# HEMA Training Simulator Progress Report

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Project Summary

The objective of this project is to design and develop a reliable and accurate HEMA training simulator, which will allow the user to learn and practice the set of stances and actions which make up the art of the German longsword. More specifically, to teach and reinforce instinctual reactions one will require to spar and fight safely within the Liechtenauer school of fencing. This will be done though sequential drills and reaction based training. The user interacts with the system through a video output device (screen, VR headset, etc.) and an Arduino wand-style motion input device, to mimic holding a sword. As of December, the entire software architecture of the system has been modelled according to UML conventions, and the design principles taught by Carleton. The system components were then mapped to Unity, the IDE being used to handle real-time 3D rendering and control flow. Also, the Arduino wand input system connects to a PC wirelessly and transmits data. While the project has not kept pace with the proposal’s optimistic timetable due to hardware shuffling, a significant portion of the engineering design work has been successfully completed.

Project Background

Historical European Martial Arts (HEMA) is a class of martial arts that refers to the masses of specialized combat disciplines developed in Europe over the late Middle Ages and Renaissance. This project focuses on a school of German fencing known as the Liechtenauer style, which uses a federschwert (feather sword) as the main weapon. The core of the Liechtenauer system is to constantly provide an immediate threat to the opponent while simultaneously defending yourself. This is done through managing one’s distance and timing of actions while being keenly aware of what the opponent is doing. These actions are exact in regards to the shape and structure of the movements made.

Report Summary

This document is a progress report for the HEMA Training Simulator project between the dates of September 6th to December 8th, 2017. The project team consists of supervisor Dr. Samuel Ajila, and two student members, Conlan Lafreniere and Eric Reesor. The objective of this project is to design and implement a HEMA training application specific to the Liechtenauer style. Mr. Lafreniere is in charge of the software design, which includes the program UI, overall system architecture, and partially the AI implementation. Mr. Reesor is responsible for designing the input system, the hardware-software interface, fabrication of the Training Sword to which the Input System will be mounted, and partially the AI implementation.

Progress

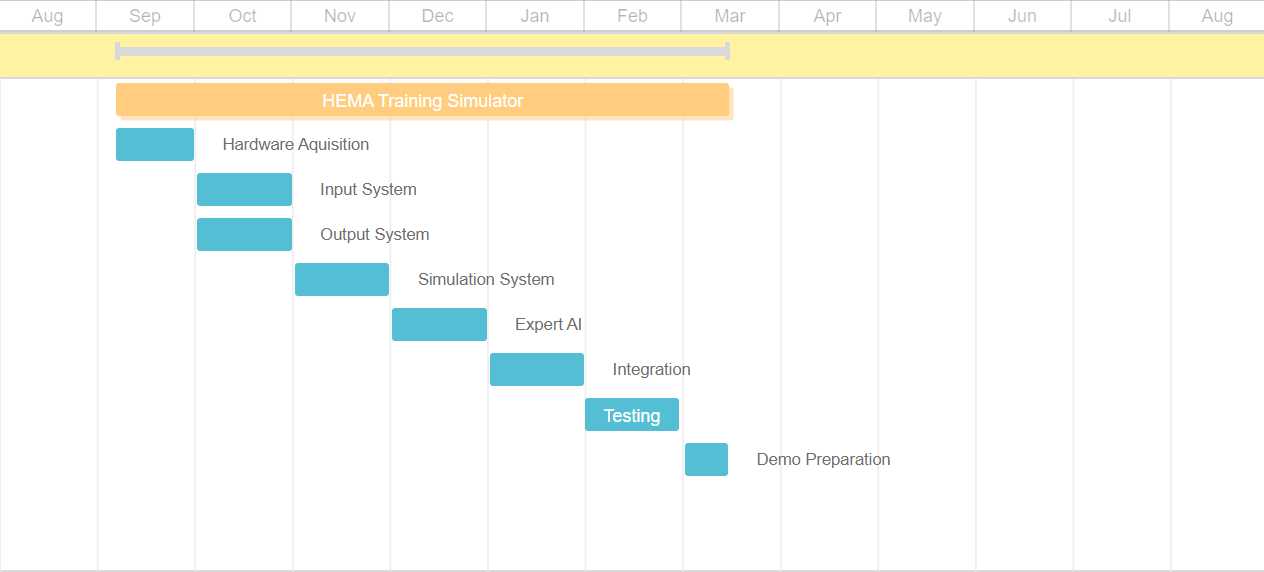


Figure 1: Project Proposal Timetable

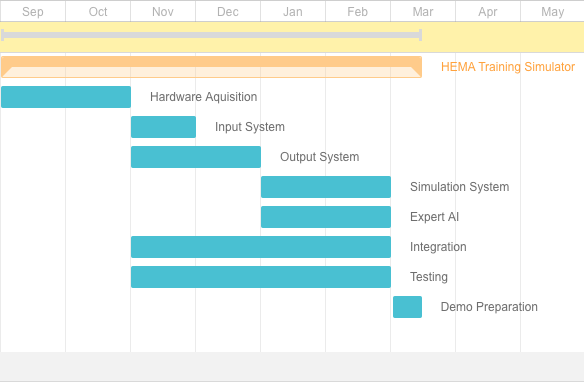


Figure 2: Project Updated Timetable

As can be seen in the above timetables, the project has fallen behind schedule. Fortunately, a large portion of the original schedule was dedicated to finalizing work such system integration and testing. Due to the scale of this project, it has proven much simpler to perform integration and testing piece-meal as components are completed. This doesn’t change that the project is lagging, and some of the less central aspects of the project may need to be dropped before March. Below is an itemized list of components completed, in progress, or not yet started.

***Complete***

- Nintendo Wii Remote Plus input system was implemented, but found to be insufficient for accurate capture of movement data.

# - New input system implemented using an Arduino Uno, the HC-05 Bluetooth Module and the 10DOF IMU BMP280 MPU9255 sensor.

# - Simulation scene created in Unity and 3D federshwert model created

# - Unity scripts created to allow input from HC-05 module into simulation scene

# - Project architecture designed in several UML diagrams, and detailed according to engineering procedures taught by Carleton

# - Application control flow implemented through scripts and Unity’s scene objects

# *In Progress*

- Conversion of raw IMU sensor data to useable data for input

- Fleshing out UI and system control to clarify usability

***To Be Completed -* High Priority**

- Implementing a standardized movement system from converted IMU input data to allow HEMA movement recognition

- Implementation of an opponent AI

***To Be Completed -* Low Priority**

- Modeling of a character avatar

- Porting Unity project to suitable VR platform

- Further improving UXD

- Implementing a user friendly training session editing screen

Conclusion

This project’s intention was to design and develop an application capable of training users in the Liechtenauer style of Historical European Martial Arts. The project has mostly kept up with the proposal’s vision, but there have been setbacks, the largest of which was the Wii Remote’s inability to capture sufficient data to emulate a sword. This had a non-trivial impact on the timetable, but progress is still being made, and the project is still within reach of an April completion deadline. Design and development will continue into the new year.