

Development Plan

4TB6 - Mechatronics Capstone

Team #5, Locked & Loaded

Abi Nevo, nevoa

Elsa Bassi, bassie

Steffi Ralph, ralphp1

Abdul Iqbal, iqbala18

Stephen De Jong, dejons1

Anthony Shenouda, shenoa2



Table 1: Revision History

Date	Developer(s)	Change
Sept 25	Abi	Drafted Team Meeting, Communication Plan, & Team Member Roles
Sept 26	Elsa	Drafted Workflow Process
Sept 26	Stephen	Drafted Intro, Demo Plan, & Scheduling

1 Introduction

The Smart Lock will be the first model of smart bike locks produced by Locked & Loaded. The lock will be mounted to your favourite bike with many features that can be controlled from a smart phone. Additionally other outputs may be monitored such as the lock state, battery level and position.

2 Team Meeting Plan

Our team will have a meeting weekly on Mondays at 10:30 AM in Thode library. Should we decide on Monday that we need another meeting that week, we will have a meeting on Thursdays at 2:30 PM, also in Thode. If more meeting time is still necessary, our group will arrange for a meeting on Friday or over the weekend.

Meetings with our supervisor, Dr. Sirouspour, will occur biweekly (once every two weeks) on Wednesdays from 11 AM to 12 PM virtually via Teams.

An agenda will be created and committed to our Git repo prior to meetings. This responsibility will be assigned to a different team member each week, on a rotation, however, all team members may suggest agenda topics. The agenda will include suggested meeting topics, who will present/lead each topic, and an estimated time of discussion. Meeting minutes will also be recorded in the same document as the agenda, by the same team member, and be uploaded to our Git repo after the meeting. This team member will also be responsible for chairing the meeting.

3 Team Communication Plan

Our primary form of fast, short communication will be through our text group chat. We will use Github to post issues and host documentation for deliverables. In addition to Github, we will also use Trello for project management and task tracking (Kanban). Lastly, we will use Teams to host virtual meetings.

4 Team Member Roles

Table 2: Team Member Roles

Role	Primary Lead	Support
Embedded Systems Design	Elsa	Abi
Documentation/Latex/"Faux Marker"/Git	Steffi	Elsa
Lock Frame Design (CAD)	Stephen	Steffi
Software (App Development)	Anthony	Abdul
Software (Wireless Communication)	Abi	Anthony
Lock Mechanism Design (CAD)	Abdul	Stephen

Each member has been designated as a lead for the various features/topics of our project, however, each member should have some knowledge of every aspect. Team members should be prepared to be flexible and give support to whichever aspect/feature has current need.

5 Workflow Plan

5.1 Code Development

Team members are expected to use the team repository on Github for code development. The master branch will be used as the current working copy of the code. To develop code, they will fork the main branches to create sub-branches that can then be merged back to the main branch according to the rules outlined below.

5.2 Rules for Merging

Merging will take place under the following branch protection rules:

1. The main branch can only be merged into and not committed to directly.
2. Merging pull requests is disallowed when tests fail.
3. Pull requests are required before merging such that one other group member must approve the code.
4. Status checks and actions must pass before merging.
5. Branches must be up to date before merging to reduce merge conflicts.

5.3 Commits

Commits should take place as often as possible, preferably for every 50 lines of code. Commit messages must be specific, concise and descriptive.

5.4 Workflow Process

Our workflow process will be as follows.

1. Create a detailed and structured plan for the software development.
2. Pull any new changes from the master branch.
3. Create a new branch to develop on.
4. Implement any independent modules.
5. Perform unit testing on the independent modules.
6. Push the changes made to the new branch.

7. Implement any dependent modules .
8. Perform unit testing on the dependent modules.
9. Merge all changes to the main branch after a pull request is approved by another group member.

5.5 Issue Tracking

Github Issues will be used to track bugs and for accountability purposes. An issue will be created when a developer is unsure about their path forward or if a bug is detected in the code. Issues will be assigned to specific team members explicitly. When an issue is detected and the team member is not able to resolve it themselves, the team lead for that issue will review and advise. Issues can also be raised if a team member foresees a conflict or problem with merging as well as for general tasks. They will be categorized according to the following

labels.

- Bug: Code that is not working properly.
- Documentation: Improvements or additions to documentation.
- Help Wanted: Extra attention is needed.
- Wontfix: This will not be worked on.
- CAD: A task related to CAD in this location.
- Wireless Communications: A task related to wireless communications (i.e., Bluetooth, GPS) in this location.
- App: A task related to an application in this location.
- Embedded Systems Design: A task related to a microcontroller in this location.
- Stretch Goal: A task related to a stretch goal in this location.
- Template: A task related to a template.

5.6 Milestones

Milestones will be created for each deliverable to keep team members accountable. They will be added continuously as necessary.

6 Proof of Concept Demonstration Plan

Our project requires a large amount of research and development, therefore we must be able to prove that our concept ideas will function as desired and our goals are accomplishable. We will prove our concept with a demonstration in November. For our proof-of-concept demo we will need to produce a prototype or model of our system which shows that we will be able to do what we need to do with the technologies that exist, and that our physical design will be able to function as desired. Our demo should be a crude system and not a final refined version.

The largest risk we foresee in our project development is our lack of knowledge in wireless communications. In order to complete our project, we first must understand which technologies exactly we must use and implement, then learn how to use those technologies, and finally implement these technologies specifically for our project. This will have to be a steep learning curve, and we must manage our time effectively in order to complete our project on time.

Our demo will need to include parts to demonstrate each goal for our product and that with some refinement and revisions we will be able to fulfill each requirement. For implementation of our demo, we will need to show the software, hardware and mechanical functionality of our product with models and prototypes. We will show our code/software through a set of test cases or utilizing a model. For our hardware we will need to demonstrate that the components will be able to complete our tasks, using a sample circuit to prove the technology works. Finally, for the mechanical design as well as packaging of our product we will need to simulate design using CAD software and prototype using 3d-printing, laser cutting, or manual construction. We will also need to test that all the components and devices will be able to communicate and work as an ensemble. Therefore, we will demonstrate that the system is able to function using the required inputs and giving the desired outputs.

7 Technology

The mobile application will be developed using XCode Ver.14.0 IDE, utilizing the Swift programming language for iOS Development. A limitation of this platform is that it only allows for iOS development. The Flutter IDE could be used as an extension as it allows for cross-platform development but requires additional research to be used effectively. For linting, we will be using SwiftLint as it is commonly used in the industry for iOS development utilizing XCode. For simple prototyping and early models, the team will 3D print components as it is cheaper and the team has extensive knowledge with the software. Once the model begins to be finalized, parts will be laser cut for higher quality testing. During the prototyping and testing phases, the team will also run FEA analysis to on solid works for free and vigorous testing. The model will also be test in a controlled wet environment for waterproof/weather resistant testing. Multiple sensors, small electric motors, and batteries will also be tested during this phase.

Other miscellaneous parts and tooling will be completed in the Hatch Centre as team members have access to the tools and resources there. The team has decided to complete all documentation using Latex and will have them posted on the team Git.

8 Coding Standard

The coding style will follow camel case for local variables (lowercaseFirstUpper-Second). Global variables however will follow the same style, but the first word will start with an uppercase letter. Constants and macros will be in full capitals. The code will be modular with functions not being longer than 20 lines of code. Each function will be responsible to complete a single task to enhancing testing and reliability. The functions will also be well commented above the respective function declaration. Also, functions will start with an action verb to describe exactly what the purpose of that function is. For linting, SwiftLint will be used for enforcing swift style and conventions.

9 Project Scheduling

Our project, work, deliverables, deadlines, and dates will be managed and scheduled accordingly so that our team will be able to complete all tasks and requirement before their due dates. Our team will have weekly meetings in which we will discuss the upcoming dates and deadlines and our goals and strategies to manage them. To manage all our work, we will use various softwares including GitHub milestones and Trello project management. We will post our required tasks and subprojects that need to be completed into GitHub milestones. The GitHub milestones will be associated with a person, a required date of completion, and a set priority. Using this we will be able to see all open issues for our project and be able to easily delegate them to get our work done.

Our major milestones are outlined from the course deliverable schedule, with the Proof of Concept Demo, Revision 0 Demo, Final Demo, & Final Documentation being the major milestones.

When a larger issue arises, or we are going to tackle a larger problem we will need to be able to split these issues into smaller more manageable ones. To decompose these large tasks, we will modularise our code/functions, utilize small commits, and be intentional with our creation of subbranches. Braking things up in terms of the skills, technologies, and knowledge required to complete each task. We will all need/be able to work on each issue so it is important to decide who will do what for our team. Each member does have different skills and interests which means tasks will be split in terms of people's preferences. When tasks can not be split easily, they can be assigned by team lead. Time will need to be managed by all team members knowing that everyone has a lot of other requirements and priorities.