COMP3000 – Project Portfolio

Computing Project

2022/2023



# 1 Acknowledgement

I would like to thank my supervisor Dr Hai-Van Dang for all the support and help that has been given to me over the course of this project. The time that she has spent with me to help me improve upon the work I have done is invaluable.

I would also like to thank my friends and family for being supportive of me during this time. They have been really helpful during my lows and I appreaciate them.

# 2 Abstract

Contents

[1 Acknowledgement 1](#_Toc127476463)

[2 Abstract 1](#_Toc127476464)

[3 Links 4](#_Toc127476465)

[4 Introduction 4](#_Toc127476466)

[4.1 Project Vision 4](#_Toc127476467)

[4.2 Background 4](#_Toc127476468)

[4.2.1 Infrastructure for the QTrobot 0](#_Toc127476469)

[4.3 Gantt Chart 0](#_Toc127476470)

[4.4 Poster 0](#_Toc127476471)

[5 Project Management 1](#_Toc127476472)

[5.1 User Stories 1](#_Toc127476473)

[5.2 Project Planning 1](#_Toc127476474)

[5.2.1 Trello Board 1](#_Toc127476475)

[5.2.2 Version Control 1](#_Toc127476476)

[5.2.3 Market Research 1](#_Toc127476477)

[5.2.4 Project Design 2](#_Toc127476478)

[5.3 Project Methodology 2](#_Toc127476479)

[5.4 Legal, Social, Ethical & Professional Issues 2](#_Toc127476480)

[5.4.1 Legal Issue 3](#_Toc127476481)

[5.4.2 Social Issue 3](#_Toc127476482)

[5.4.3 Ethical Issue 3](#_Toc127476483)

[5.4.4 Professional Issue 3](#_Toc127476484)

[5.5 Project Development 3](#_Toc127476485)

[5.5.1 Stage 1: Early Stages 3](#_Toc127476486)

[5.5.x Softwares and Tools 3](#_Toc127476487)

[5.6 Project Testing 3](#_Toc127476488)

[5.6.1 User Testing 3](#_Toc127476489)

[5.7 Meeting Minutes 3](#_Toc127476490)

[6 Sprint Reviews 4](#_Toc127476491)

[6.1 Sprint 0 4](#_Toc127476492)

[6.2 Sprint 1 5](#_Toc127476493)

[6.3 Sprint 2 5](#_Toc127476494)

[6.4 Sprint 3 6](#_Toc127476495)

[6.5 Sprint 4 7](#_Toc127476496)

[6.6 Sprint 5 8](#_Toc127476497)

[6.7 Sprint 6 9](#_Toc127476498)

[6.8 Sprint 7 9](#_Toc127476499)

[6.9 Sprint 8 9](#_Toc127476500)

[6.10 Sprint 9 9](#_Toc127476501)

[6.11 Sprint 10 9](#_Toc127476502)

[6.12 Sprint 11 9](#_Toc127476503)

[6.13 Sprint 12 9](#_Toc127476504)

[6.14 Sprint 13 9](#_Toc127476505)

[6.15 Sprint 14 9](#_Toc127476506)

[7 Critical Evaluation 9](#_Toc127476507)

[8 Evaluation (Discussion of Deviation, Big Changes) 9](#_Toc127476508)

[9 Conclusion 9](#_Toc127476509)

[10 References 9](#_Toc127476510)

[11 Appendix 10](#_Toc127476511)

# 3 Links

|  |  |
| --- | --- |
| **Document Reference** | **Online Links** |
| [Gantt Chart](#_Gantt_Chart) | [High Res Image (Imgur)](https://i.imgur.com/RVbzxjV.png), [(Mirror)](https://files.catbox.moe/5wyc0n.png) |
| [Trello Board](#_Trello_Board) | [Trello](https://trello.com/invite/b/stCxAKF8/bacc4ca9cf8aefa46403a2451d15e98f/comp3000computingproject) |
| [Version Control](#_Version_Control) | [GitHub](https://github.com/greatyarn/COMP3000_Computing_Project) |
| [Meeting Minutes](#_Meeting_Minutes) | [OneDrive](https://liveplymouthac-my.sharepoint.com/:w:/g/personal/gregory_kua_students_plymouth_ac_uk/ET_B3DV5e4NFkSzo-IntXoQB-lrf6EN-2o3SvNtGJFMPZQ?e=sp2L0p) |
| [Linux GUI Issue](#Linux_GUI_Issue) | [High Res Image (Imgur)](https://imgur.com/a/XXE2ADH) ([Mirror](https://files.catbox.moe/wo4iak.zip)) |
| [Flowchart Maker and Diagram Software](#_5.5.x__Software’s) | [Draw.io](draw.io/) |
| [Gantt Chart Software](#_5.5.x__Software’s) | [GanttProject](https://www.ganttproject.biz/) |
| [Operating System for QTrobot](#_5.5.x__Software’s) | [Ubuntu](https://ubuntu.com/) |

# 4 Introduction

## 4.1 Project Vision

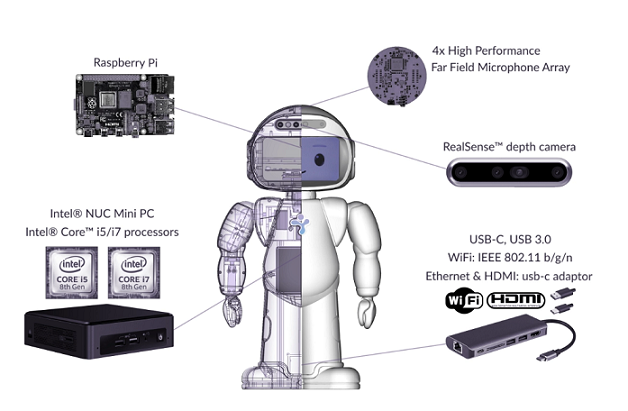
*The QTrobot is a toddler-like humanoid robot built by LuxAI. This project, Audio Authentication via Voice Recognition on QTrobot, or AAVR for short, is a software for patients who would like to allow for an easy way to authenticate themselves through robots with the use of their voice. This authentication process with the use of a human voice allows for patients to retrieve their medical records, which might contain their age, height, and weight. This method of authenticating by voice is safer and more convenient as it reduces the amount of human interaction that is needed, therefore allowing for an improvement of personal data security as a whole. With voice authentication, this allows for multiple different patient profiles to be set up conveniently.*

New Project Vision

## 4.2 Background

(Background bout the project)

### 4.2.1 Infrastructure for the QTrobot



The QTrobot is an autism robot tutor for improving a child’s learning outcome at home (QTrobot, 2022). The documentation on the LuxAI website states that the robot is made off a raspberry pi, 4x microphones, a depth camera powered by Intel’s RealSense and a Nuc. The camera that is in the robot is connected to the Intel Nuc. The USB C adapter that is provided is also connected to the Nuc. The raspberry pi connects the rest of the components together. The Raspberry Pi links to the Nuc via an internal LAN (Local Area Network) cable. Each device, the nuc and the raspberry pi has been setup with different IP addresses. This component consists of the display that is on the face opf the robot, the speakers and microphone. There is also another usb at the back of the robot to plug in to the Raspberry Pi directly.

The QTRobot in the current configuration for this report is done via wifi through the Raspberry Pi. The Raspberry Pi passes the internet connection that is received through the LAN cable which is in the robot internally. This is how both the Raspberry Pi and the NUC can get an internet connection through one network.

## 4.3 Gantt Chart

Gantt charts are used to show the project flow. This flow will be split based on the sprints that have been set. The sprints will be set at every two weeks. The blue line at the start and at the end marks the start of the first sprint and the final day of the last sprint. The image attached below shows the first revision of the gantt chart that has been made. The gantt chart below is made using [GanttProject](https://www.ganttproject.biz/) which is an open source Gantt Chart Maker tool that have been found.

The gantt chart exists to allow for the project to be split between sections. It also gives a top down overview of an estimation on how the project will be run.

Chart, timeline, bar chart

Description automatically generated

## 4.4 Poster

The poster that can be seen below shows …

(Poster to be inserted here)

# 5 Project Management

## 5.1 User Stories

## 5.2 Project Planning

### 5.2.1 Kanban Board

The Kanban board that is being used is being made with the help of [Trello](#_3_Links).

### 5.2.2 Version Control

A version control is used within this project to keep track of changes within the code. This allows for any accidental deletion of codes if the previous versions of it has been committed and pushed. This also serves as a memory bank to look back at lines of codes or files that have been deleted or changed. With this, the developer is able to look back at which section of the file that could have broken the newer version of the program and revert back to it if needed.

The version control that is being used in this project is GitHub. GitHub is used as it is free to use and it allows for the use of git command line.

### 5.2.3 Market Research

#### 5.2.3.1 HSBC Banking

[HSBC UK](https://www.hsbc.co.uk/ways-to-bank/phone-banking/) developed a new voice-driven technology back in 2020. When one calls the support help line on their mobile phone. The user would be instructed to repeat a sentence which is “My Voice is my password”. This allows HSBC to do a check whether if the user calling is the person that owns the bank account.

This system is similar to the current project that is listed within this documentation where it needs to compare a current voice recording to a saved one to check which user is talking

#### 5.2.3.2 Google Assistant

[Google Assistant](https://support.google.com/assistant/answer/9071681#vm_pr&zippy=%2Cvoice-match-personal-results) has a feature called Voice Match. Voice Match allows users of Google Devices to let their device knows that they are the owner of a Google Device. This is used on one of their Nest product lineup called the Google Nest Hub, where it is able to show personal results using your personal search history and mail history if it is able to authenticate you when you say the key words, “Hey Google” or “Okay Google”. This also works on other Nest Enabled Devices and the Google Assistant Software on Android Phones. iOS and iPadOS devices can connect their Google Devices such as their Nest Mini or Nest Hub via their device but are not able to use Voice Match directly on their Apple Device.

#### 5.2.3.3 Windows 10 / 11

Windows is an operating system (OS) created by Microsoft. In version 10 and 11 of Windows, Users are able to enable [Speech Recognition](https://support.microsoft.com/en-gb/windows/windows-speech-recognition-commands-9d25ef36-994d-f367-a81a-a326160128c7#WindowsVersion=Windows_11) on their windows compatible devices if it meets the standard requirements. It is able to learn your voice and users are able to train it so that the device understands the user better. It is used for simple and complex tasks to allow the user to use their devices completely hands free if they want to.

### 5.2.4 Project Design

## 5.3 Project Methodology

Diagram

Description automatically generated

A picture containing text, sky, indoor, map

Description automatically generated

## 5.4 Legal, Social, Ethical & Professional Issues

This section will go through the considerations of the LSEP issues that might happen during and after the project development of this project.

### 5.4.1 Legal Issue

### 5.4.2 Social Issue

### 5.4.3 Ethical Issue

### 5.4.4 Professional Issue

## 5.5 Project Development

### 5.5.1 Stage 1: Early Stages

The project started with the developer being able to choose a supervisor for this project. The supervisor selection was done with the developer needing to submit a proposed idea to a supervisor of their choosing. This was done within the first two weeks of the COMP3000 module. After much deliberation, Dr Hai-Van Dang was made as the supervisor of choice in this project.

Next, the PID (Project Initiation Document) has to be made. The PID is meant to be the output of [Sprint 0](#_6.1_Sprint_0). The base of Sprint 0 is meant to be the starting point of the project. The [project vision](#_4.1_Project_Vision) was also made during this period of time. This document can be found on the GitHub Link [above](#_3_Links).

### 5.5.2 Stage 2: Learning ROS

### 5.5.3 Stage 3: Learning AWS

### 5.5.x Software’s and Tools

The main development IDE (Integrated development environment) that is used within this project is Visual Studio Code. It is one of the tools that the developer is particularly well-versed in. Other than that, charting tools such as [draw.io](#_3_Links) and [GanttProject](#_3_Links) have been used to create the graphs and diagrams within this document. As stated above [here](#_5.2.2_Version_Control), Git is also being used. Next, [Trello](#_3_Links) is being used as the Kanban Board. More information on why is it being used specifically can be found in the section [here](#_5.2.1_Kanban_Board).

For the robot itself, [Ubuntu](#_3_Links) is used a lot during this project as it is the main OS.

## 5.6 Project Testing

Project Testing is done after the develop…

### 5.6.1 User Testingss

## 5.7 Meeting Minutes

(Insert Meeting Minutes here)

# 6 Sprint Reviews

This project uses the scrum methodology thus needing sprint reviews. Sprint reviews are used to include what has been completed during the set time, and what the backlog will look like within the next sprint (Wrike, n.d.).

## 6.1 Sprint 0

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

Description automatically generated

Sprint 0 runs from the 6th October till 20th October. The project initiation document (PID) was made that includes the title of the project, project vision, risks, Gantt chart. This initial document will be the basis for the whole project which shows where the project would head in the future and acts as a steppingstone. The GitHub Repository has also been made during this sprint. A Trello board has also been set up to allow for management of tasks and within Trello automations has been set up for automatic labelling.

## 6.2 Sprint 1

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

Description automatically generated

Sprint 1 runs from 20th October till 3rd November 2022. During this sprint the QTrobot was checked to make sure that it can turn on and off it’s microphone via the ROS service. The base code was pushed with a template. It was here where there was a Linux GUI issue which did not allow me to run the terminal or any system apps. (Images can be found in the Links section of this document) It was then fix within a week.

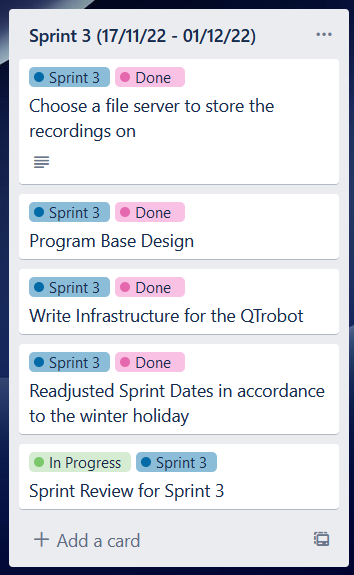
## 6.3 Sprint 2

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

Description automatically generated

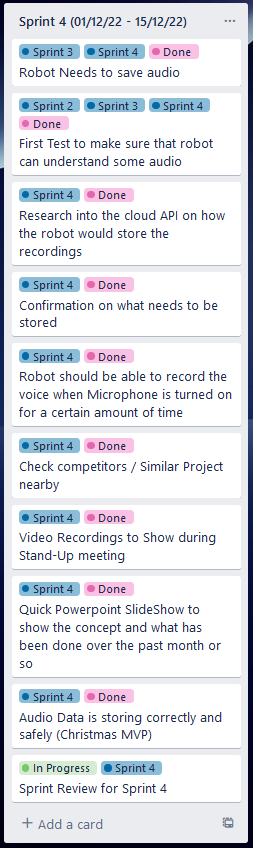
Sprint 2 runs from the 3rd of November 2022 until the 17th November 2022. This sprint went into more research into Audio Recognition. Google’s speech recognition library and Amazon’s Rekognition was also checked accordingly to see which is more suitable for this project. Project Planning for the base designs for the enrolment phase and the recognition phase has been made using draw.io. The internet issue that has been persistent has been fixed during this time.

## 6.4 Sprint 3



Sprint 3 runs from 17th November 2022 until the 1st December 2022. This sprint consisted of a meeting with Dr Hooman from the University of Hertfordshire on the 18th November. This meeting consisted of information on Visual and Spoken interfaces, Dealing with Voice Biometric. There was talks on Fourier Transformation, Frequency domain and time domains. This meeting helped with the base understanding for Speech Recogntion. S3 by Amazon was chosen as the file server to store the audio recordings. Base first designs were made for the infrastructure section of the report and was written out. Sprint Dates were also readjusted to follow the winter holidays.

## 6.5 Sprint 4



Sprint 4 runs from the 1st of December till the 15th of December 2022. At the end of this sprint, there will be a showcase to the supervisor that shows the progress of what has been done over the past 4 sprints. One of the main development of the project that can be stated is that the robot is able to save the audio that is recorded. The data is stored locally. Other than that, considerations on what data that is need to be stored has been taken into account. Within the same spectrum, the user would be able to know when they are being recorded. Other competitors and / or similar projects has been checked out and written within this report [here](#_5.2.3_Market_Research). A quick PowerPoint presentation was made up to show the concept that has been done as well. The PowerPoint presentation can be found over [here](https://liveplymouthac-my.sharepoint.com/:p:/r/personal/gregory_kua_students_plymouth_ac_uk/Documents/Year%203%20(Stage%204)/COMP3000%20Computing%20Project%20(22AYAUM)/Submissions/Final_Submission_COMP3000_GregoryKua/MVP%20Folder%20(Including%20Video%20Footage)/MVP_3.pptx?d=w5b47efffb8244b78b2f723cc2345f623&csf=1&web=1&e=nIbkaq).

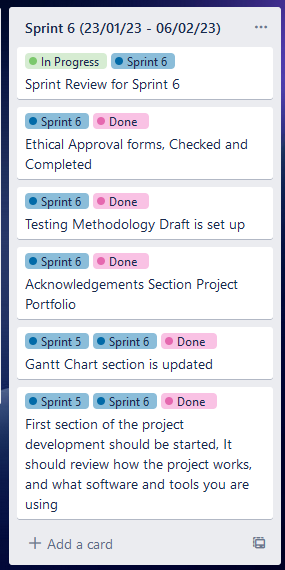
## 6.6 Sprint 5

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

Description automatically generated

Sprint 5 runs from 9th January to 23rd January. Documentation has been updated during this sprint. Meeting Minutes has been reworked to be easier to read and to prepare for insertion within the documentation. References has been reworked to follow Harvard referencing instead of short links. There has been no major development to this project due to other modules taking over most of the time. Main heading for Sprint Review section has been written out here as well.

## 6.7 Sprint 6



Sprint 6 runs from 23rd January to 6th February. This sprint, Ethical approval forms have been checked. Document has been updated with more hyperlinks and have surpassed 2000 words within this sprint.

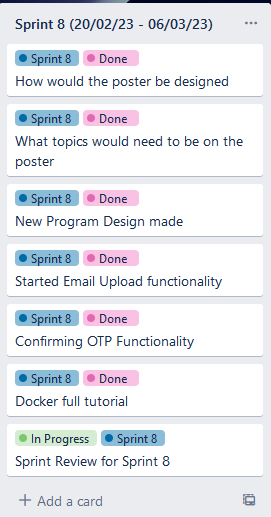
## 6.8 Sprint 7

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

Description automatically generated

Sprint 7 runs from 6th February to 20th February. During this sprint, plans for downscaling the project was made here. This is due to the fact that there were some unknown issues with boto3’s API. This caused some inconsistency on when it will run. Timeline from here on out has been affected slightly.

## 6.9 Sprint 8



Sprint 8 runs from 20th February till 6th March. During this sprint, the poster designs were started to be made. This includes with checking what topics and text would need to be on the poster. This is for the March submission. Next, program designs were made as well. Email uploading functionality have been started. OTP (One Time Passcode) functionality has also been implemented. During this sprint, the developer decided to learn docker in full to make development easier.

## 6.10 Sprint 9

## 6.11 Sprint 10

## 6.12 Sprint 11

# 7 Critical Evaluation

# 8 Evaluation (Discussion of Deviation, Big Changes)

# 9 Conclusion

# 10 References

Google (n.d.) *Teach google assistant to recognize your voice with voice match - android*, *Google Assistant Help*. Google. Available at: https://support.google.com/assistant/answer/9071681#vm\_pr&zippy=%2Cvoice-match-personal-results.

HSBC (n.d.) *Telephone banking: Give our friendly team A call - HSBC UK*, *Telephone Banking | Give Our Friendly Team a Call - HSBC UK*. HSBC. Available at: https://www.hsbc.co.uk/ways-to-bank/phone-banking/.

Microsoft (n.d.) *Use voice recognition in Windows*, *Microsoft Support*. Microsoft. Available at: https://support.microsoft.com/en-gb/windows/use-voice-recognition-in-windows-83ff75bd-63eb-0b6c-18d4-6fae94050571.

Microsoft (n.d.) *Windows Speech Recognition commands*, *Microsoft Support*. Microsoft. Available at: https://support.microsoft.com/en-gb/windows/windows-speech-recognition-commands-9d25ef36-994d-f367-a81a-a326160128c7#WindowsVersion=Windows\_11.

*QTrobot, an engaging educational robot for children with autism and special needs education* (2022) *LuxAI S.A.* LuxAI. Available at: https://luxai.com/robot-for-teaching-children-with-autism-at-home/.

# 11 Appendix