

Turn me into a Sprite

Project Outline

CS39440 – Major Project

Kallum Ibrahim-Davies (kai4)

Computer Science and Artificial Intelligence – GG4R

Supervisor – Hanna Dee (hmd1)

Version 1.0 – Release

7th of February 2023

Project Description

The goal for the Turn me into a Sprite project is to develop an application to create sprites for Scratch. The application would take a video input from the user, most likely through a webcam. Record a short clip. Then using computer vision technologies to detect the background and remove it from the frames. The user would then go through the video and select frames from it to make a .sprite3 file so that you can import it to Scratch to use for those projects

The Target user base of the system would be young children just learning how to program so one thing I would need to take into consideration would be the UI making sure it is very simple to use for the students .

On the more technical side, one aspect I'll need to investigate is the computer vision aspect of the software. I have done some research and it seems clear that I'll need to use OpenCV[2] to be able to remove the background of the image. There are many ways to do this but for my case I think using Mediapipe's Pose framework[1] would allow me to remove the background the simplest way while also giving a great result.

For this Task I'll be using Python, although I'm not familiar with this language as compared to Java, For this project, having access to frameworks and libraries that are more specific to computer vision is a essential to making sure its successful.

Proposed Tasks

- **Investigate CV techniques to remove the background** – Research more into OpenCV and other computer vision techniques that could be used for this task. Additionally prototype these findings so that I can find one that would work best for the project.
- **Set up a Version Control System** – I'll need to make sure I set up version control for the project. I'll also be keeping all written work here too. I'll be basing the structure of this off the 2nd Year Group Project to keep everything organised.
- **Development** – Tasks for the Development side of the project
 - **Create a child-friendly GUI** – As mentioned before the main userbase for this system would be young students first learning how to program. So, it's important to guide the user with clever UI- Design
 - **Take a video of the user and remove the background** – Need to be able to take a video of the user and save it for later use. Additionally remove the background of the video so that later when we create these frames into sprites the background doesn't show on the costumes. The background should be static as a minimum but as the application would be used in classrooms where these conditions aren't typical I'll be aiming for 'Zoom' level of background subtraction.
 - **Allow the user to select frames from the video to use as costumes** – After the user takes a video, they should be able to review it and select any number of frames to be costumes in the sprite. Additionally, the user should be able to name each costume. All names should be unique as well.
 - **Convert frames into a format for Scratch import** – Should be able to convert the frames into a .sprite3 format, which is just a zip with a target file plus PNGs. User should be able to select target destination
 - **Investigate CV techniques to remove the background** – Research more into OpenCV and other computer vision techniques that could be used for this task. Additionally prototype these findings so that I can find one that would work best for the project.

- **Testing** – I need to make sure I set up automated tests for the system along with manual tests too. For this I'll be using unittest framework[4] to do the automated testing.
- **Weekly Meeting with my supervisor and Project Diary** – In this project I will be having weekly group meeting with my supervisor Hannah Dee to discuss my progress and for recommendations on how I should progress in my project. Additionally, every Friday evening I'll be writing a brief diary to keep track of what I've learnt from the past week and any progress I've made.
- **Demonstrations** – There will be 2 demonstrations for this project. The first will be a Mid-project demonstration that will last 10 mins or so. In this Demonstration I'll hope to demonstrate the main functionality of the project of removing the background plus taking mutable pictures and the exporting functionality. In the second, it will be a 20 mins where I show the whole project completed demonstrating the technical aspects of the project. There will then be 10 mins of questions.

Project Deliverables

- **Final System** – The source code for system should be produced before Friday the 5th of May. This will be published with the version control .
- **Test Document** – A test document would need to be produced to show all the automated testing and manual testing being done. For this project I'll most likely use unittest framework for python.
- **Project Report** – The final report for the project will be around 10,000 to 12,000 words and will explain what I did to achieve the final system including the requirements, design, experimenting methods, implementation, testing and evaluation with some other things as well.
- **Ethics Form** – For this project it is important that I collect a good dataset for testing purposes. This would most likely be videos of children aged 10-12 as this is the target user base. As Laws and regulations are strict on collecting data of children I'll need to produce an ethics form for collecting this data. Even then if I decide to only collect data from adults an Ethics form still needs to be produced.
- **Final Demonstration** – This will not a document but rather a 30-minute discussion to explain my program and the technical achievements that I made while creating it.

Annotated Bibliography

[1] Google LLC, "MediaPipe Homepage" [Online] Available at : <https://google.github.io/mediapipe/> [Accessed February 3rd 2023]

[2] OpenCV, "OpenCV HomePage" [Online] Available at <https://opencv.org/> [Accessed February 3rd 2023]

[3] Ahad Cove, (Sep 29, 2018) "OpenCV Background Subtractors: MOG vs MOG2 vs GMG vs KNN vs CNT" [Online] Available at : <https://www.youtube.com/watch?v=M6yUIAhxBxk> [Accessed February 3rd 2023]

[4] Python, (Feb 07, 2023) "unittest – Unit Test Framework" [Online] Available at : <https://docs.python.org/3/library/unittest.html> [Accessed February 7th 2023]