Table 1: Revision History

Date	Developer(s)	Change
09/25/22	Muhanad Sada	Workflow Plan, POC Demo Plan, Technology
09/25/22	Ahmed Nazir	Technology

<div align="center">

Development Plan
Mechatronics Engineering

Team 25, Preliminary
Ahmed Nazir, nazira1
Stephen Oh, ohs9
Muhanad Sada, sadam
Tioluwalayomi Babayeju, babayejt

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1 Team Meeting Plan

The team plans on having in person meetings weekly on Mondays from 2:30-4:30PM. These meetings will be used to catch up on work done in the last week, next steps and any important updates. If in person meetings are not possible we will conduct them through Microsoft Teams. This weekly meeting is mandatory but we might also have other meetings throughout the week depending on what stage we are in for the project. All meetings will contain an agenda and each team lead will give updates on next steps.

2 Team Communication Plan

Our team will be using a Microsoft Teams group as our main method of chat, and to delegate tasks we will be utilizing GitHubs issue tracker.

3 Team Member Roles

- Stephen Oh - Team Liaison, Database Lead

- Ahmed Nazir - Hardware Lead, Inventor Expert

- Muhanad Sada - Software/Hardware Team, Git Expert

- Tioluwalayomi Babayeju - Software/Hardware Team

4 Workflow Plan

Team members will use the GitHub repository dedicated for the capstone project. The feature branch workflow will be used whenever there are any code changes

except for simple fixes such as syntax errors, comments, variable renaming, etc. Branches will also be utilized for any significant documentation changes such as section additions/modifications and diagram insertions. Pull requests will be used in conjunction with branches to review/verify code and document changes. Branches will follow the following naming structure: scope/description, ex. feat/adding new function.

4.1 Issues

The issues feature in GitHub is used to track all of the tasks for the project. Once the team or individual members identify a task, an issue will be created. In order to keep issues updated with commits related to it, the following commit message structure will be followed: (scope): [#issue number] description. When creating an issue, a team member will select one of the issue templates based on the scope of the task. There are a total of five templates:

- Bug report - any tasks used to report a bug and fix it

- Feature – any tasks that involve requesting and implementing a feature

- Enhancement - any tasks that require updating code for enhancement purposes

- Documentation – tasks that involve adding or editing documentation

- Miscellaneous – any tasks that are not covered under the scope of the other templates

Labels will also be added to issues to identify which component of the product is being worked on. The following labels will be utilized: database, desktop application, GUI, hardware, and mechanical design.

4.2 Project Board

The project board is used to organize and identify the status of each task. The project contains five columns each describing the current status of the issue:

- To-do - When tasks are first created, they are placed in this list

- In-progress – The issue has been assigned to a team member and is currently being worked on

- In-Review – The work has been completed and now to needs to be reviewed

- Done – Once team member(s) review and approve the changes, the issue will be moved to this stage

- Outdated/Ignored – issues that were created but later determined to be unnecessary

5 Proof of Concept Demonstration Plan

The proof of concept demonstration should prove three essential functionalities of the product. The first is the ability of sensors to measure desired data and send that information to the hardware. The second is having the capability to receive/send data at three different levels, which includes hardware, desktop application, and database. The POC should be able to show that hardware can receive information from a sensor and send that information to a simple desktop application. The application should then be able to receive that data and display it on the GUI. At this point, the application would be able to send that information to a database, which is populated accordingly. The third ability, is to show live data on the application's GUI, however implementation difficulties are expected. This is due to the tediousness of creating a connection that provides both smooth and continuous data transfer between the hardware and the application. In addition to these functionalities, there is the risk of being constrained in testing as we might not have access to a Formula E car or it will be difficult to duplicate. Therefore, the POC should also have a testing environment that mirrors the conditions/setup of the mechanical parts of a Formula E car upon taking measurements. If the implementation of the above essential abilities and testing environment are verified then the level of confidence of creating a successful data automation product will be achieved.

6 Technology

6.1 Programming Language

The programming language of choice is Python. Python is the perfect language for data analysis and data manipulation. Python contains many libraries specifically for data analysis.

6.1.1 Libraries

- Pandas: Data manipulation library
- Matplotlib: Math library to help visualize data in graphs
- PyQT: Python GUI library
- PyFirmata: Python library that allows serial communication between Python and the Arduino board

6.2 Software Tools

To assist with developing our product we will be using the following software tools.

Tool Name	Explanation
Autodesk Inventor	Inventor will be used for all the CAD design work to create our hardware
VSCode	Our team will be using VSCode as our primary code editor because of the vast extensions it has. VSCode also integrates nicely with git and GitHub
GitHub Desktop	GitHub desktop is an easy to use GUI which interacts with our GitHub repo and makes editing code and files faster
Pylint	The linter extension we plan on using is Pylint, it will keep our coding style consistent between different people and it is specifically made for Python
Arduino IDE	Software used to write and upload code onto Arduino board
Amazon RDS	Also known as the Amazon Relational Database Service that allows you to create, connect to, and manage database instances

6.3   Hardware

- Arduino Board: Open-source microcontroller

- Wifi module: Gives Arduino Wifi access

- Sensors: Measuring desired values

- 3D Printer: Printing CAD designed hardware components

7   Coding Standard

Coding Standard	Explanation
Coding readability	- Capitalize SQL key words to differentiate them from columns and table names - Avoiding deep nested loops to help make it easier to follow and read - Avoid creating long function that do multiple tasks, instead make small functions which do a single task. - Writing comments consistently explaining what is happening in each section of the code - Using meaningful variables to help make code more understandable - Using appropriate naming conventions
Module headers	- Creating module names - Creation date - History of changes to modules - Summary of what each module does - Functions and variable name changed in each modules - Tracking various issues in each module
Proper indentation	- Proper space between two function arguments after a comma - Proper indentation and spaces for nested blocks in code - All braces should start from a new line and the end of the braces also start on a new line

8 Project Scheduling

In order to manage our project scheduling and hit deadlines, we are prepared to have weekly meetings to see how the development of our product is going. In these meetings we will go over each person's delegated tasks and see if they were met. If they are not met we will see if this will affect the schedule we have set out and if it does we will put more resources into making sure it is completed. We will have major deadlines added to a shared calendar on teams in order for team members to see it as we work on our project. In the beginning of each month during our Monday meeting, we will discuss potential roadblocks and what must be completed for the month. Delegating tasks will be made during weekly meetings and would be based on the schedule of each individual and their expertise.