completion of this document. Without their contributions, we would not have been able to complete it.

True360:

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- Sari Lewinsky
- Wyman Martinek

Iowa State University

- Akilesh Tyagi
- Thomas Daniels
- Alexander Stoytchev

1.2 Problem and Project Statement

Problem:

True360 aims to provide an immersive experience for customers going to zoos and aquariums. They do this by creating special moments called "WOW! Moments". These WOW! Moments are recordings from within a zoo or aquarium exhibit that signify something interesting happening. True360 provides the WOW! Moments to Zoo customers in the form of 360 degree video. The Zoo can then take the moment, and either share it through VR headsets at the zoo, in order to provide an immersive VR experience, or they can publish the video on various social media platforms to encourage customers to come to the zoo.

Unfortunately, there is a problem in that there is no way to publish these videos easily across multiple platforms within a user-friendly desktop application, while also allowing True360 to be a part of the publishing process. Current solutions fail to address all use cases needed by True360. True360 needs a way to be able to track which of the WOW! Moments have been published, and be able to obtain insights into video metrics such as views, likes, number of comments, and more. Without this, True360 isn't able to engage their business customers, and prove that these WOW! Moments are actually a valuable product, and eventually, it could cause True360 to lose customers.

Creating a way for users to upload WOW! Moments that is easy to use, extendable in functionality, and that allows True360 to tailor to their own specifications is crucial to the business needs of True360.

Project Statement:

To solve this problem, we developed a cross-platform desktop application that will allow users to publish videos to certain social media platforms. Users will be able to use the app to upload a video from their computer, select the desired platform, and fill out information about the video. Quality of life is improved for the user due to no longer needing to interact with all the websites of the different platforms they might want to publish on, or no longer needed an additional license with a third party publishing product. By creating a product unique to True360, the company is able to be involved in that publishing process.

We also created a database and centralized cloud server to hold publication data. This allows True360 to know exactly where WOW! Moments are being published. They are able to query APIs for these publishing platforms and provide analytics to businesses to optimize their upload strategies. This creates a better relationship between True360 and their customers, ensuring a positive experience for all parties involved.

1.3 Operational Environment

We developed a desktop application that can run on both Windows 10 and MacOS Catalina in a business environment. The on premises server is handled by the zoo in a controlled environment with heat dissipation and dust filtering.

1.4 Requirements

General:

- Automated tests will be run on the systems before it is deployed to production.
- All features and code within the systems will be documented with comments within the code.
- All code must be approved by at least 2 other developers before being merged into a codebase.
- All UI designs will be approved by True360 before they are submitted to production.

Cloud System:

- Create a cloud based Django web server that is able to receive HTTP POST requests from the desktop app that contain video publication data.
- Create a cloud based Postgres database that the cloud based Django web server can store information from the HTTP Post requests messages.
- Contains a */publish* POST endpoint that adds a published video to the Postgres database
- Create a cloud based process that runs daily to retrieve views, likes, and shares from all the videos that were published through the True360 Desktop Application across multiple social media platforms.
- Contains a */support* POST endpoint that receives a name, description, and application version number, and then formats and sends the information in an email to support@true-360.com
- Contains a */requestEdit* POST endpoint that receives a video ID/Title, and associated zoo, and formats and sends the information in an email to edit@true-360.com

Desktop App:

- Desktop Application can run on Windows 10 and MacOS Catalina
- Allows users to publish a selected video to YouTube, Facebook, and Vimeo in the optimal video format for each platform.
- Allows users to configure login credentials to multiple accounts per platform, and then select a specific account when publishing
- The Desktop Application will be built in Electron to offer cross compatibility on MacOS and Windows
- API keys and passwords for connected publishing platforms will be encrypted and hashed using the NIST standard and stored on the Network Share Server
- Desktop app will automatically update when the user launches it if update is available
- Desktop app will hit the */publish* endpoint on the cloud web server on successful video publish. It will supply the video URL
- Uninstallation of the Desktop Application should remove all the files associated with the Desktop Application on the user's computer, but keep the corresponding information within the cloud database.

- Users that have the Desktop Application will have an option in the Application to send a support request to the cloud based web server that will notify the necessary individuals of the support request by sending a */support* POST request to the cloud web server.
- The Desktop Application will include a "Support" section to aid users in understanding how to properly use it.
- Users should be able to submit "project" requests to True360 through the cloud based web server at */requestEdit* that notifies the editing team certain videos they would like True360 to edit.

Non-Functional Requirements:

- The product shall appear easy and simple to use.
- The product shall perform swiftly for the user.
- The product shall be usable by users with limited computer experience.
- The product shall be built to anticipate any future software updates.
- The product shall not display any offensive terms or symbols.
- The product shall comply with each social media platform terms of service.
- The product shall be built to last.

1.5 Intended Users and Uses

To attain an end product that performs well and provides the best user experience, we must make sure that we fulfill the uses and needs of the users specified below.

Intended Users:

- Zoo/Aquarium Management
- Zoo/Aquarium Staff
- True360 Administration

Intended Uses:

- Uploads 360 captured camera footage of animals (WOW! Moments) to specified media platforms.
- Extendability to add additional social media platforms.
- Documentation of the video publication data.
- View the analytics of the video publication data.
- Email True360 "Project Edit Requests" with selected video(s).

1.6 Assumptions and Limitations

Assumptions:

- Users will have either the latest versions of Windows 10 or MacOS Catalina installed.
- True360 app will be extensible to support other social media and VR kiosks.
- True360 app will be easy and seamless for the user experience.
- Detected WOW Moments! will already be stored on the zoo's local server.
- End users will know how to navigate to their directory to find the videos.
- End users have existing social media accounts to publish videos to.
- Zoos will have enough internet bandwidth to successfully upload 8k resolution videos.
- The end product will eventually be deployed across multiple zoos in the US.

Limitations:

- There is no budget for developing the True360 app.
- The end product will not support mobile OS.
- Most of the development team has little to no experience developing Electron apps.
- True360 app is limited to the Electron framework.
- True360 app is not guaranteed to work with older builds of supported OS's.
- The end product will only be used by zoos in the US and that are contracted with True360.

1.7 Engineering Standards

In the project we will have certain engineering standards to follow to ensure quality. Refer to appendix C for information on how to access these standards.

IEEE/ISO/IEC 24748-5-2017 - ISO/IEC/IEEE International Standard - Systems and Software Engineering--Life Cycle Management--Part 5: Software Development Planning

- This standard applies to our project throughout the planning and design of how our application will be built. It details how to plan the development throughout the project life cycle and how to complete it.

IEEE/ISO/IEC 23026-2015 - ISO/IEC/IEEE International Standard - Systems and software engineering - Engineering and management of websites for systems, software, and services information

- This standard applies to how our visual layout of the application should be designed. In the standard it mentions how certains measures should be taken to make everything readable and how to design color-blind friendly color schemes.

IEEE 1016-2009 - IEEE Standard for Information Technology--Systems Design--Software Design Descriptions

- This standard applies to representing a software design for recording the design information and communicating the relevant information to design stakeholders, most notably the client.

1.8 Expected End Product and Deliverables

A desktop-based commercial application that will streamline the zoo employee experience for publishing WOW! Moments to various social media platforms. The application will be installed via an ease-of-use downloadable installer which will deploy the software onto the employee's machines, and it will be designed to work on both Windows 10 and Mac OS Catalina. Once installed, the user will be able to access WOW!

Moments in a shared drive on their local network which is connected to the True360 server located at the zoo.

Once in the server's WOW! Moment directory, the user will be able to upload any mp4 files generated by the True360 system and have the True360 Desktop Application to publish that video. If the user decides to publish a video, a user will be able to add context information and the video will be published to the platform of choice. From this context menu the user will also be able to send True360 personalized support requests as well as configure their social media account configurations..

There will only be one initial configuration aspect of the application which will be to link the app with the zoo's social media accounts. This configuration will live on the True360 server at the zoo and all computers that have the True360 software installed will access this file. This will allow for the configuration process to be efficient for the end-user. The application will then receive updates to both improve the user experience and to provide any security fixes. This software will be delivered by the end of April 2021.

2 Project Plan

2.1 Task Decomposition

Project Goal:

True360 has tasked us with creating a desktop application for zoos that are partnered with True360. The Desktop Application will allow for employees at the zoo to publish videos that are "WOW" moments to the zoo's corresponding social media platforms and also maintain a database of publishing data that lives within True360's AWS cloud account.

Elements of the Overall System:

Desktop Application:

The Desktop Application will be the tool that employees at the zoo will use to publish their videos to their corresponding social media platforms.

AWS Cloud Account:

The AWS Cloud Account will be the centralized area where the publishing data will be stored so that True360 can monitor usage of the Desktop Application.

On Premises Server:

The On Premises Server holds the video files that can be published as well as configuration files that will link their social media accounts to their Desktop Application.

Tasks:

Source Control Setup:

- Create Repositories for Desktop Application Code and Cloud Based Scripts
- Create Branching Strategy for Each Repository

Cloud Environment Setup:

- Setup Virtual Machine what will Run the Cloud Based Web Server
- Setup Postgres Database that is able to be Linked to Cloud Based Web Server
- Create Recurring Process to Retrieve Interaction Data with Videos Published through True360 Desktop Application

Desktop Development and Testing Environment Setup:

- Setup Testing Environments for Mac OS Catalina and Windows 10 Operating Systems
- Build Basic Electron App that Each Team Member can Test on their Machine
- Organize Code for Electron App in Source Control Repository into Front-End and Back-End Categories

Backend Desktop Application Development:

- Develop Backend of Desktop Application to Send HTTP Post Requests to Localhost Server
- Change Basic HTTP Post Requests to Send Requests to Cloud Based Web Server

Cloud Web Server Development:

- Develop Web Server to Receive HTTP Post Requests with Multiple Endpoints
- Develop Process to Ingest Basic Data Into Cloud Based Postgres Database

Testing of Desktop Application Linked with Cloud Web Server and Database:

- Create Action Button in Desktop Application to Send Basic HTTP Post Request to Cloud Based Web Server
- Test Ingesting of Basic HTTP Post Request to Cloud Based Postgres Database from Cloud Based Web Server

Social Media API Integration Development:

- Develop Basic Publishing of Video to Youtube, Facebook and Vimeo Using Each Platform's API
- Develop HTTP Post Requests to Send Responses of Successful/Failed Publishing to Cloud Based Web Server

Cloud Database Schema Design for Social Media Response Messages:

- Create Table Designs for Each Social Media's Response Message
- Create Specific Endpoints for Each Social Media Response
- Create Ingestion of Each Social Media Endpoint Into Cloud Based Postgres Database

Mac OS Catalina and Windows 10 Installer Generation:

- Test Installer Generation for Mac OS Catalina and Windows 10
- Test Installation on Mac OS Catalina and Windows 10
- Test Uninstallation on Mac OS Catalina and Windows 10
- Test Desktop Functionality on Mac OS Catalina and Windows 10

Develop CI/CD Process for Updates to Desktop Application:

- Develop Process to Check Version of Desktop Application with Latest Version of Code Base in Source Control Repository
- Develop Process to Either Update Application Immediately or Delay Update

Develop Process for Building Social Media Configurations:

- Develop Process to Retrieve Social Media Configurations from Network Share Server
- Develop Process to Add Multiple Accounts for Each Social Media Platform

Develop Process for Parsing Social Media Configurations:

- Develop Process to Parse Social Media Configurations that Allows Users to Publish to Corresponding Social Media Platforms

Develop Process for Updating Social Media Configurations:

- Develop Process for User's to Update Their Social Media Configurations

Create UI That is Linked to the Backend Functionality of the Desktop Application:

- Implement Designs of UI
- Link Action Buttons to Backend Functionalities

Test Functionality of Entire Desktop Application and Cloud Based System Working Together:

- Test Functionality of Desktop Application Using UI for Each Social Media Platform
- Test Functionality of Cloud Based Web Server and Ingestion of Data Into Cloud Based Postgres Server
- Test Functionality of Daily Process that Retrieves Interaction Data for Each Video Published Through True360 Desktop Application

2.2 Risks And Risk Management/Mitigation

The scores associated with each risk is the percentage chance of affecting the project negatively. The risks with a score of **0.5** or above will have a risk mitigation plan associated with the risk.

Risks

- There is no budget for developing the True360 app: **Score 0.2**
- The end product will not support mobile OS: **Score 0.1**
- Most of the development team has little to no experience developing Electron apps: **Score 0.6**
    - *Mitigation Plan:* The Desktop Team will create a basic Electron application in the beginning to better understand how to move forward with Development during the rest of the project.
- True360 app is limited to the Electron framework: **Score 0.4**
- True360 app is not guaranteed to work with older builds of supported OS's: **Score 0.3**
- The end product will only be used by zoos in the US and that are contracted with True360: **Score 0.2**
- The Desktop Application will rely heavily on the strength of the internet connection at the zoos: **Score 0.4**
- The Desktop Application will rely on the user's computer resources for video processing and social media uploads, which will require a computer with good processing speed: **Score: 0.4**
- Development process may be modified due to the pandemic: **Score 0.5**
    - *Mitigation Plan:* The team has designed the project and project timeline in mind with the idea that we will not be meeting in person, and all communications and meetings will be online.
- Iowa State University goes online and the team now has to work remotely from Ames: **Score 0.5**

    - *Mitigation Plan:* The project team will not be greatly affected by this due to the project not needing to deal with any hardware as it is solely software-based. The team will all be able to find internet access outside of Ames.
- The client, True360, is shut down: **Score 0.1**
- The team members working on this project change: **Score 0.2**
- Team does not have the prior experience necessary for the complexity of this project: **Score 0.4**
- Team has personality clashes which leads to problems with management: **Score: 0.3**
- Team has the wrong approach to completing the project: **Score: 0.3**
- Team uses the wrong programming language in completing the project: **Score: 0.3**
- Team members are unable to perform to the best of their ability (e.g. low motivation, become ill): **Score: 0.1**
- Team mismanages the project tasks: **Score: 0.4**
- A team member drops the class and we have fewer people to complete the project: **Score: 0.1**
- The client tries to change the requirements of the project on us: **Score: 0.3**
- The team experiences feature creep in the development of this project: **Score: 0.4**
- The time it takes to complete tasks has been underestimated: **Score: 0.3**
- Features are implemented poorly and lead to more work than expected: **Score: 0.3**
- The team fails to communicate effectively between its members: **Score: 0.1**
- The team fails to communicate effectively with the client: **Score: 0.1**
- The end product will be rejected by users: **Score: 0.3**
- The team does not have access to the necessary resources to complete the project: **Score: 0.2**
- The team does not have the financial resources necessary to complete the project: **Score: 0.1**
- The team experiences technical difficulties that disrupt the project development: **Score: 0.2**
- The team experiences internet outages that disrupt the project development: **Score: 0.1**
- The APIs used for social media platforms could change: **Score: 0.3**
- The desktop application does not comply with each social media platform terms of service: **Score: 0.2**

2.3 Project Proposed Milestones, Metrics, and Evaluation Criteria

The milestones are derived from the tasks in section 2.1. Since we are building the system from the ground up, these are our milestones and evaluation criteria:

Phase 1: Environment Setup with Managed Source Control Process

- Source Control Setup: The application will be maintained with a git repository and any merge requests will be approved.
- Cloud Environment Setup: Setting up a database that will be hosted on the cloud.
- Desktop Development and Testing Environment Setup: Setting up testing environments so that the application can be tested thoroughly across each developers system.

Phase 2: Basic Functionality Development

- Backend Desktop Application Development: Develop backend to send HTTP requests to the local server.
- Cloud Web Server Development: Develop a cloud web server to receive HTTP post requests.
- Testing of Desktop Application Linked with Cloud Web Server and Database: Set up basic testing of sending data to the web server.

Phase 3: Finalizing Advanced Functionality Development

- Social Media API Integration Development: Basic publishing of videos to various social media using their API.

- Cloud Database Schema Design for Social Media Response Messages: Creating specific endpoints for each social media response.
- Mac OS Catalina and Windows 10 Installer Generation: Testing installation and functionality on Windows/MacOS.
- Develop CI/CD Process for Updates to Desktop Application: Checking for application updates.
- Develop Process for Building Social Media Configurations: Developing a process to retrieve configurations and adding multiple accounts for each social media platform.
- Develop Process for Parsing Social Media Configurations: Developing a process to parse social media configuration.
- Develop Process for Updating Social Media Configurations: Developing a process to allow users to update social media configuration.

Phase 4: Complete Functionality with UI Development and Testing

- Create UI That is Linked to the Backend Functionality of the Desktop Application: Create a UI that end users will interact with that is linked to the desktop application backend.
- Test Functionality of Entire Desktop Application and Cloud Based System Working Together: Testing functionality for the UI linked with multiple social media platforms, video data analytics retrieved and ingestion of data into the cloud.

2.4 Project Timeline/Schedule

The following timeline is the anticipated timeline of how our team plans to complete this project. The different colors represent different phases of the project throughout its development lifecycle. Each task is assigned to either the Cloud Team or Desktop Team, as well as tentative team member assignments. Each task also shows the tentative start and end dates.

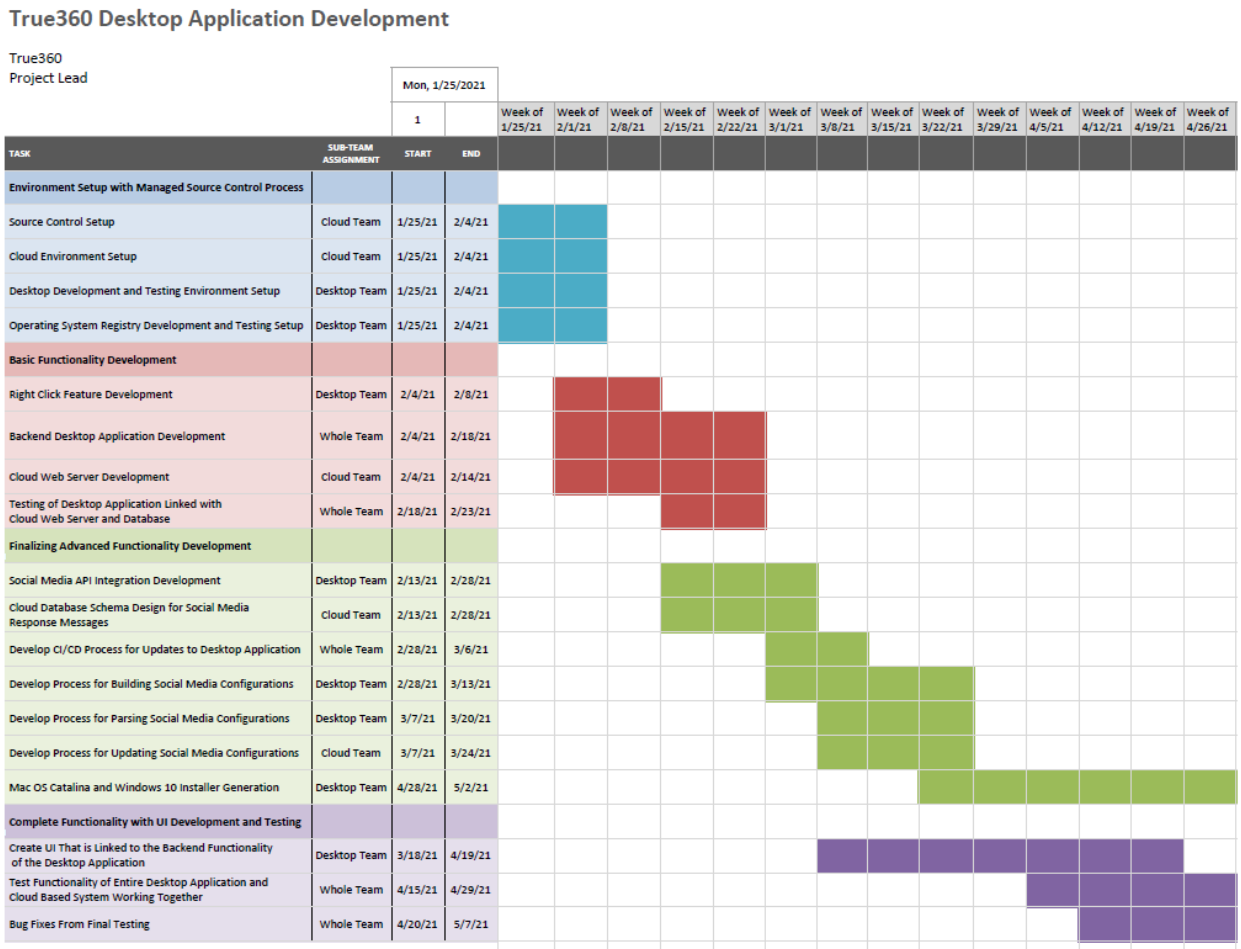


Figure 2.1. Gantt Chart of the Project Development Timeline

2.5 Project Tracking Procedures

The 3 major tools that our group will use to track progress throughout the lifecycle of this project include Slack, Pivotal Tracker, and Gitlab.

In order to communicate effectively, our group will use Slack to communicate. This will allow us to determine when to schedule team meetings, advisor meetings, and meetings with True360 to keep them informed. This will also allow for quick, informal communication to troubleshoot and resolve any problems, instead of waiting until the next meeting to bring the issue up.

In order to stay on track with our project timeline, we will be using Pivotal Tracker, a tracking tool similar to Trello. This will allow us to create stories to work on and keep track of what needs to be done and what is done. In addition, we will be able to brainstorm ideas as well as assign and prioritize certain tasks.

In order to keep the group's software uniform and up to date, we will be using Gitlab. This will allow us easy access to update, manage, and receive the latest revisions of the project's code. Additionally, it will allow for the group to resolve merge conflicts and allow for any changes in the code to be approved by other developers.

2.6 Personnel Effort Requirements

In order to keep track of effort levels for a task, we will be assigning each task with a number of hours to complete the task. These hours are generally assumed to be for the task overall, rather than per team

member. Depending on the task, this means that if a task can be completed by one person in 2 hours, but everyone in the group has to do it, it will be listed as 14 (2 hours * 7 team members) hours. These numbers also include the hours put into creating automated tests for the feature, as necessary.

Each member of the team is expected to complete approximately 6-8 hours of work per week.

Table A

Task	Effort Level (hours)	Explanation
Source Control Setup	14	Source Control is a simple process, and we all have experience with this, so we have assigned it 2 hours per member.
Cloud Environment Setup	10	The cloud environment needs to be deployed in a place that is accessible, but is otherwise a simple process that will take approximately 3 hours for 3 members.
Desktop Development and Testing Environment Setup	20	The desktop environment is similar to the cloud environment setup, but slightly longer since it includes the testing environment.
Operating System Registry Development and Testing Setup	12	Editing the registry can be a difficult task, but it is still simple in scope, thus it is given 12.
Right Click Feature Development	6	Once it is known how to edit the registry, adding a registry key for a right click feature becomes a simple task.
Backend Desktop Application Development	60	The bulk of development for the desktop application is done within this task, and since it contains a large number of features, it will take 60 total hours.
Cloud Web Server Development	60	Similar to the backend desktop application, the cloud web server will also take a similar number of hours, since it is large in scope.
Testing of Desktop Application Linked with Cloud Web Server and Database	8	Since most of the testing is done when different functions are created, this task will have the majority of work already finished,

		with it needing minor additions.
Social Media API Integration Development	36	This task is largely dependent on the number of platforms, but it is estimated that it will take 12 hours for each of the 3 platforms we will support.
Cloud Database Schema Design for Social Media Response Messages	8	The database we will be using for social media will be simple, but it still requires thought. This should take 2 members about 4 hours.
Mac OS Catalina and Windows 10 Installer Generation	10	Electron supports creating installers, but we will need to edit this slightly by including editing of the registry keys, which will take slightly longer than the custom out of the box Electron installers.
Develop CI/CD Process for Updates to Desktop Application	10	Setting up the CI/CD will need to be done for both the desktop application and cloud server, but it is a straightforward process for anyone that has created a CI/CD pipeline before.
Develop Process for Building Social Media Configurations	30	This task is slightly more complex than other tasks because it requires taking into account many different other tasks.
Develop Process for Parsing Social Media Configurations	8	Assuming the configurations are made with a standard notation such as JSON, parsing is simple. It is assigned a few more hours to account for any errors that come up with the config associated with our code.
Develop Process for Updating Social Media Configurations	10	Once we know how to parse a configuration, we will be able to update it, but we will need to figure out what information needs to be updated.
Create UI That is Linked to the Backend Functionality of the Desktop Application	45	The UI requires more care since it is a product that will be given by a company. This requires it to be modern, and have significant research done into ensuring everything is working correctly.

Test Functionality of Entire Desktop Application and Cloud Based System Working Together	15	This task assumes that most functions are already tested via automated testing, but it requires more hours to ensure that we have covered all edge cases, and put the product through QA.

Table A. Tasks and Corresponding Effort Levels

2.7 Other Resource Requirements

Other resources that are required to complete this project include:

- Access to an AWS Web Server
- Access to an AWS Storage Bucket
- Access to a Central Database
- Designated Social Media Accounts for Testing Purposes
- Testing VMs for Mac OS and Windows 10
- Online Material and Information for Programming and Development Purposes

2.8 Financial Requirements

No financial resources will be required to complete the project.

3 Design

3.1 Previous Work And Literature

In order to know that we are not "reinventing the wheel" we have compared our proposed project, the "True360 Publishing System", to other products that perform a similar function.

	Hootsuite	Adobe Premiere Pro	Final Cut Pro	True360 Publishing System
Product Description	Social Media Management platform	Video editing software	Video editing software	Social Media publishing platform
Advantages	Already developed for use, multiple partners and thoroughly tested.	Able to edit videos and upload in the same program.	Able to edit videos and upload in the same program.	Unique to True360, more 1-on-1 support scenarios and can tweak to specific user needs.
Shortcomings	To upload to certain sites (i.e. YouTube) it requires a premium subscription	It is a video editor software that can require a large sum of money to obtain.	It is a video editor software that can require a large sum of money to obtain.	Developed by a group of college students rather than professional engineers, some of whom have little experience developing such a product.
Differences	Global platform used by many businesses for social media management.	Has video editing	Has video editing	Application unique to True360 and their customers.

Table B. Proposed Project and Similar Products Comparison*

*References for Hootsuite, Adobe Premiere Pro, and Final Cut Pro can be seen in section 6.2

3.2 Design Thinking

In order to know how to design this system, we needed to discuss the various social media platforms that users are publishing their content to, the metadata that should be included with the video files and also the different OS platforms our software should support. The zoo users have a lot of influence on the design because they are ultimately the ones who are going to be using it. For example, we want the interface to be easy to use for non-technical zoo users. Since zoos in general are not very technical, we have to accommodate our design to that and therefore build our application in such a way that it is easy for the zoos to understand.

Some of the other design ideas that have come up was making the system only web based with no installer, having users install an Electron app, having no app to install and using just the context menus from the OS. We ultimately settled with using Electron since it is cross platform and allows development of UI and editing registry files for the context menu. Other problems we ran into was how we would handle updating

our app or how the zoos would handle updating apps on their systems because of security reasons. All of this affected our design thinking and process.

Our client also wanted the app to be built a certain way so we had to come up with a way that satisfied what the client was envisioning, but also design our app in a way that was possible within our experience. During our project planning phase, we had to clarify the requirements with our client in order to move onto the design phase of how we think our app would capture what the client wanted. Originally, the client wanted to include video editing and other features to our software, but it was out of scope of our experience and also not particularly relevant to the main design of what our app is supposed to do. Therefore, during our design thinking phase, we settled with what would best fit the requirements.

3.3 Proposed Design

Desktop Application

- The True360 Desktop Application will be made using Electron.
- Users will be able to open relevant files using the True360 Desktop application
- We will use NodeJS for this application
- Available on MacOS and Windows
- This Desktop application will publish to multiple platforms such as Youtube, Facebook, and Vimeo.

Cloud and Database

- We need a place to store these videos' information
- The application will send notifications to the server when a video is published

Benefits of Mentioned Practices

- NodeJS is a simple language to use and the team has adequate knowledge on it.
- MacOS and Windows will give True360 the ability to benefit from consumers who use both OS's.
- The Database will allow True360 to monitor and record the videos being published in their brand's name.
- Being able to publish on multiple platforms will allow for more exposure for the videos to be seen and published.

Testing

- AWS experimentation and research
- Electron Application

3.4 Technology Considerations

Team Experience

In order to determine what technologies to use, our team needs to recognize the strengths and weaknesses in our team experience, then see the potential trade-offs between them.

Strengths:

- Front End development experience
- IoT development experience
- Networking experience

Weaknesses:

- Have no experience with using the social media APIs
- Have little experience with developing/deploying/updating executables

Trade-offs:

- We have enough experience to complete the majority of the software
- Our weaknesses can be overcome by studying the necessary resources

Knowing this, our team has several possible solutions and design alternatives to remedy these constraints.

Possible Solutions and Design Alternatives:

- Find a software package that can simplify the process of helping create the app
- Use an application API to aid in performing updates

Technology

In the process of finding a solution to the clients problem, we came up with two possible solutions. One of them is a web application while the other is a desktop application.

Web Application

Strengths:

- No need to deliver updates to all clients
- No need to create an installer
- No need to create application for different platforms
- UI will need to be created and tested

Weaknesses:

- No direct access to zoo server filesystem
- Will need to handle high-volume video compression and streaming

Trade-offs:

- Needs to handle video streaming

Desktop Application

Strengths:

- Direct access to server file system
- UI will need to be created and tested

Weaknesses:

- Installer will need to be created for each platform
- Updates will need to be delivered to the application

Trade-offs:

- Needs to be updated and installed on users' machines
- Needs to work with native OS

A desktop application also led to a follow-up technology discussion, the type of software to use, which eventually reduced down to whether or not to use Electron or UI native to the OS.

Electron

Strengths:

- Works with languages our team is familiar with using
- Will only have to make one application to run on multiple OS's
- Automatically updates to the latest version

Weaknesses:

- Our team has not directly used Electron in the past

Trade-offs:

- Need to spend more time designing a UI
- Not guaranteed for an UI to look good

Native OS

Strengths:

- Guaranteed to work with an OS

Weaknesses:

- Our team is unfamiliar with creating native applications
- Have to directly edit the registry

Trade-offs:

- Will have to make different applications to run with each native OS
- More complex to create than an Electron app

3.5 Design Analysis

Overview

The process of designing the systems for the True360 Desktop Application took many different turns during the ideation process. There were concerns of developing within new frameworks and also across different operating systems. These concerns were quite large in the beginning which had the team worried about how we were going to accomplish this goal. In the end, we settled on the Desktop Application due to the research that was conducted for each possible option that our team had brainstormed. Below is a list of possible solutions and reasoning as to why they would or would not work.

Completely Web Based Application

Due to the concerns of developing a desktop application, the first pivot was to create a web based application. There were many pros and cons for this, but there were just as many for the desktop application. The main reason as to why the web application was not chosen was due to the uploading of

large video files to the cloud. For this reason, the Web Application idea needed to be scrapped and head back to the drawing board.

Complete Desktop Application with No Outside Internet Contact

Since the Web Application had troubles with uploading the videos, the next approach was to try and figure out how to integrate the desktop application completely based on the network at the zoos. This was a good approach for the videos living in an on premises database but lacked the ability for True360 to monitor usage of their application. This was a large part that True360 would have liked to have so we needed to head back to the drawing board.

Intermingled Desktop Application with Web Based Functionalities

The final idea that was settled upon was to build a desktop application that sent certain information to a cloud based system. This way, the video uploading problem would be solved and True360 could have visibility as to how much their system was being utilized.

Final Design Choices

The final product that will be delivered is a desktop application that allows zoo employees to easily upload their "WOW!" moment clips to their social media platforms. Behind the scenes, there are programs that use Facebook's, Youtube's and Vimeo's API to upload selected videos to the zoo's corresponding social media account. When this is done, certain data is sent to the cloud based system for True360 to stay up to date on what videos were published through their platform and also which zoos are using the system. These metrics will also be displayed in the desktop application for the zoo employees to see as well so that zoos can have a centralized dashboard to keep track of their published videos.

3.6 Development Process

Our team is following the Agile development process, as all of our team members are most familiar with this practice. Using an Agile-based approach will allow us to compile the requirements into different tasks to complete. Each sprint will be one week long. Section 2.4 illustrates the tentative timeline that our team will follow in order to complete this product on time, broken up into one week sprints.

We will use Pivotal Tracker in order to assign various tasks and to team member(s) and track progress. Section 2.3 outlines the different milestones and tasks we need to complete in order to finish this product. Additionally, we will use the merge requests on GitLab to track each individual's progress and changes they have made. Our milestones represent the main phases needed to complete the project (phase 2 is dependent on phase 1, phase 3 is dependent on phase 2, etc.). Some tasks from some phases overlap, however those tasks are independent with each other and will not bottleneck the project completion.

Following Agile practice, at the end of each sprint we will have a weekly meeting for the team, as well as a meeting with the client True360, in order to effectively communicate. This will allow for any input or concerns along the development process, as well as give individual and project progress updates.

Furthermore, in line with standard Agile practices, our team will create and evaluate various tests for the features that are carried out and throughout the project development. These tests are outlined in section 4 of this document.

3.7 Design Plan

Design Plan Overview

Our project is split into 4 different modules, a desktop application, a centralized cloud server, a zoo server, and publishing platforms. Two of these modules are ones that are already created, the publishing platforms, and the zoo server. We will be developing and creating the other two modules, the desktop application, and the cloud server.

Figure 3.1 shows an overview of the architecture of the system, and how they will communicate. The design for the two modules we are creating and all modules communication will be explained.

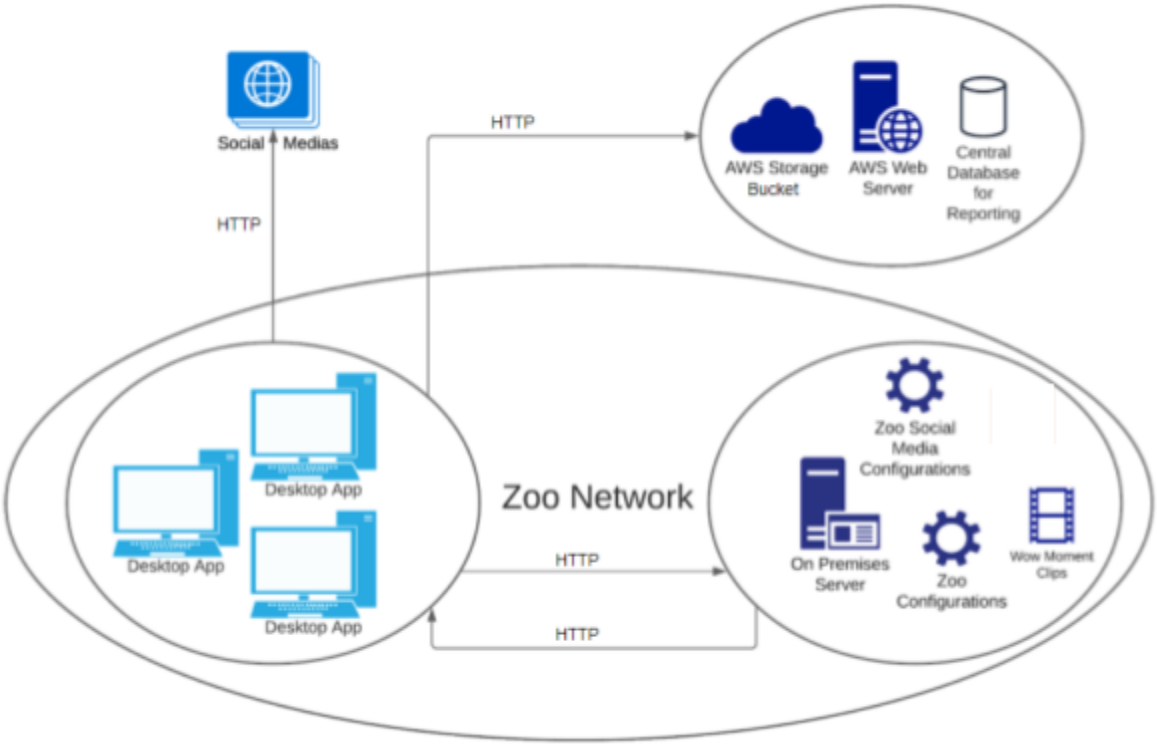


Figure 3.1 Overview of the product's architecture design plans.

Desktop Application

Which use cases will it cover?

- Upload 360 captured camera footage of animals (WOW! moments) to specified media platforms
- Extendability to add additional social media platforms
- View Analytics of recent videos
- Email True360 "Project Edit Requests" with selected videos(s)

Technical Design

The desktop app will be the primary program that users will interact with. It will be created with Electron using React-Bootstrap, so that it will be compatible across platforms. The program will be launched via a shortcut icon.

Before beginning the development of the application, the visual look and feel had to be completed. This was completed initially by creating rapid wireframe mockups by hand. The wireframes went through three different iterations before deciding on the final UI designs to use as a design reference. Below

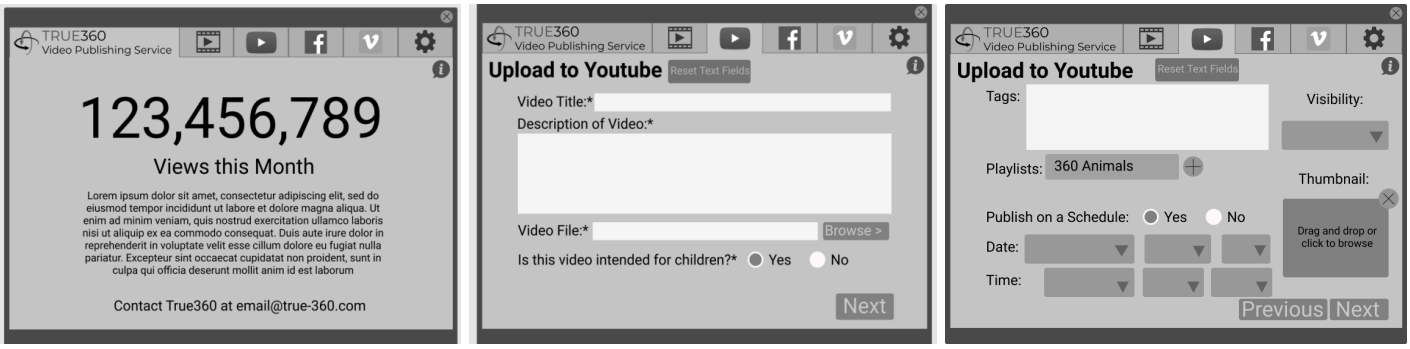


Figure 3.2 (Left-Right) Version 1 wireframes of the home page, the initial upload to YouTube page (required information), and the following upload to Youtube page (optional information)

Figure 3.3 (Left-Right) Version 2 wireframes of the home page, the initial upload to YouTube page (required information), and the following upload to Youtube page (optional information)

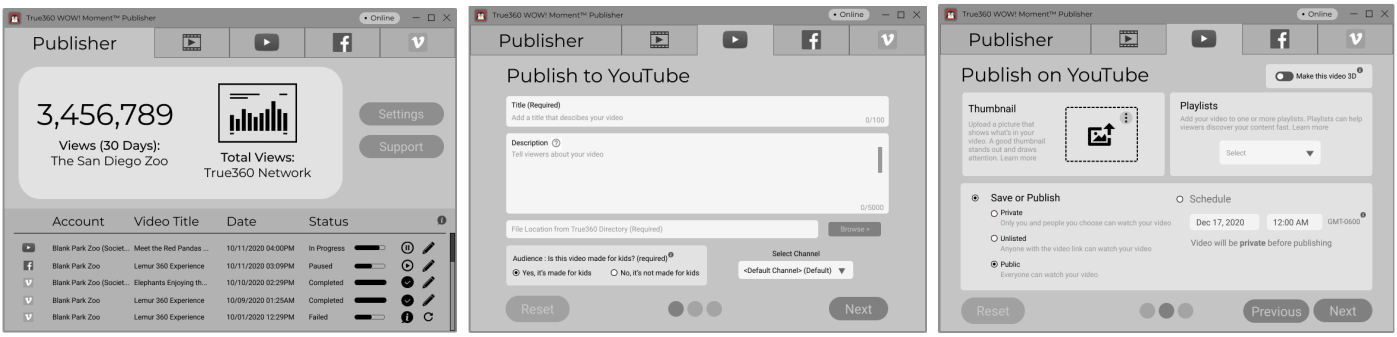


Figure 3.4 (Left-Right) Version 3 wireframes of the home page, the initial upload to YouTube page (required information), and the following upload to Youtube page (optional information)

Along with the wireframes, a design for the application sitemap to know the navigation of the app was created. The figure below shows the desktop application sitemap.

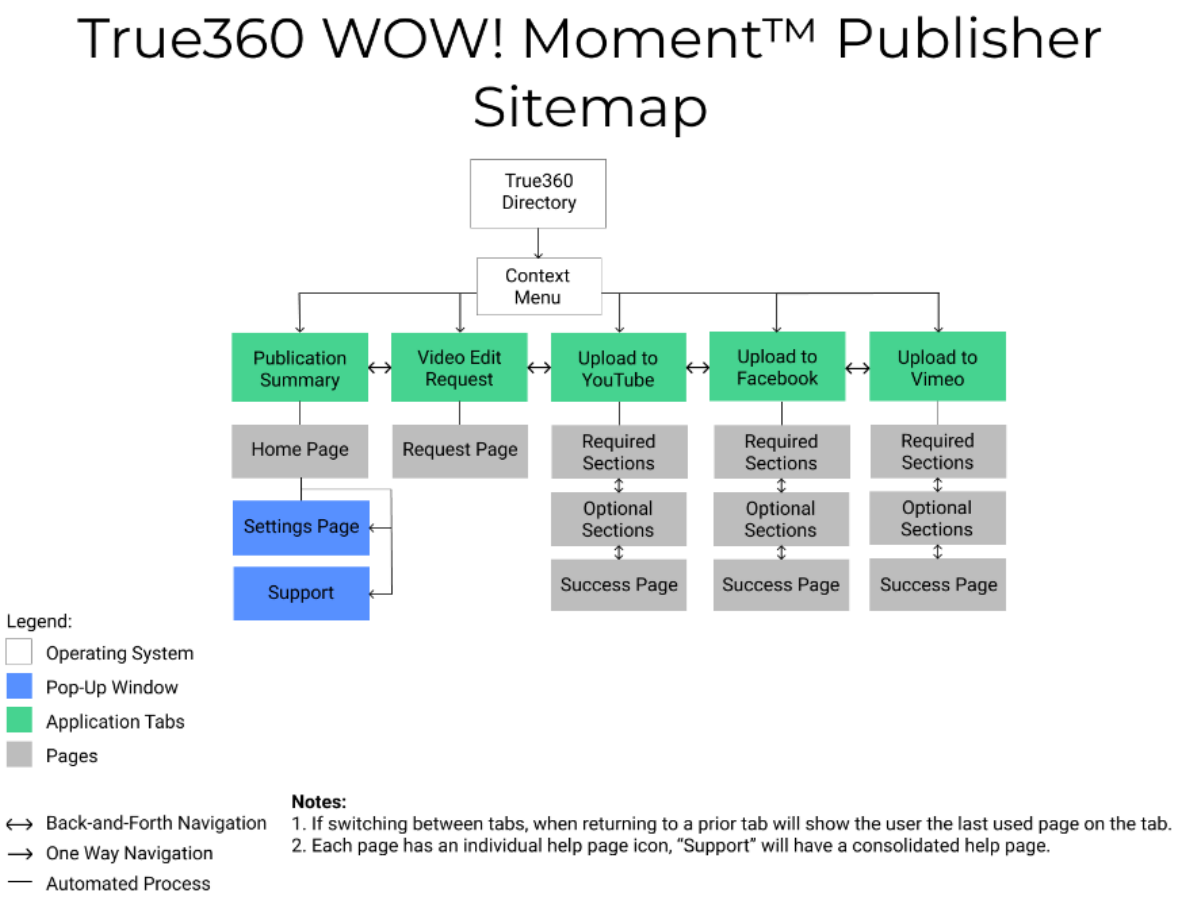


Figure 3.5 Sitemap of the Publishing Application

The page for a publishing platform will contain forms for information about the upload that the user wants to provide, for example, title, description, etc. Once the user has filled in the correct forms, they can click a "Publish" button. A flowchart for what happens when a user clicks "Publish" is seen in figure 3.7.

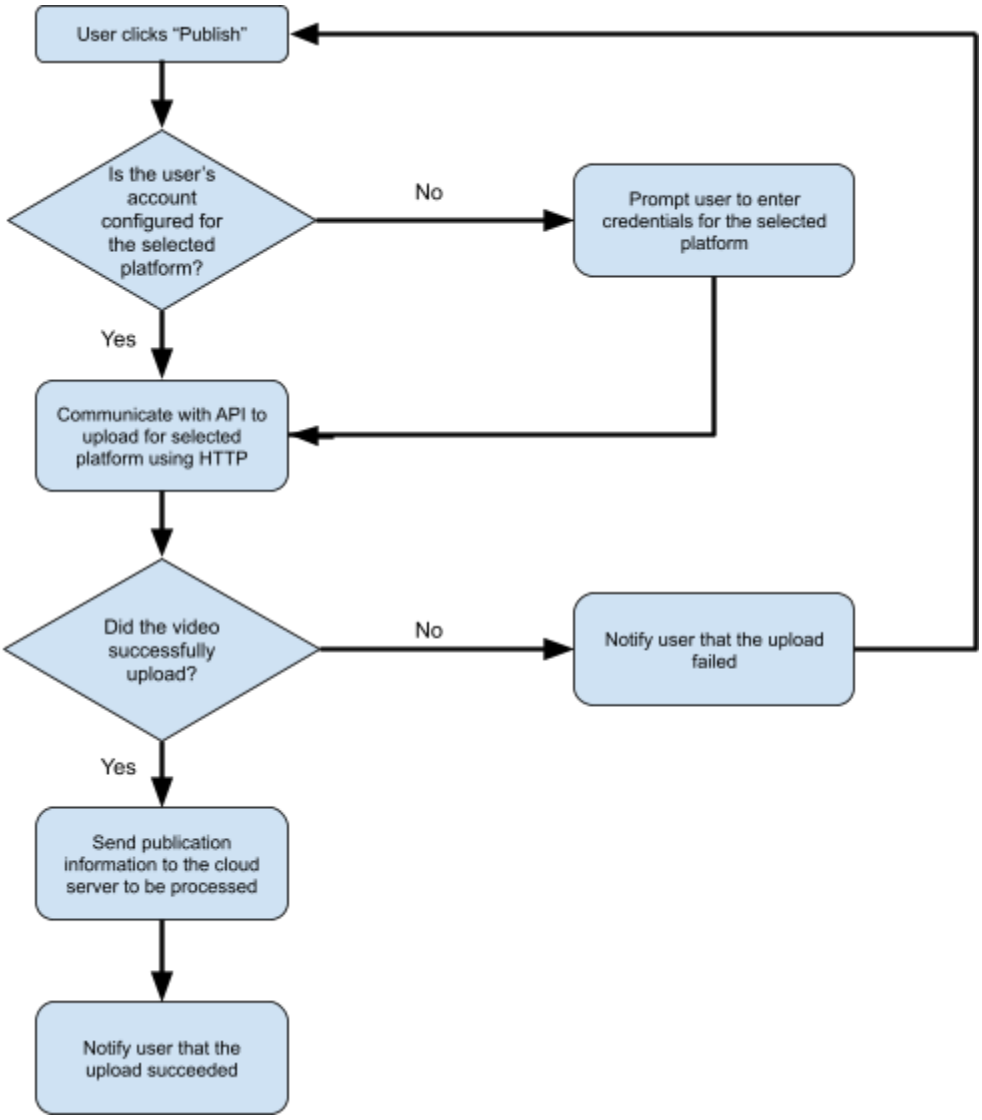


Figure 3.6 User Flowchart for Publishing

In addition to the standard feature of publishing videos, the technical design of other features is outlined as follows:

Project Edit Requests

- Users will be able to select one or more videos to be selected for an editing project. If they select an option similar to "Start Edit Project with True360", an email with the selected videos will be sent to edit@true-360.com

User Documentation

- Users will be able to use the support feature that will show them documentation on how to use the product.

Installing and Uninstalling

- Electron is able to automatically make installers for both the Windows 10 and MacOS Catalina platforms we are supporting.

Centralized Cloud Server

Which use cases will it cover?

- Document video publication data

Technical Design

The cloud server will consist of a Django server that connects to a Postgres database. Both the database, and the server will be hosted with Amazon Web Services. The primary function of the central server is to document video publication data. It will do this by using a database table for each publishing platform. Information stored within the database will consist of general analytical data of a published video, such as likes, and views, as well as video IDs. The specific content included can be seen in Figure 3.7 in the database diagram.

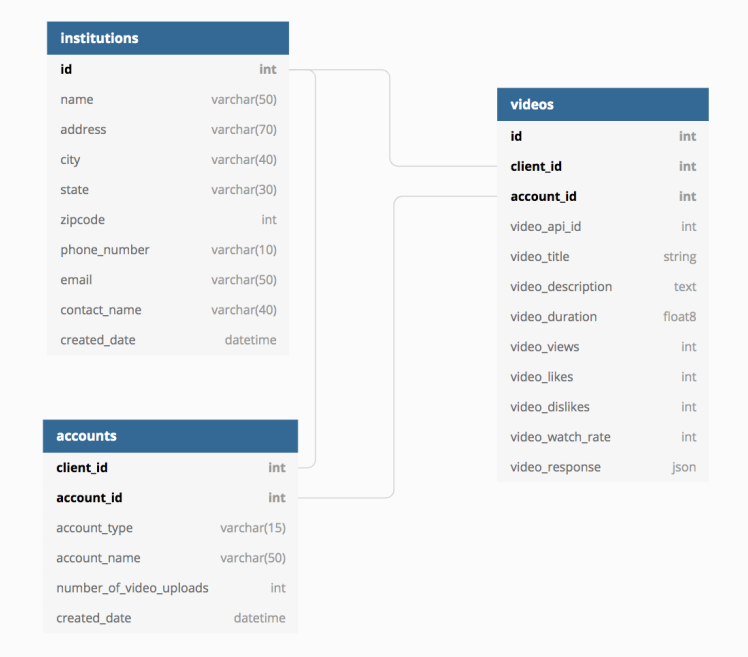


Figure 3.7 - Database Diagram for Video Publication Data

4 Software Testing

4.1 Unit Testing

Below are the different units in our design that we will need to test throughout development.

- Test proper retrieval of social media API keys
- Test that API keys can establish connection
- Test that users can log in with their credentials for all social media accounts
- Test that accounts credentials can be removed
- Test that account configurations are synced between computers
- Test that all API calls are submitted with proper parameters
- Test that database connections are properly configured
- Tests that database upload parameters are correct
- Tests that database calls return the correct information.
- Tests that client/user data is stored securely.

4.2 Interface Testing

Since there is no hardware involved, the testing will be mainly software driven. We have broken the project implementation into a front-end app and back-end system which will need to be tested. The interface testing will include the front-end desktop app and back-end system which consists of the desktop server and cloud server.

For the front-end application that is being developed with Electron, we are using Spectron. Spectron is an Electron testing framework for writing test cases. This will make it easy to tell if the UI is functioning correctly as the core functionality of the front-end application is to have users configure social media accounts to and navigate through a UI consisting of tabs. Spectron can test if these tabs are visible, displaying properly and log errors. We will have to set up dummy accounts on each social media platform for publishing videos to test if they are being uploaded properly to the account.

For the back-end server systems, we are using the Python unittest module. We can send requests to a web server and get the response back to make sure we are getting the correct data. Further testing can be done with mocking server responses from the APIs we are going to use.

4.3 Acceptance Testing

Every task we complete will be assigned to a ticket. In the tickets description it will contain acceptance criteria. These criteria will outline exactly what is expected for the ticket when it is turned in. When a developer is showing the result of a ticket, they must go through each bullet point and show that the functional and non-functional requirements are completed.

Throughout our project development process, we will be involving our client in the acceptance testing. Our group will be doing this testing weekly in accordance with our sprints. Our client will be present as our team develops and specifies our acceptance criteria for each task. By doing it like this, we will not have acceptance criteria until right before we start working on a feature, but that allows us to be able to adjust acceptance criteria based on current needs of the project. We will also be able to know the exact requirements needed, which will avoid any ambiguity. This will help ensure that everyone is on the same page and allow the project to be completed efficiently.

4.4 Usability Testing

Since our project is designed to be used by a real person and not automated, we will need to have real people test it out. In order to do this we will ask preliminary questions for using the application. Have a tester complete a list of specified tasks within the application. Then have the tester complete the closing questions. This will allow feedback on what is clear within the application and what improvements, if any, should be considered.

4.5 Results

Throughout this initial design phase, we've needed to complete certain tasks that allow us to know if future project development is possible. We called these tasks "chores" and they enable us to complete further features within the project. The following is a list of chores that were completed during the Fall 2020 semester and the results from them:

- Rapid WireFrame Mock-up for Organization of Desktop Application Pages
    - A "tab" based system will work better than a multi-window application
    - The simpler the system looks will be better for the end user
    - The required video detail fields that an end-user would want
    - This allows use to know what the interface should look like to be user-friendly
- Research Response Messages After Publishing

    - The APIs for what we are developing for return the correct video statistics we need
    - The YouTube upload API defaults to uploading videos private
    - There are various API limits that may stop us from developing the features as intended
    - This allows us to configure the publication database to hold information we can receive
- Amazon Web Services Tests
    - There are free tiers for AWS that will be able to host our cloud side
    - Django web server running on an Amazon EC2 Instance
    - Postgres Server running on an Amazon RDS instance
    - This allows us to create a centralized cloud server/database

To see the results of testing during the development process, please refer to section 5.4.

5 Development Process and Implementation

5.1 Design Evolution

When transitioning from design to implementation, there were many differences between our proposed design, and our final product. Many of the tasks listed from section 2.6, Personal Effort Requirements, ended up being underestimated in terms of how long they would take to complete. Additionally, some of our risks did happen, and were not properly mitigated. Lastly, some tasks were determined by the client to be out of scope during development.

The features that we *did* complete are the following:

- Uploading of videos to YouTube, Facebook, and Vimeo
- Project Edit Request
- Video History and Analytics
- Login Page
- Support Requests
- Backend Videos Database

The following features are ones that we *did not* fully complete:

- Right Click to Open
    - This was completed as a proof of concept in semester 1, but was never integrated into the final product installer
- Installation and Automatic Updates
    - This section was partially completed with installers created, but the automatic updates weren't integrated
- User Bug Reports Submission to True360

The following features are ones that were determined to be out of scope:

- Watermark and Metadata
- Optimize Videos per Platform
- Open "Browse" in a specific directory
    - This ended up not being possible due to operating system permission restrictions

These features consisted of significant design changes (See Appendix F for UI changes):

- The Back-end API was switched from using Express to Django
    - This change was made because Django contained many features that we needed out of the box such as user authentication, and would reduce development time compared to using Express.
- The front-end Electron app used React as the front-end framework
    - This change was made because we determined that React had a strong component system, and would allow for easier code reuse.
- Home Page Views Display
    - The design of this section in particular had to be changed late in the design process upon finding out that the YouTube terms of service (Appendix D) didn't allow YouTube API data to be displayed combined with data from other platforms.
- Settings Page UI
    - This design of this section did not end up being the same as planned in the initial wireframes. The design only supported single accounts for each platform, when originally multiple accounts were meant to be supported. This was done due to time constraints.
- Various UI Changes
    - As mentioned in Section 3.7 various user interface changes were made from the initial wireframes due to time constraints, better usability, and client requests.

5.2 Front-End Development

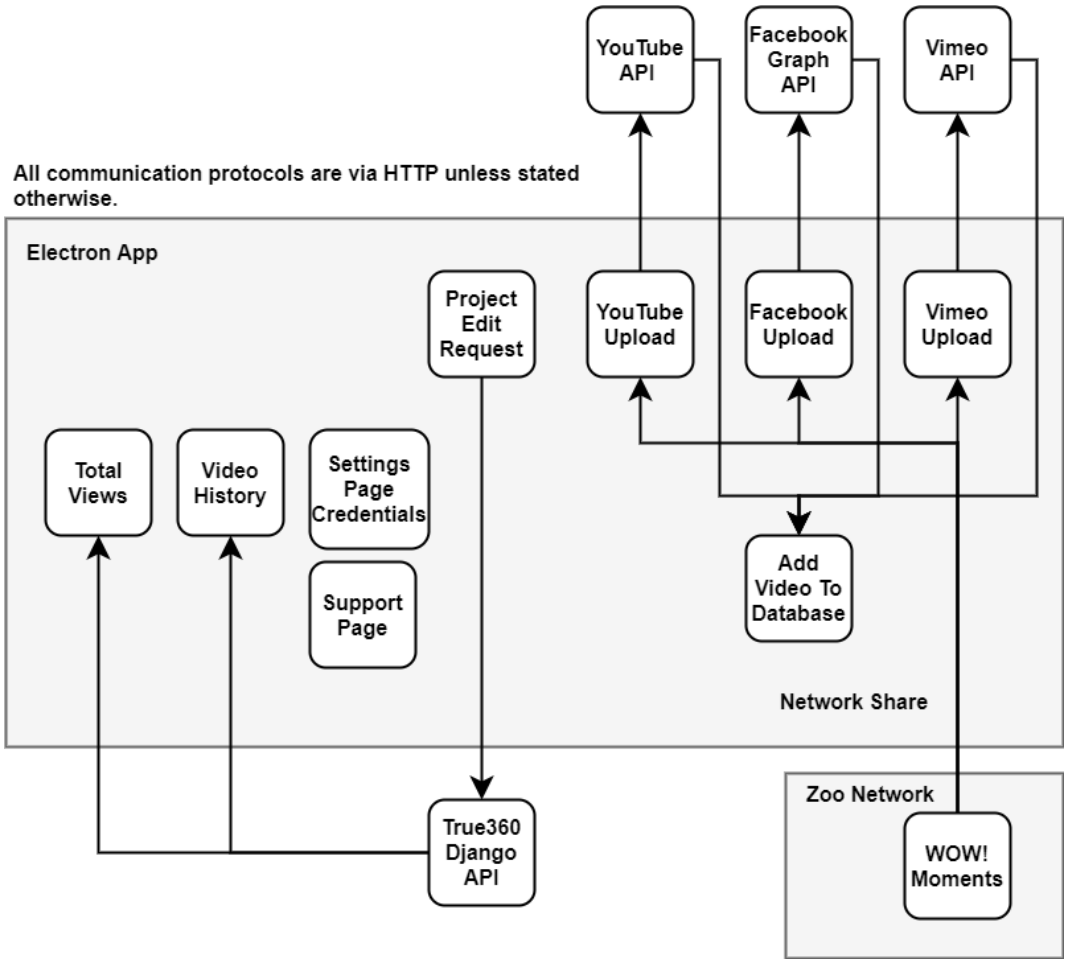


Figure 5.1 - Technical Design of the Front End Electron App

Front-end development needed to allow users to login to obtain an API token to view video analytics and upload their 360 degree videos to various social media platforms. We accomplished this by using Electron to build our front-end desktop web application because it supported cross platform OS and used the React.js library to build our UI components. This required us to learn and understand about how React.js handles states, components, portals, redirection and other various functionalities to make our application work properly.

Simple actions like clicking a button to redirect to another page were more sophisticated than we thought because of the state changes, information being lost when states were changed and also what sort of components or functionalities needed to be binded before the components were loaded. This made us reconsider how or where the variables we needed were going to be stored within our app to use.

Components also needed to be handled properly and checked when information was changed for the data to be consistent. The UI also needed to look good or conform to what the client wanted so we needed to make sure that both the UI looked nice and also functioned properly. This was a time consuming process for the front-end team considering how certain requirements were changed or updated as well, which meant we had to change or add things to the UI. Refer to Appendix E for more details on how the UI was designed and implemented.

The application was also communicating with multiple social media platform API's so we had to learn how to use their API's and hook it up with our front-end application as well. Each of the APIs for each platform had differing functionalities, and use cases, so switching from one API to another basically required relearning and redesigning the entire flow of how to upload. For example, YouTube used an OAUTH2 flow for authentication, but neither Facebook, or Vimeo did. This meant that adding API keys for YouTube had to have its own unique flow. Vimeo could only add thumbnails to a video after a video was uploaded, which was unique to it.

With the APIs, we also ran into problems with completing verification in order to receive access to specific API features. These companies, namely Facebook and YouTube, required pretty extensive review processes where we had to interact with the company and request access. This took much longer than anticipated, and was only completed toward the latter half of the semester, slowing progress down considerably.

5.3 Back-End Development

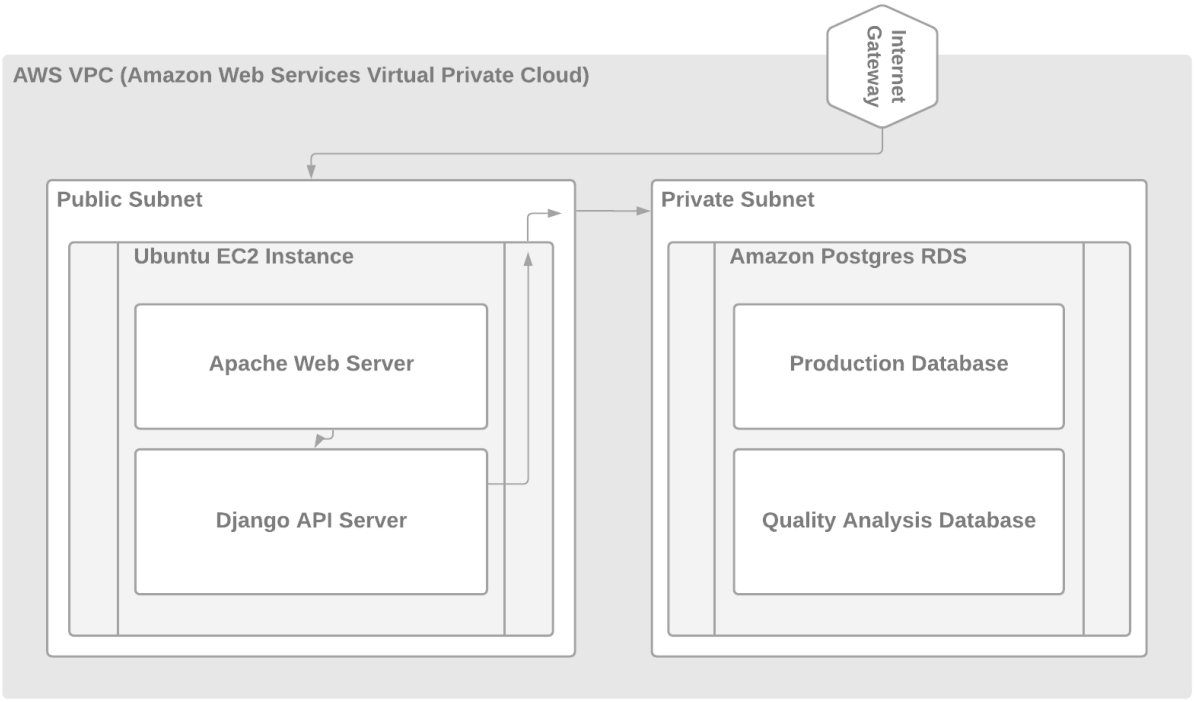


Figure 5.2 - Technical Design of the Back-End Django API

Django Application

The back-end of the application was created using the Django REST Framework and needed to give users the ability to create accounts so that they could log in using the front-end interface. To handle the log-on, an authorization token service was created to associate a key with each user so that once a user logs in they can access their individual video statistics and personal settings stored for the front-end application to use. The back-end has several other endpoints that are used for other services as well such as sending emails. The client wanted the emailing service to allow the end-user to send an email to True360 in the event that they want a request to edit a video using True360's video-editing service, or to report an error within the application.

Amazon EC2 Instance

The Django server lives on an Amazon EC2 instance within Amazon Web Services. This Virtual Machine is running Ubuntu 20.04 and is tailored specifically to handle requests coming from the desktop application. An Apache2 web server is running within the Virtual Machine that listens on port 80 for requests sent from the desktop application. When a request is received, the Apache web server forwards the messages to the Django application.

Amazon RDS Instance

The database that stores the administrative information for the desktop application is an Amazon Postgres RDS instance. This stores the information about each institution's uploaded videos. This is where the homepage gets its video information from in order to highlight which videos have been uploaded through

the application. The RDS holds tables for video information, institution information, and authentication tokens for each request made to the django application.

Amazon Virtual Private Cloud
The EC2 and RDS instances have been placed within a Virtual Private Cloud network in order to keep information within the backend system secure. There are two subnets within the Virtual Private Cloud, one is a public subnet and the other is a private subnet. The public subnet is connected to the internet gateway that is outward facing to the internet. This internet gateway opens the public subnet up to requests made over HTTP. The EC2 instance is connected to this public subnet and listens on port 80 for requests to the Apache server it is running. When the server needs to either get/update/delete any records in the RDS, it makes requests over the private subnet to the RDS instance. This setup helps to mitigate risks of outside malicious actors being able to access each institution's data.

5.4 Testing Results

Automated Testing
For testing we used Spectron Mocha and Postman. The testing consisted of making sure the endpoints were communicating, and making sure the UI was displaying the right components. Since we had to test many different UI functions, a lot of these tests were also done manually. This was done in order to meet the demands of what the client envisioned the UI should look like. For example, making sure a dialog box opened up or if the next state of the component was loaded or if the text, headers and colors looked proper. Hitting the end points mainly consisted of getting the correct views from the Django API and that the login token was being properly sent to the front-end app. Tests were mainly conducted to make sure the video analytics were being retrieved properly, proper login tokens were being sent correctly to the front-end app so that the institutions could access our back-end API, or support messages were properly being sent to the True360 email service.

User Testing
In order to better understand the validity of our solution, we decided to undergo user testing. Our testing was not conducted with actual institution employees, but was conducted with close friends of some of the team members. In total, there were 8 users that tested the product. More users, and institution employees would have been tested, but due to time constraints we were unable to test.

The tests consisted of a simple 3 part process. The users were given a pre-survey to fill out, which consisted of basic questions collecting user experience with social media managers. Then, they were asked to use the Electron app to complete two tasks: Add in the given API credentials, and complete an upload to Vimeo. After completing the tasks, the users were asked to complete a post-survey asking about their experiences completing the tasks, and any suggestions or improvements they had. To see the results of these surveys, please see Appendix G.

There are two portions of the testing that are significant:

1. "Do you think you would use a social media publisher in the future?"

   During both the pre- and post-surveys, this same question was asked. As shown in Figure 5.3, 0% of users wanted to use a social media publisher during the pre-survey.

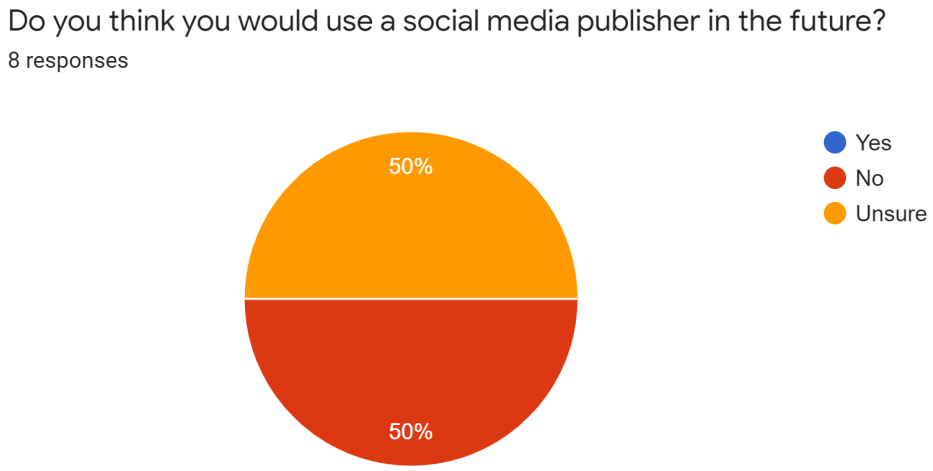


Figure 5.3 - Pre-Survey Results of "if a user thinks they would use a social media publisher"

After the tasks were completed, as shown in Figure 5.4, 25% of the users said that they would use a social media publisher in the future. This shows that our solution did in fact have some viability in that it made people want to use a product similar to it when they hadn't wanted to before.

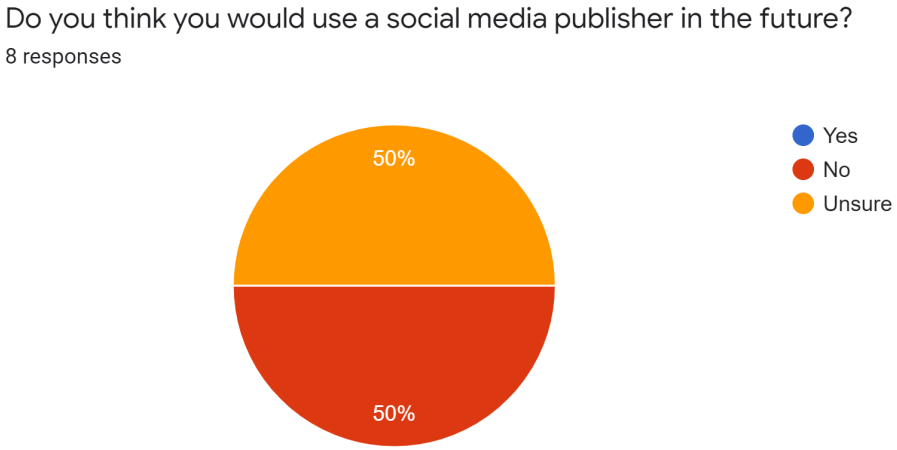


Figure 5.4 - Pre-Survey Results of " if a user thinks they would use a social media publisher"

2. "How ____ did you feel while completing the tasks?"

Two questions were asked during the post-survey. The questions asked users to rate on a scale from 1-10 how confident/frustrated they were while completing the tasks. These questions were asked in order to gain insight into how users felt when using the app. The results for each of those questions can be seen in Figures 5.5, and 5.6, respectively.

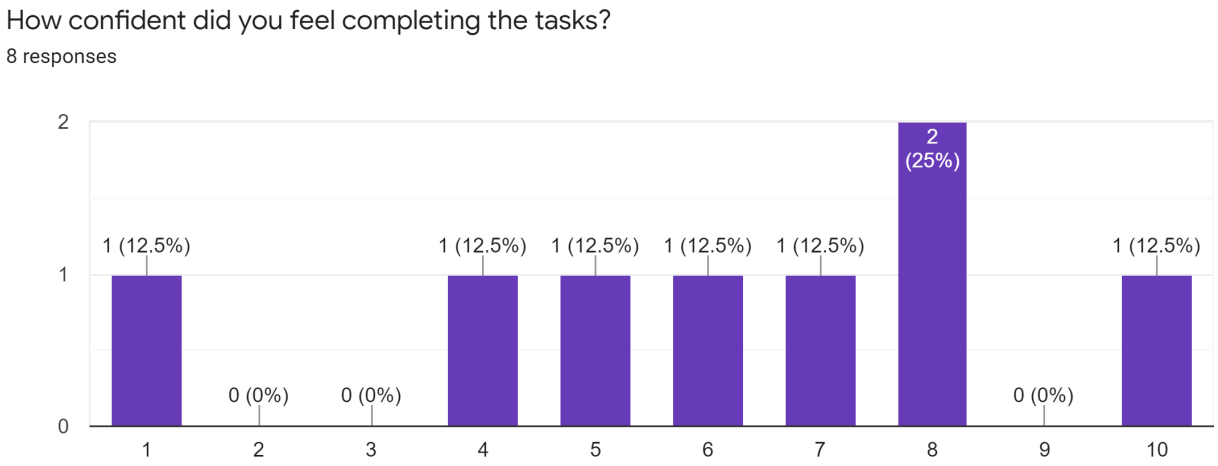


Figure 5.5 - Post-survey results of confidence during tasks

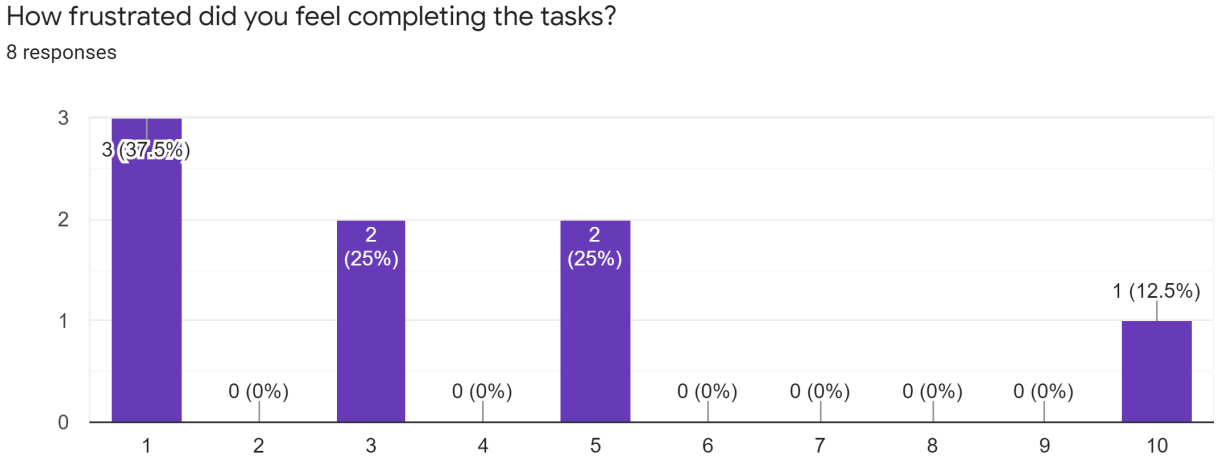


Figure 5.6 - Post-survey results of frustration during tasks

Looking at these charts, we can understand that users were neither confident, nor unconfident when using the app, and the majority of users felt no or slight frustration while using the app. From looking at the reasoning given from the testers, it was determined that there was not enough *feedback* within the app that showed users that they had in fact completed the task. For example, when saving API information on the settings page, there was no confirmation on if the information had actually been saved or not. This meant that even when a user successfully completed the task, they might not have realized it. For frustration, it was determined that a lot of frustration came from not understanding if the application was doing what it needed to, and also logins being different from the typical social media logins that they were used to.

Conclusions

From completing user testing, it was determined that the most important features to prioritize when developing this product further were the following:

- Give feedback to the users on success/failure
- Error handling
- In-App tutorials

5.5 Technical Challenges

Many of the technical challenges that the team faced was because many of us were not familiar or had very little experience with the frameworks that were being used for this project. There was also the problem of our client wanting to change our requirements during the development process, like other different frameworks to use or to scrap the Electron App for something else. Lastly, the client we were was wanting to implement features that were not feasible or impossible to do like implementing video editing or watermarks.

The biggest technical challenge was learning all the different types of programming languages and API's needed to complete this project. There was typescript/javascript, html/css, python, node.js and react.js. Even though React is a javascript library, it had a pretty steep learning curve for the team and felt like learning an entirely new language. Since we were working with three different social media platforms, it also meant we had to learn how to use three different API's. This slowed the development process down a bit because we had to get familiar with these and the team had limited experience with these different API's. For example, we had to consider the quota costs for calling the API's for each social media platform and if we went over this quota, our application would be blocked. To get around this, we had to contact the social media companies and explain to them how our application worked for them to approve us properly.

Lastly, getting the UI to look nice but also function properly was a difficult task. This ended up eating much of the time during the development process. Implementing certain buttons or colors then having to change them later because the client either wanted them changed or modified a bit which resulted in us having to go back and revise particular designs for a button or UI component until the client we were working with was satisfied.

5.6 Development Lessons

There were many development lessons learned from developing this project. Weekly meetings were held with the customer to go over what needed to be developed and implemented for the project and each team member was assigned to complete it. It helped us understand and organize the overall development process since each team member knew what they needed to do so we learned how to organize and tasks individuals with certain goals.

Some other lessons we learned during development was how important it was to keep in communication with the entire team to make sure everyone was on track during the development process. This was important the team needed to know what everyone was doing at all times to make sure the functionalities that were being implemented made sense and worked. Requirements were either changing or being updated as well. Sometimes we worked in pairs to make sure we could complete what we needed to get done for the week which was a good learning experience.

Lastly, we learned how to work with multiple different types of languages used to create this project which was one of the hardest things to do in this project, working with the various social media platform API's plus how to use them properly and also how to connect the front-end app with the back-end server. We learned

that working with so many different API's and hooking them all up was no feasible task which resulted in either delays or some functionalities not being completed for this project given the shortened semester length.

6 Closing Material

6.1 Conclusion

In closing, the end product for True360 was completed and developed by using Electron and the React.js library for the front-end and setting up the API server back-end using the Django Rest Framework. This allows Zoo institutions to login to accounts that are set up by True360 to obtain a login API token. This token is then stored on the app to retrieve video analytics from the back-end server. Institutions can also access support within the app to request video editing for their WOW! Moment videos. The development and requirements changed initially from what we were tasked to do. For example, implementing a right click feature, having automatic updates, etc. Some of the features we wanted implemented, could not be implemented within the scope of this semester, but many of the core functionalities that the client deemed the most valuable part were successfully implemented.

6.2 References

H. Inc., "About Us," *Hootsuite*. [Online]. Available: https://hootsuite.com/about. [Accessed: 26-Oct-2020].

"Final Cut Pro X," *Apple*. [Online]. Available: https://www.apple.com/final-cut-pro/. [Accessed: 26-Oct-2020].

"Adobe Premiere Pro," *Adobe Premiere Pro User Guide*. [Online]. Available: https://helpx.adobe.com/premiere-pro/user-guide.html/premiere-pro/using/whats-new.ug.html. [Accessed: 26-Oct-2020].

6.3 Appendices

Appendix A: This appendix contains links to documentation relating to the APIs we will be using in the project. This includes things such as API quota limitations from various social media platforms.

YouTube Quota: https://developers.google.com/youtube/v3/determine_quota_cost

Vimeo Quota: https://developer.vimeo.com/guidelines/rate-limiting

Facebook Quota: https://developers.facebook.com/docs/video-api/guides/publishing/

Appendix B: This appendix contains links to different technology we will be using for development.

Electron: https://www.electronjs.org/

NodeJS: https://nodejs.org/en/about/

Amazon Web Server (AWS): https://aws.amazon.com/about-aws/

Postman: https://www.postman.com/

Spectron: https://www.electronjs.org/spectron

SinonJS: https://sinonjs.org/

MochaJS: https://mochajs.org/

MacOS Automator Service: https://developer.apple.com/library/archive/documentation/LanguagesUtilities/Conceptual/MacAutomationScriptingGuide/MakeaSystem-WideService.html

Appendix C: This appendix contains links to the Engineering standards used throughout the project lifecycle.

IEEE/ISO/IEC 24748-5-2017 : https://standards.ieee.org/standard/24748-5-2017.html

IEEE/ISO/IEC 23026-2015: https://standards.ieee.org/standard/23026-2015.html

IEEE 1016-2009 : https://standards.ieee.org/standard/1016-2009.html

Appendix D: This appendix contains links to the terms of service the application needs to follow for various social media platforms.

YouTube: https://developers.google.com/youtube/terms/api-services-terms-of-service

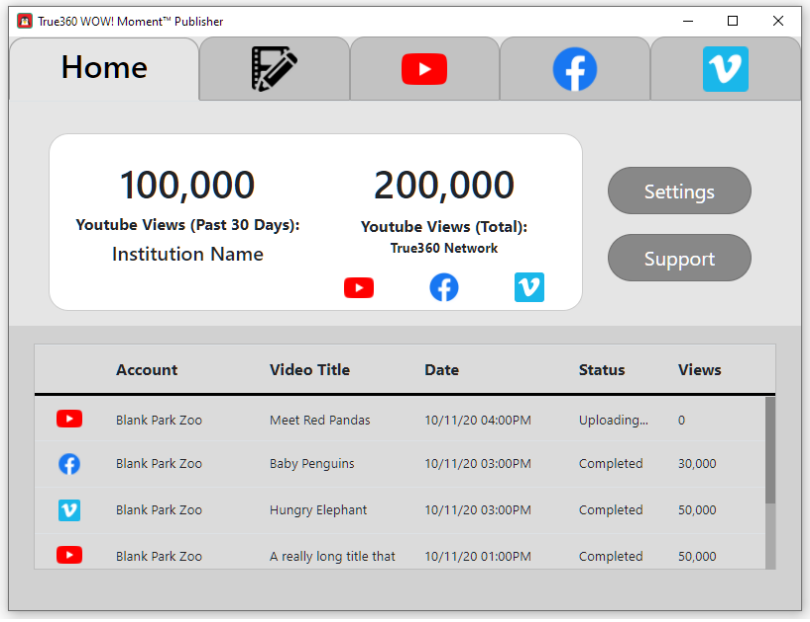
Vimeo: https://developer.vimeo.com/guidelines/terms

Facebook: https://developers.facebook.com/terms/

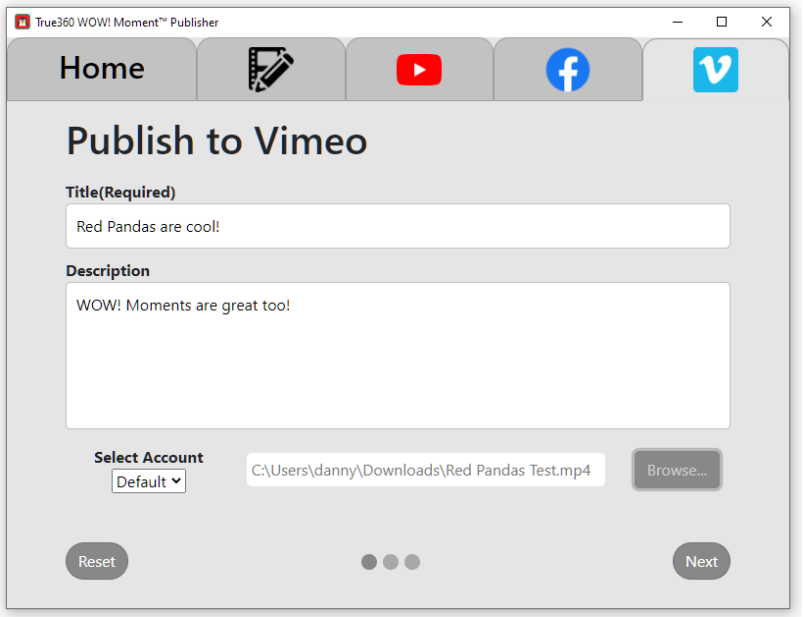
Appendix E: This appendix contains the Operation Manual, a basic guide on how to use the product.

This application is closed source, and not public, so there are no instructions on how to download and set up the application itself. This guide assumes that you have a contract with True360, and have received separate instructions on downloading the application.

1. Click on "Settings" on the Home Page and add in the API credentials for your desired platform. Assuming you have a contract with True360, these credentials will be provided to you.

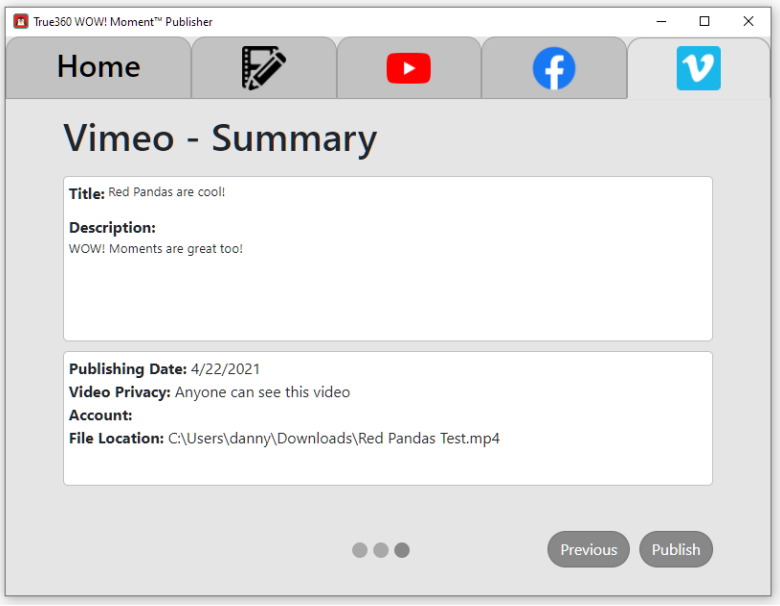


2. Click "Add Publishing Account" and close the Settings Page once it is finished.
3. Click on the logo for the platform you wish to upload to.
4. Fill out the corresponding fields on the required sections.

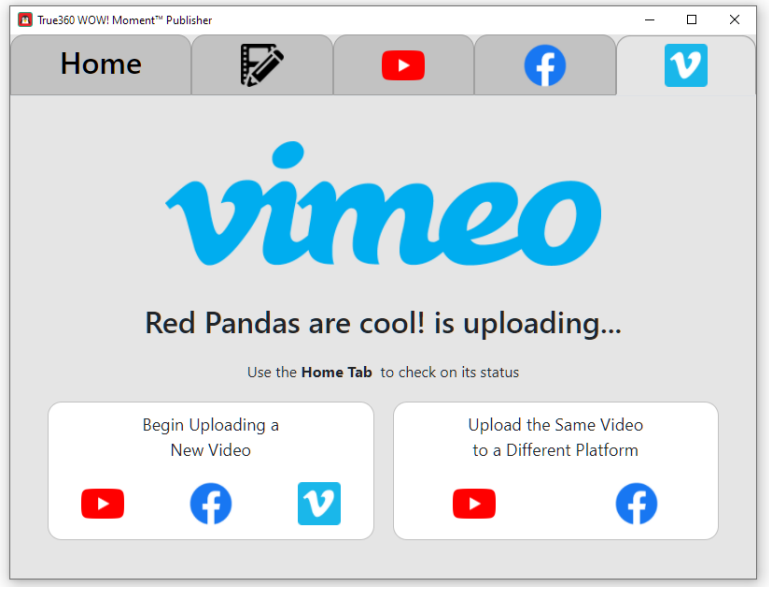


5. Click next to view the optional sections. Fill out the fields needed.

6. When you are finished, click next again to be brought to the summary page. Verify that your information is correct, and click "Publish"



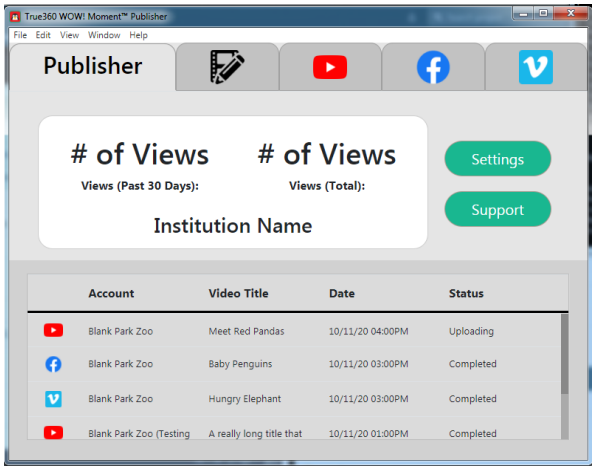
7. Congratulations! You have successfully uploaded your video.



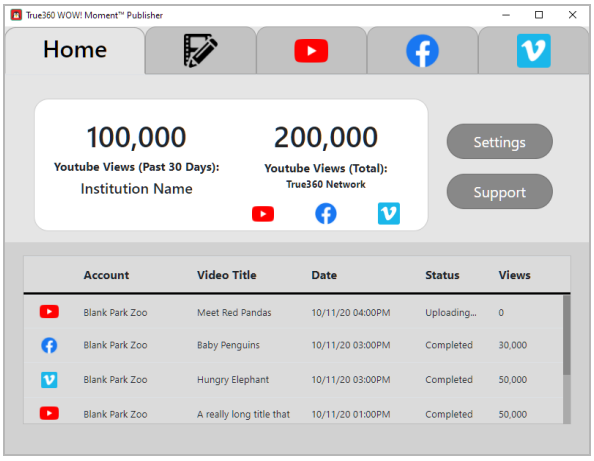
Appendix F: This appendix contains more specific images of significant design changes

The home page had to be changed to comply with the API Policies for retrieving views. The views were unable to be combined with the views from other social media platforms.

Home Page Views Display:



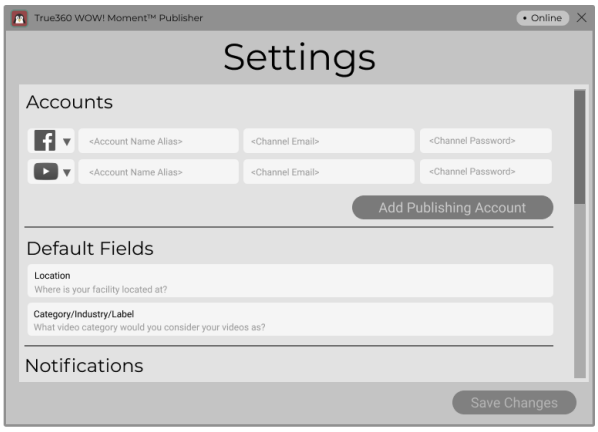
Initial Home Page with all Views Grouped Together



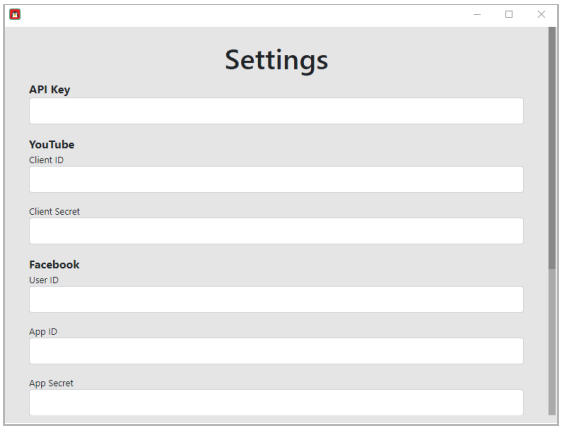
Revised Home Page with Separate Views for each Platform to Comply with Youtube's API Policies

Due to time constraints, we were not able to finish the settings page to look exactly like the wireframes. So below shows the settings page wireframe versus the implementation in the app.

Settings Page UI:



Wireframe of the Settings Page



Implemented Settings Page

Appendix G: This appendix contains links to responses from User Testing

Folder containing user testing surveys and task list:
https://drive.google.com/drive/folders/1lRBv-I8UNDEfOFkY22gZiY4GoGWvcnK7?usp=sharing