

The logo for Carnegie Mellon University, featuring a dark blue background with a grid of colorful lines (red, green, yellow, blue) forming a diamond pattern.

**Carnegie  
Mellon  
University**

# Team B0: AutoErasing

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Jiayi Wang, Wenqi Deng, Xiaoyu Chai

# Use Case / Application

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- **Use Case:**
  - Aims to reduce the human effort in erasing boards
  - Assist instructors to easily determine which section of the board to erase through gathering students' "votes"
- **Solution:**
  - **Board erasing system**
  - Erase a certain section of the board using motor-driven erasers upon instruction from the web application
  - Web application gathers relevant information from students
  - RPi controls the stepper motor and drives erasers

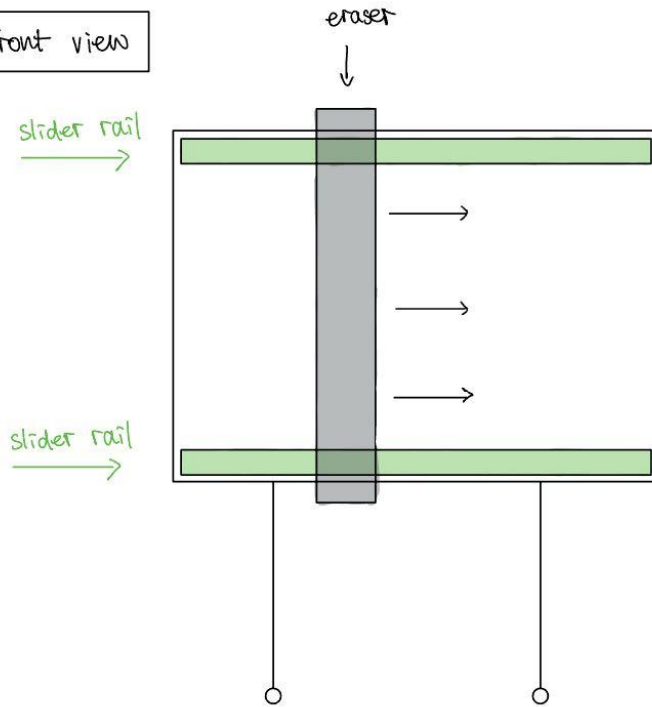
# Quantitative Design Requirements

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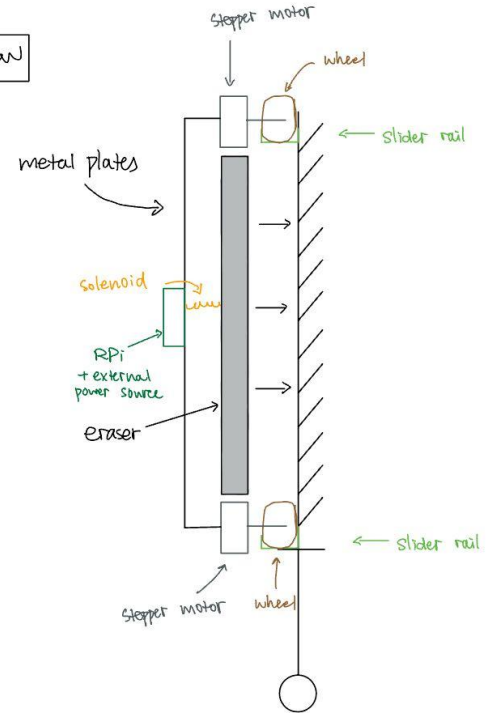
Case	Requirements
Latency	Erasing one section (18''x 24'') takes less than 10s
User Experience	Users should take < 5 min to understand how to use the web application
Accuracy & Functionality	Have > 92% of participants agree it's clean
Accessibility	< \$200 (excluding the board and eraser)
Battery Life	Should function as manual erasing for > 80 min

# Solution Approach - Hardware

Front view



Side view





# Solution Approach

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- Raspberry Pi as microcontroller because it can interface with web app better and it's cheap
- Erasers move horizontally not vertically to avoid gravity trouble
- Stepper motor can control the exact position of eraser for erasing individual sections
- Solenoid should be pull type

# Solution Approach - Web Application

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The image displays two side-by-side mockups of a web application interface for an 'AutoErasing' whiteboard. The left mockup is labeled 'Instructor View' and the right is 'Student View'. Both views feature a header with the title 'AutoErasing' and a user identification field (user id for instructor, student id for student). The main content area shows a whiteboard divided into two sections by a vertical dashed line. In the instructor view, the board is labeled with 'Current Board Setting: single whiteboard, 36'' x 24'' and 'Current Section Setting: horizontal, 2 sections'. Below the board, two status indicators show '... students are taking notes' for each section. In the student view, the board is empty, and two buttons labeled 'Still Taking Notes' are positioned below each section.


**Instructor View**

AutoErasing  user id

**Current Board Setting:** single whiteboard, 36'' x 24''  
**Current Section Setting:** horizontal, 2 sections

... students are taking notes      ... students are taking notes

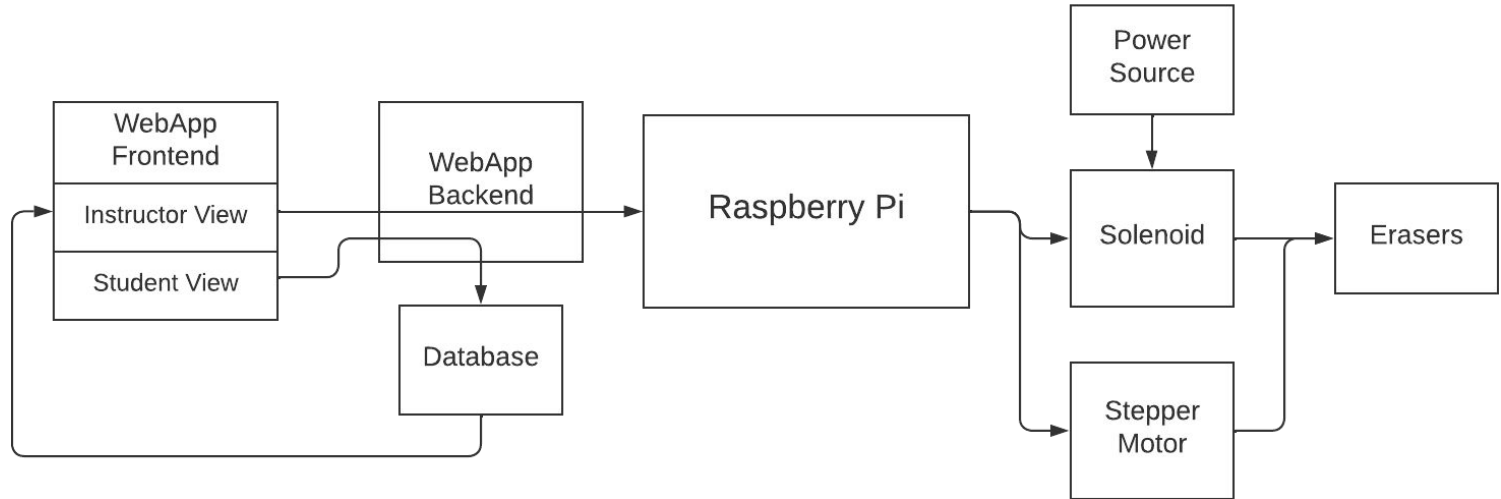
**Student View**

AutoErasing  student id

Still Taking Notes      Still Taking Notes

# System Specification / Block Diagram

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# Implementation Plan

	<b>Buying</b>	<b>Assembling / Developing</b>
<b>Hardware</b>	<ul style="list-style-type: none"><li>● Raspberry Pi</li><li>● Solenoid</li><li>● Stepper Motor</li><li>● Power Source</li></ul>	<ul style="list-style-type: none"><li>● Self assemble the parts</li><li>● Program the motor and solenoid control via Raspberry Pi</li></ul>
<b>Software</b>	<ul style="list-style-type: none"><li>● AWS and domain name for deployment</li></ul>	<ul style="list-style-type: none"><li>● Program web pages and interactions via HTML/CSS, Python and Django</li></ul>



# Test, Verification and Validation

<b>Requirement</b>	<b>Test</b>	<b>Metrics</b>	<b>Mitigation of Failure</b>
Latency	Test the latency time of motor, solenoid as well as the entire system	Erasing one section (18"x 24") takes less than 10s	Identify latency bottlenecks and mitigate based on what is identified
User Experience	Compare ease of navigation of our vs other web applications, and ease of using our system vs erasing manually	Users should take < 5 min to understand how to use the web application	Revise UI design based on feedback from participants

# Test, Verification and Validation

<b>Requirement</b>	<b>Test</b>	<b>Metrics</b>	<b>Mitigation of Failure</b>
Accuracy & Functionality	Gather participant feedback to compare cleanliness of system erasing vs manual erasing	Have > 92% of participants agree it's clean	Adjust the speed of stepper motor and pressure of solenoid
Battery Life	Simulate erasing in lectures to test if battery life is sufficient to last during the class time	Power supply should support the system for > 80 min	Compare different power source options, and research how to further optimized power usage

# Project Management

