BatteryRobot Manual

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Table of Contents

[Project Overview 4](#_Toc168944761)

[Robot Parts 4](#_Toc168944762)

[Electrolyte Synthesis 4](#_Toc168944763)

[Testing Electrolytes 4](#_Toc168944764)

[General Limitations and Warnings 5](#_Toc168944765)

[Requirements 6](#_Toc168944766)

[File Hierarchy 7](#_Toc168944767)

[Version Control 8](#_Toc168944768)

[Codebase 9](#_Toc168944769)

[Main.nproj 9](#_Toc168944770)

[Locators 9](#_Toc168944771)

[Pipette and Gripper Locators 9](#_Toc168944772)

[Types of Locs 9](#_Toc168944773)

[Mapped Locs 9](#_Toc168944774)

[Classes 9](#_Toc168944775)

[BatteryRobot 9](#_Toc168944776)

[T8 9](#_Toc168944777)

[PowderShaker 9](#_Toc168944778)

[PStat (Todo) 9](#_Toc168944779)

[Gamry 10](#_Toc168944780)

[Powder Protocols 10](#_Toc168944781)

[External Libraries 10](#_Toc168944782)

[Errors Raised for Safety Purposes 10](#_Toc168944783)

# Project Overview

## Robot Parts

**Robot Arm(Rob)**

The robot arm consists of a gripper and pipette holder. The gripper is used to move vials around different locations on the deck e.g. (rack, carousel, heat plate etc). Meanwhile the pipette holder is used to collect plastic disposable pipettes and draw solvents to synthesize electrolytes.

**Powder Dispenser(P2)**

The powder dispenser is attached to the carousel and shakes at specific amplitudes and durations to dispense a given mass of powder. It is capable of dispensing masses as fine as 10mg with 5% error.

**Heat Plate(T8)**The heat plate is a metal 4x3 rack that is used to heat up vials to specific temperatures. Beneath it, is a magnetic stirrer that spins at a given speed to stir the contents of the vials as it is being heated.

**Electrolyte Testing**A pump is connected to the carousel that draws specific amounts of synthesized electrolyte and pumps it to electrodes that are connected to a Gamry potentiostat. 3 types of measurements can then be conducted on the electrolyte: **potentiostatic EIS, galvanostatic EIS, and cyclic voltammetry**. Testing data is output onto an Excel spreadsheet for each process.

## Electrolyte Synthesis

Electrolytes are synthesized on the rack/deck.

## Testing Electrolytes

# General Limitations and Warnings

Cannot perform vial and pipette operations for safety purposes

# Requirements

North API is flexible with the Python versions and will run as long as an interpreter is provided.

However, Python 3.7.9 is required to install Gamry packages through the .whl files they provide. Therefore, the entirety of this project is written using Python 3.7.9, including the packages installed.

# Folder/File Hierarchy

The project is located under the BatteryRobot folder, whose hierarchy is as follows:

A diagram of a project

Description automatically generated

The PStat folder is ignored by Git, and only available on the lab PC as it contains an unreleased alpha version of the Gamry API.

# Version Control

Project uses Git for version control. Project repository is on GitHub under the Lopez Group email.

[GitHub link here](https://github.com/lopezgroup-NU/BatteryRobot)

To clone:

Request collaborator access from the lopezgroup-NU account. Once access is granted, clone the repository using either Github Desktop or the command line.

# Codebase

## Main.nproj

The most important file for this project is the \*.nproj file (for this project, it’s named Main.nproj). This file contains all the robot configurations, locators, and general project information.

## Locators

All locators are imported from MainProject\src\main\Locator.py. However, locations are stored in the Main.nproj file, not the Locator.py file itself. They are only exported to the latter for script execution.

Locators can be edited through the “Locator” tab on the NorthIDE (see “View”).

### Pipette and Gripper Locators

Locations can either be relative to the pipette holder or gripper of the robot. On the “Locator” tab, each Locator will have an icon denoting which part of the robot it is relative to.

### Types of Locs

#### Standard

#### Grid

### Mapped Locs

All the currently mapped Locs are accessible through Locators.py (See Appendix X).

## Classes

### BatteryRobot

Class for North’s robot arm.

### T8

Class for North’s heatplate

### PowderShaker

Class for North’s powder dispenser

### PStat (Todo)

Class for Potentiostat. Class not implemented, but methods are. Available in utils/PStat

## Gamry

Stuff about Gamry goes here.

## Powder Protocols

All powder protocols are defined in MainProject\src\main\settings\powder\_protocols.py.

## External Libraries

Pandas

Gamry Python API

## Errors Raised for Safety Purposes

Some Exceptions (errors) are raised during runtime to avoid collision between components of the robot.

# Appendix 1: All Locators