Project Management Report

**Client Name : Salaheddin Alakkari**

**Project Name : Deep Learning Model to Detect Heart Arrhythmia in ECG Data**

**Group 32**

**Pascal Raos, 3rd Year ICS**

**Maryann Foley, 3rd Year ICS**

**Anton Tiscoschi, 3rd Year ICS**

**Ailbhe Merriman, 3rd Year CSB**

**Kevin O’Donnell, 2nd Year CSB**

**Minjuan Luo, 2nd Year ICS**

**Zhongyuan Liu, 2nd Year ICS**

# **Project Planning Process**

The project planning and control processes were essential in designing and maintaining the project. The first example of this was in the initial planning stage of the project, as we agreed on the requirements with the client. It was very important that our end product was agreed on early. Our clients at ADAPT were extremely helpful in providing quick feedback so we would not be blocked at any stage.

Next in the planning stage we defined our user interface. This was essential as we were developing a mapping tool. So the majority of our work would be front-end work. The UI and UX of our project was not reliant on any other factor so it was easy to plan. It was important to have a simple and intuitive interface. We were given a lot of very helpful advice and guidance from the clients in ADAPT and the following prototype was the result.

This feedback loop continued throughout the project and enabled us to effectively alter plans sprint to sprint. We were enabled by the client to manage the team effectively. Every time the project went through a large change we would take on feedback from the client in the next sprint. We found that the planning and control processes were very effective in aiding the development as well as managing the group. This iterative approach allowed us to tackle problems as they arose instead of them piling up until the last second.

# **Project Goals and Objectives**

## **2.1. Objectives**

The aim of our system was to create an Artificial Intelligence with a high degree of accuracy in its assessments. We planned to create an intuitive user interface that will allow the client to input their own ECG data, and if time permits, to potentially incorporate ECG readings from fitness trackers such as an Apple Watch or a FitBit. The end goal was to provide an accurate assessment of a patient's heart condition based on their ECG readings. We believe that we achieved all of these objectives barring the incorporation of ECG readings from FitBits and Apple Watches. Ultimately, after researching what we would need to do to make this possible, we realised that these specifications were just outside the scope of our project.

## **2.2 Goals**

Our goal was to deliver an intelligent deep learning model that has been trained on the “MIT-BIH Arrhythmia Database”, a dataset which consists of 48 half-hour ECG readings sampled at 360 samples per second to create approximately 110,000 data entries. These data entries are split at approximately 90,000 in the training dataset, and 20,000 in the testing dataset. Alongside this, we hoped that we would deliver a clear and intuitive user-interface that would allow a user to input their own ECG data in csv format to determine whether patient(s) data contains irregular heartbeats. We believed that we reached all of our goals. We were able to reach our goals due to the project planning and consistent work as a team.

# **Project Scope**

## **3.1. Product Backlog**

Once we switched to our new project there were no changes to the scope of the project. The requirements for our new client were quickly defined, both in and out of scope. We were able to deliver everything within our requirements document/agreement and our client did not request anything that was outside it.

**College Deliverables:**

* Requirements Document:
  + Describes the current system, the proposed system, functional and non-functional requirements, the system prototype and UML diagrams.
* Requirements Presentation
  + A presentation on the contents of the requirements document.
* Software Design Specification
  + Describes the system design, the tools and frameworks used in the project and the system design models.
* Project Plan
  + The current document detailing the planning of the project.
* Final Presentation
  + A presentation on how the project went, the final deliverable and what the team learnt.
* Development Report
  + A technical report detailing the development of the project.
* Management Report
  + A report reflecting on the management of the project.
* 7 x Individual Reflective Essays
  + Individual reflections on working on the project.
* Final Code Bundle
  + The code which is handed over to the client.

**Software Deliverables:**

* A web based application, where an AI determines if the person has heart problems based on the ECG data submitted to the application.

A portable system which allows the user to upload CSV files, which the Ai that is located on the backend server can access. The AI determines if the person has heart problems based on the ECG data, and relays usable data to the front-end

The following items are in scope for the project:

* Developing the user interface.
* Training AI models that will return if a heart is healthy from ECG diagrams.
* Converting data received in CSV format into a more readable structure.
* Relaying data by means of endpoints serving requests coming from the web application.
* Completing the functional and non-functional requirements set out in the project description.

The following items are out of scope for the project:

* Considering the limitations of time, additional features asked for such as getting ECG data from an apple watch or fitbit might not be entirely feasible and as such we would, for now, consider them out of scope of the project.

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# **Project Approach**

## **4.1. Scrum Sprints**

Due to the unique nature of our project, the first scrum will be taken from the beginning of our second project, i.e starting from 07/03/22, the Monday when we decided which AI project to do.

| **Scrum Title** | **Description** | **Start Date** | **End Date** | **Duration** |
| --- | --- | --- | --- | --- |
| Research | Meetings with our client to gain a better understanding of what we need to do. Doing research on deep learning and getting to grips with our dataset. Also deciding on which languages and softwares to use. | 07/03/22 | 14/02/22 | 1 week |
| AI and UI Development | Begin work on the development aspect of our project. Continued learning and research of TensorFlow and Keras for the Deep Learning AI team and Flask and HTML for the UI team. Accommodate the 2nd year’s continued efforts to learn new languages and GitHub. | 15/03/22 | 29/03/22 | 2 weeks |
| Integration of work from both teams | These two weeks will be dedicated to finishing off our project and integrating the work completed by both the UI and AI Deep Learning teams. Both the management report and the development report will be completed also. | 30/03/22 | 14/04/22 | 2 weeks |

# **Project Organisation**

## **5.1. Staff**

| **Name (Role)** | **Year** | **Prior Experience/Skills** | **Experience/Skills Acquired** |
| --- | --- | --- | --- |
| Pascal Raos  (Team Lead, Backend Manager) | 3 | Most familiar with using Java and Python. Notable projects include working using Python to make API calls to AWS services, and organise network data from a company’s system of machines. | Creating and training models using Keras and Tensorflow libraries and manipulating data in pandas dataframes.  Team management and work allocation skills. |
| Ailbhe Merriman  (Backend Manager) | 3 | Previous experience in Java, Python, Haskell, Vue.js, CSS and javascript. Prior experience creating an intuitive interface for knowledge graphs. | Gained experience in creating deep learning models using Keras and Tensorflow. Also learned group management skills. |
| Maryann Foley (Frontend Manager) | 3 | Previous academic and professional experience has been in Python, Java, JavaScript, C, and HTML. I have worked at Bloomberg LP and Square. | Learned project management skills, division of work into smaller, easier accomplished tasks  Experience with data formatting for pandas and Tensorflow |
| Anton Tiscoshi (Frontend Manager) | 3 | Experienced in Java and C. Latest project was creating an attendance mobile app for my volleyball team to motivate them to not miss training and come on time. | Improved knowledge of project management and teaching/guidning skills.  Using HTML, CSS and Bootstrap to develop a webpage.  How to manage client expectations. |
| Kevin O’Donnell (Frontend Developer) | 2 | Most experience in Java, with some experience in C++. Taken on one project prior to this, where as a group we created an interactive interface to examine covid cases in the USA. | Using bootstrap, HTML, CSS and Python all for the first time. Gained the knowledge of creating a flask application, working in a team as well as developing an understanding of AI. |
| Minjuan Luo (Backend Developer) | 2 | I’m good at using Java, Arm and C language to code. Analysing data with my group members, successfully displaying useful information through Processing in multiple ways. I am learning python as well. | Creating CNN and LSTM models and training LSTM models using Keras and Tensorflow libraries through python language.  Take in data by using class weight methods other than resampling.  Scrum video recording skills and group collaborative experiences |
| Zhongyuan Liu (Frontend Developer) | 2 | Previous coding experience with Java, C, Arm assembly language. Worked with a team to produce an analysis of COVID-19 cases in the United States in Java before. | The front end is mainly responsible for the direct UI interface for uploading ECG data, and visualisation of the output of the result page. During the production of the front end, I learned to use PYTHON, HTML, CSS and other languages to make web pages. Learn to use GitHub for storage, editing and teamwork |

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## **5.2. Staff Charts**



# **Risk Analysis**

| **Risk Element** | **Impact**  **(1 to 5)** | **Likelihood (1 to 5)** | **Risk Factor**  **(I \* L)** |
| --- | --- | --- | --- |
| Miscommunication with Client | 4 | 1 | 4 |
| Deep Learning AI has poor accuracy | 5 | 2 | 10 |
| Unable to apply product in a simple real world scenario (basic input of ECG csv file) | 4 | 1 | 4 |
| Unable to apply product in a complex real world scenario due to time constraints(reading smart watch data) | 2 | 4 | 8 |

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## **6.1. Risk Mitigation**

| **Risk** | **Measures to Reduce Risk** |
| --- | --- |
| Miscommunication with Client | Frequent communication with client; discussions within team about clarifying questions; precision in documentation and communications |
| Deep Learning AI has poor accuracy | Ensuring the data is correctly formed and balanced before training the model will eliminate all risk |
| Unable to apply product in a simple real world scenario (basic input of ECG csv file) | Ensuring there is a planned connection between the input in the simple UI and the input to the AI will be the only difficulty, creating a simple UI to take in a file should cause no issues. |
| Unable to apply product in a complex real world scenario due to time constraints(reading smart watch data) | We talked about possibly extending our AI’s functionality to read in smart watch ECG data directly, however due to time constraints caused by the changing of our project, this level of application may not be feasible if we take too long to get the deep learning model trained |

# **Project Control**

In order to control our project execution, we used a multitude of resources. In order to increase efficiency and progress, we had regular meetings, both in person and over Zoom, and used them to establish a plan for our coming sprints. We had a shared google drive folder, where we collaboratively worked on documentation using Google Docs and Google Slides and gathered resources, and a github repository for sharing our code. To ensure team communication, we had an active team WhatsApp group message, where we discussed all aspects of the project with great frequency. This active line of communication also allows us to keep on top of deadlines, as we would notify each other and make sure everyone is aware of pending submissions. Our team is in frequent communication with our client to ensure that all details have been ironed out and all of our expectations are made clear.

# **Communication**

## **8.1. Client Communication**

Our communication with our client, Salah Alakkari, was primarily through email and Microsoft Teams. We also conducted meetings in person on a couple of occasions. Through these meetings, we were able to discuss our project options and refine the work we would be doing, as well as learn about relevant tools we can use. We met with our client on a weekly basis. These meetings were really helpful as Salah was very knowledgeable and always willing to help us when needed.

## **8.2. Team Meetings**

Our team was communicating mainly through WhatsApp, as it is where we were all most likely to be active. Additionally, we had a Google Drive shared folder, where all of our documents are stored but also where we shared resources and developed working plans. We met at least once a week over Zoom for our SCRUM meeting, usually on Friday afternoons, but we would also meet after client or demonstrator meetings to discuss any developments to our project.

**8.3. Demonstrator Meetings**

We met weekly with our demonstrator, Alex, on Tuesdays in the demonstrator’s Blackboard Collaborate room. Topics of discussion were primarily progress on the project and any issues or difficulties encountered. We showed the demonstrator a demo of our project, displaying our progress. Our demonstrator was very helpful as he kept a consistent schedule, emailed the meeting time in advance and offered us some technical advice. When we had significant issues with our project at the beginning of the term Alex was extremely helpful and offered to get in touch with the course leader, Macu.