Carnegie Mellon University

Team B0: AutoErasing

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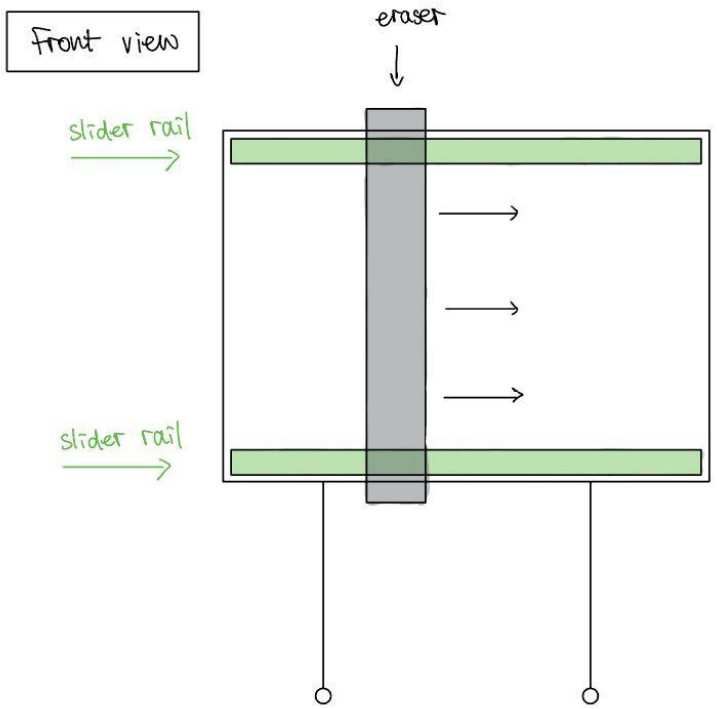
Use Case / Application

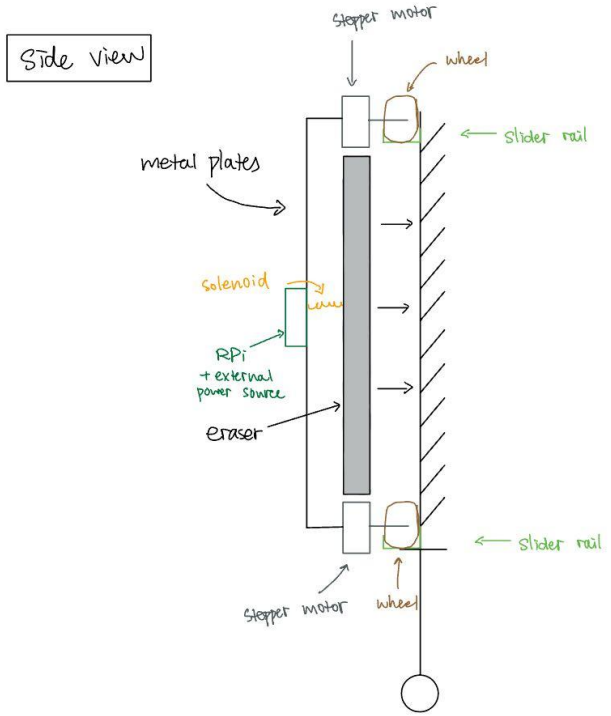
- **Use Case:**
  - Aims to reduce the human effort in erasing boards
  - Assist instructors to easily determine which section of the board to erase through gathering students' "votes"
- **Solution:**
  - **Board erasing system**
  - Erase a certain section of the board using motor-driven erasers upon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

Quantitative Design Requirements

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



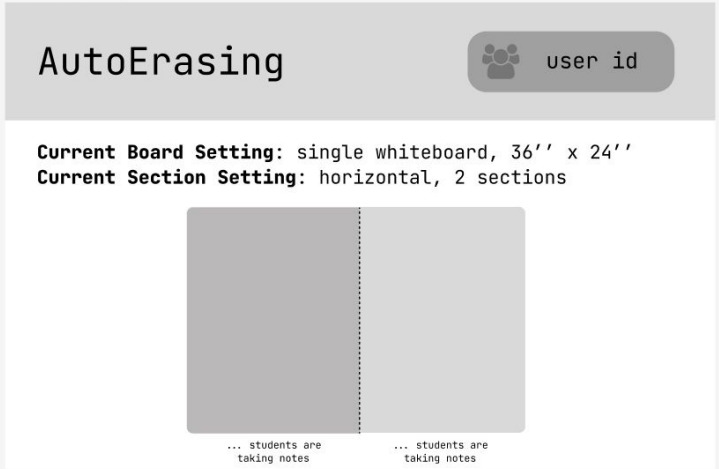


Solution Approach

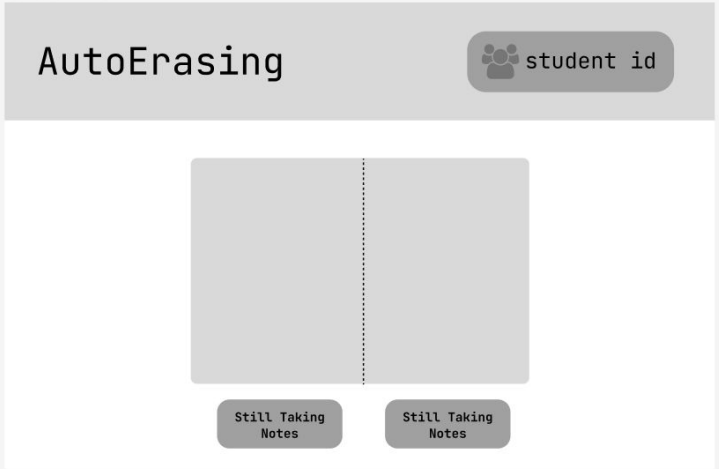
- Raspberry Pi as microcontroller because it can interface with web app better and it’s cheap
- Erasers move horizontally not vertically to avoid gravity trouble
- Stepper motor can control the exact position of eraser for erasing individual sections
- Solenoid should be pull type

Solution Approach - Web Application

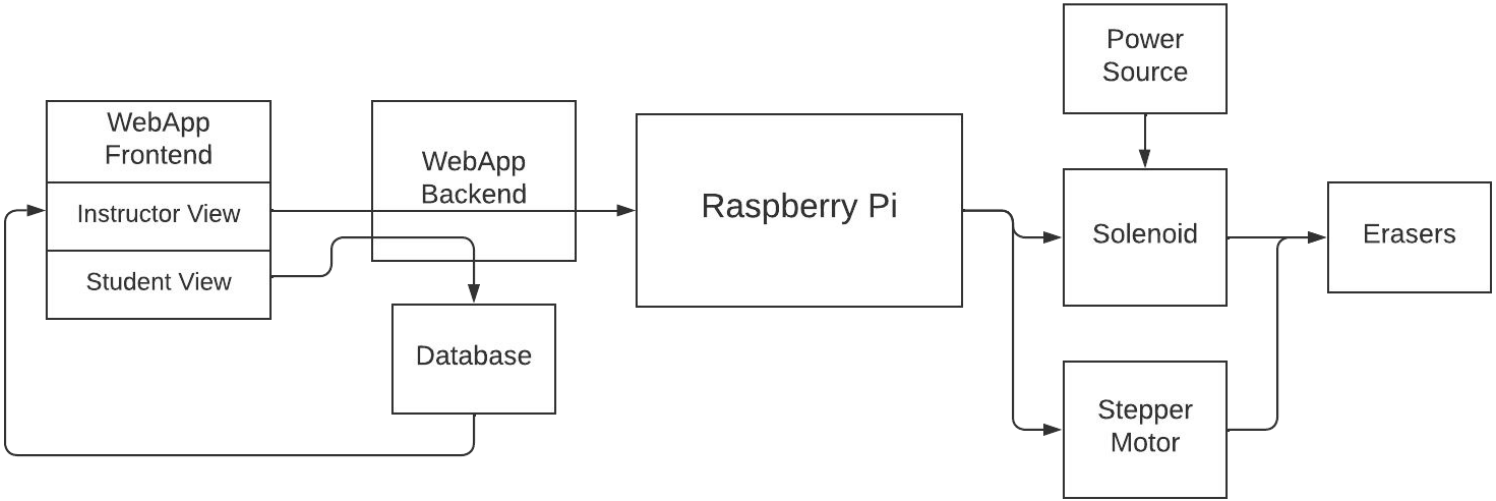
Instructor View



Student View



System Specification / Block Diagram



Implementation Plan

	Buying	Assembling / Developing
Hardware	● Raspberry Pi ● Solenoid ● Stepper Motor ● Power Source	● Self assemble the parts ● Program the motor and solenoid control via Raspberry Pi
Software	● AWS and domain name for deployment	● Program web pages and interactions via HTML/CSS, Python and Django

Test, Verification and Validation

Requirement	Test	Metrics	Mitigation of Failure
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

Requirement	Test	Metrics	Mitigation of Failure
Accuracy & Functionality	Gather participant feedback to compare cleaness 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