Turn me into a Sprite

Final Report for CS39440 Major Project

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**Abstract**

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# 1 Background and Objectives

## **Background**

In this Project the goal that was set was to create a piece of software that turns the user into a sprite for use in Scratch. The proposed tasks where to take a shot video of the user against a static background, subtract the background chose some frames of the video to turn into a sprite poses. And then be able to import this into Scratch.

The motivation for this piece of software would be a support tool for young children when learning to program. The thought was that they would be more inclined to learn and code if they could somehow put themselves into Scratch. Therefor an application that could do this seamlessly would be beneficial for young students starting to learn.

Additionally, as someone who’s done work with Aber Outreach[1], which is a part of Aberystwyth’s computer science department that helps young people develop an interest in computing, I knew that software like this could contribute to the development of young people in a positive way.

### **1.1.1 What type of Application?**

Early it was important to establish how the application should be built, whether it would be a web app, a standard desktop application or even a mobile app. There where many positives to all. A web application would make a lot of sense for this application, as Scratch is a web tool already so this would make sense, however. As I don’t have any experience in web development and there’s already a lot of new elements that I’ll have to pick up like computer vision techniques to separate the for ground and background I think a website wouldn’t be the best idea.

Another possibility could have been a mobile app. I do have some experience in android development so I would have somewhere to start. But thinking of Scratch as a tool it is mainly used in front of a computer so making an app wouldn’t make a whole lot of sense.

Lastly was a standard desktop application. This made the most sense overall. I have the most experience with making these types of applications so when it came to the time constraint of the project knowing how to use the tools would make the most sense. Additionally, as users would already be on a computer it wouldn’t cause a lot of friction.

## **Analysis**

To begin there was a lot of research to do on Scratch as a platform for learning and how students interact with Sprites. There was also research done into how you could import the sprite into Scratch. Besides the research done into Scratch there was also research done to see what methods I should use remove the background of the image and what languages would best suit these tools.

### **1.2.1 Current Tools**

From looking around there didn’t seem to be a lot of sprite makers for Scratch the one most used was the official Sprite Maker tool in Scratch[2]. The tool is straight forward to use and allows users to input pictures of themselves. And doodle on them with paint tools, add text to a costume and import images from the user’s computer. However, it doesn’t archive what the goal of the project is which is removing the background of the user.

Although there wasn’t a sprite maker that could remove the background of images there are plenty of pieces of software that can segment the image to remove the background of an image from a person. RemoveBg[4] is an online tool that can do this quite well. For the application of sprite making if there were 5 costumes in a sprite you would need to repeat this step 5 times, and for children this could be a very tedious.

Graphical user interface, text, application, chat or text message

Description automatically generated

Figure 1 : Showing RemoveBg software removing the background of a photo.

### **1.2.2 Sprites**

Sprites in general[7] are graphical two-dimensional objects used in video games. Typically, there’re just bitmap images or a collection of images to make animations. Normally sprites will represent players, enemy’s, NPC pretty much any interactable object within a game.

In Scratch[3] and how Sprites work here. The best way to describe them would be to think of a sprite as a group of different costumes. You can use the costumes to represent different states of the sprite. There can be any number of costumes in a sprite as well and each costume should be given a unique name so when switching from one to another the user shouldn’t get confused.

### **1.2.3 Importing to Scratch**

One of the tasks early in the project was to find out how import a custom sprite into scratch. From some research on the scratch wiki[5], it was discovered that. Scratch uses the Scratch 3.0 file format which is used to store exported Scratch files including sprites that use ‘.sprite3’. For sprites there is a file that’s compressed using ZIP that contains a target JSON file called ‘sprite.json’ the target file contains a lot of information about the stage, the name of the sprite, any code-blocks associated with a sprite and a lot more.

For the needs of the project the most important part is the costume parameters. This part tell scratch what sprites there are, their names, and the images are associated with the sprite. Inside the .sprite3 file are images for the each of the costumes.

### **1.2.4 Webcam Input**

Its clear that there will be a need for webcam input. Although a mp4 video could be uploaded to the software and get a similar result. Having a live webcam would mean the program would be much more interactive for users and overall create less tension when using the program.

### **1.2.5 Tools**

When it comes to the language used in the project. There was the direction to use Java as the main language of the program as this was the most familiar language. After prototyping and experimenting with different techniques however there was a clear limitation for java when it came to the types of segmentation that was possible and the quality of the segmentation. For this reason it was decided that there would be a pivot to use Python 3 as after research and speaking with the supervisor python leaded itself to more computer vison projects as there are a wider range of libraries supporting it.

### **1.2.6 Mediapipe**

Mediapipe is an open-source framework developed by Google that provides solutions for building real-time computer vision and machine learning applications. It offers customizable modules that can be used to develop tasks like face tracking, object detection and for this projects case pose detection which enables the software to track a person.[8]

### **1.2.7 Image Segmentation**

One of the requirements of the software was to make sure the background of the user could be removed from the image. There were three different ways of doing this. The first way would be to use a green screen to remove the background. Green screens work by filming Infront of a background that’s all one colour(most of the time green) and then removing that colour digitally[6] commonly this is referred to as chroma keying. For this application this wasn’t the best option. As this application would normally be used in schools it would be unlikely that they would have a green screen on hand. Additionally, one big limitation of green screens is the fact if the user is wearing green, it would also be keyed out. Although the method would be the simplest this wouldn’t be the best choice for this application

Another method could be to detect the background from the foreground and remove it. There are many different methods there has been implemented that will be discussed in the implementation section.

Lastly there was the option to detect the user in the frame and remove everything else. This is typically by creating a skeleton of the person in the frame and mapping on the person this can then be used to detect what is a person and what’s in the background.

### **1.2.8 User Interface**

Clearly there will be a need for users to have a GUI for them to interact with. When researching it was important to understand that the main user base would be children aged 8-12. Because of this it should be a note to make sure the user interface is geared towards this audience[9]

## **Process**

### **1.3.1 Methodology**

When starting the project, it was clear that there needed to be an adaption to an existing model. For this project it was decided to adapt Scrum / Kanban approach. Of course, in a single person project it quite challenging to follow Scrum. So, in this case the scrum master, product owner and the developer team where all me, the reason Scrum was chosen was because there was a need for being able to be adaptable as there was a lot of new components in this project. Because of this there was a weekly stand-up meeting held every Monday where a list of objectives where set for the weekly sprint. Instead, up a backlog which is very typical of scrum it was instead decided to use a Kanban board to keep track of these objectives. This was decided as it was found that a backlog felt too restrictive as if a certain task was taking too long or was hitting a brick wall being able to change the task to something else while keeping a log of where in the pipeline a task was very helpful.

### **1.3.2 Version Control**

When it comes to version control it was important to choose something reliable and drawing on previous experience with Git it was a simple chose. The option for using the university’s GitLab was considered but as the project would typically be worked on outside of the universities. network constantly having to re-log into the university’s VPN seemed like a relatively tedious task. Therefore, it was decided to use GitHub as it allowed committing changes without being on a certain network while still giving all the features that was needed for the project.

Additionally, PyCharm which was the main IDE used in the project has integration with GitHub allowing incoming merges to be delt with a lot easier.

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