

Mark My Words

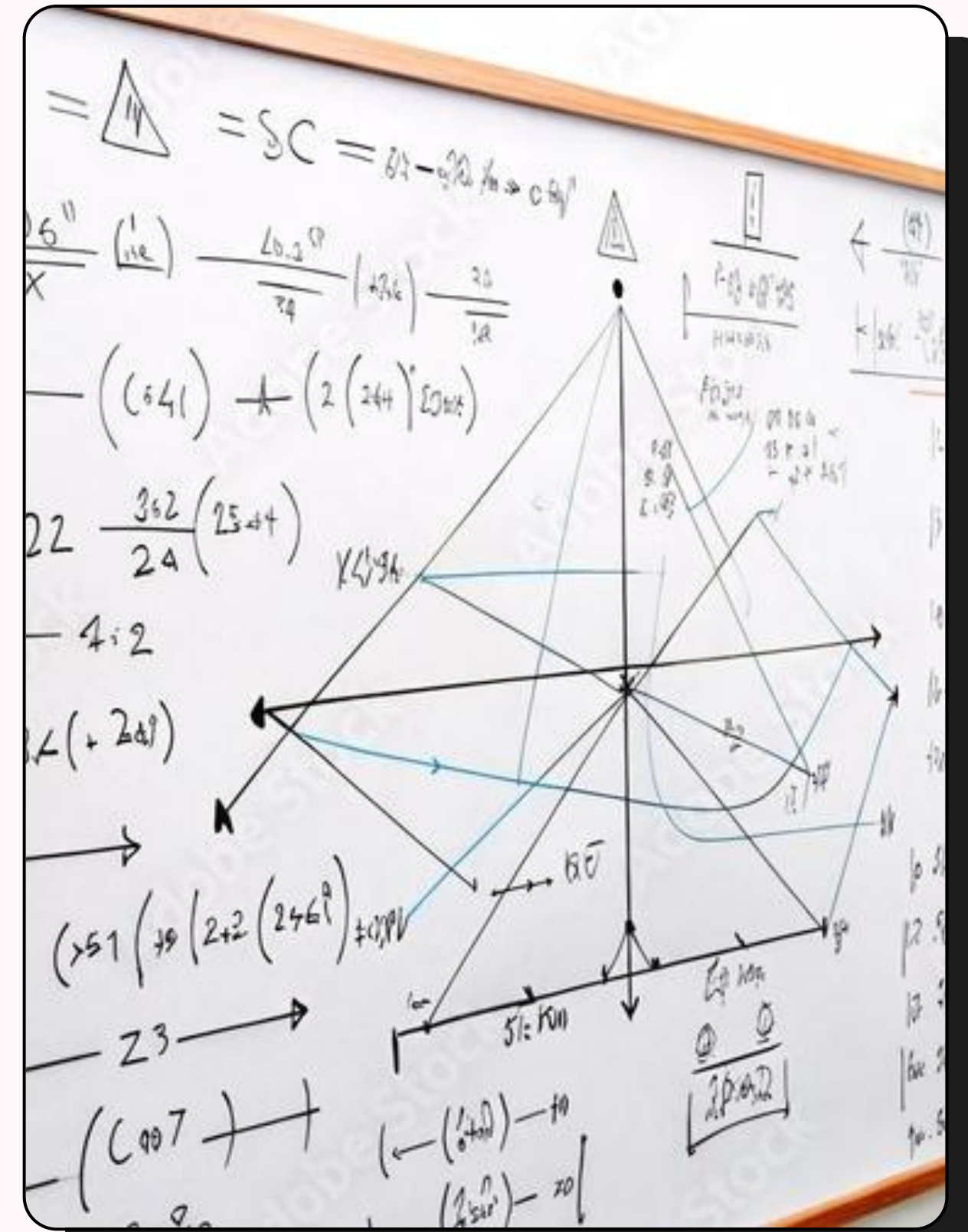
Alex Dietrich, Andrew Wang, Ethan Sharf



Use Case

Copying across can be difficult

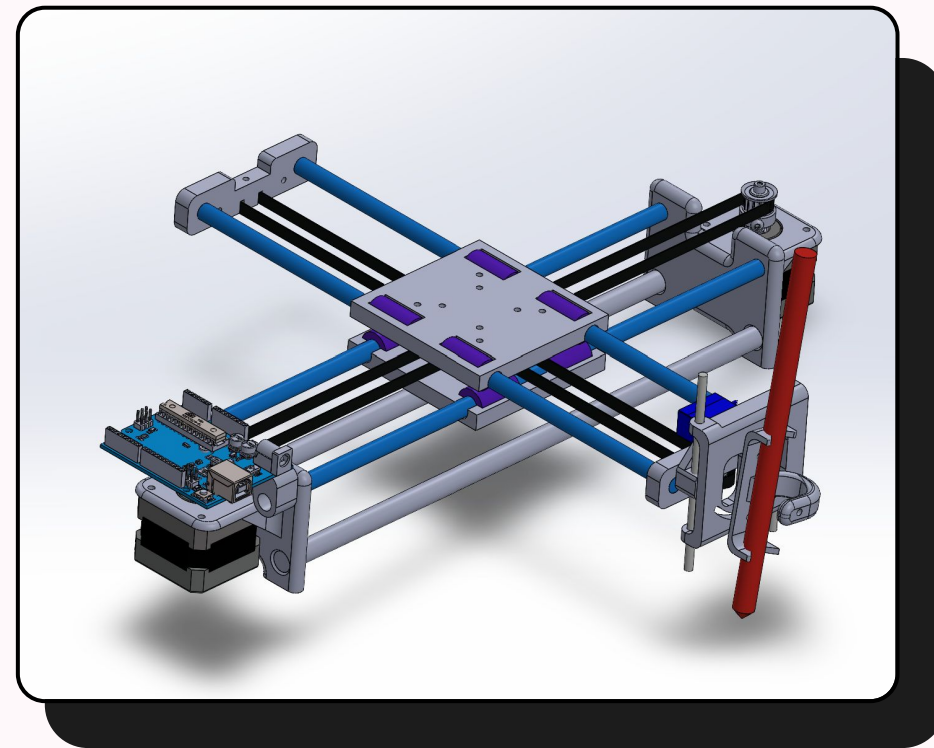
- Rewriting information can lead to mistakes
- Drawing on a whiteboard can be time consuming
- Diagrams and images need to be precise



Design Requirements

Speed	10cm/s -> 150RPM per motor
Power	Powerable by standard 120V AC outlet
Transportability	Under 20kg total weight
Motor Accuracy	Within one step without skipping
Total Processing Time	30 seconds for 1 page with any amount of text or images.
Stand Support	Stand must support 5kg gantry at 4'6" max height

Solution Approach



Gantry

- Custom 1200mm x 320mm gantry design
- Servo motor for marker raising and lower mechanism
- 2 stepper motors and timing belt for movement



Structure

- Prefabricated cart as base
- Autonomous wheels for realignment driven by stepper motors and timing belt
- Wooden supports
- Economical and easily transportable

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Upload a PDF diagram and we'll convert it into precise SVG drawing paths for our automated whiteboard system.

No file chosen

Page to Convert:

Drawing Area Dimensions (in inches, optional):

Width in Height in

Leave blank to use original PDF dimensions

Software

- PDF upload to local host
- Convert PDF -> PNG -> SVG -> Gcode to drive the motors
- Utilize CV for image pre-processing



Solution

A portable gantry system that:

- Accepts PDFs from a website which are uploaded to a Raspberry Pi.
- Converts diagrams/text into motion commands by generating toolpaths
- Draws in columns and moves autonomously
- Executes motor control for wheels, gantry, and marker

ECE Areas: Software, Signals

Solution Changes

Roadblock	Change
Custom structure is too expensive <ul style="list-style-type: none">• Prior material cost at \$454.68• Minimum additional cost of \$152.89	Utilize pre-fabricated cart <ul style="list-style-type: none">• Less expensive• Accomplishes the same task
Small gantry area <ul style="list-style-type: none">• Difficult raising and lowering mechanics	Increased gantry height <ul style="list-style-type: none">• Removed unnecessary raising and lower complexity



Website Testing

Area	Method	Target	Progress
UI/UX Layout	Survey 15 people to evaluate the website’s responsiveness, design, and usability	Ensure a 4/5 average rating for layout clarity, consistency, and accessibility. Ensure 80% agree that they could complete the upload task easily	✓
Workflow	Run 30 full cycles: upload → process → preview	Ensure 90% of cycles complete without UI/pipeline error	✓
Error Handling	Submit 20 invalid files (unsupported types, corrupt PDFs, 0-byte files).	Ensure 100% trigger correct error	→ SOON

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Conversion Successful

Your PDF has been converted to SVG and saved to your Downloads folder.

SVG File Location:

/Users/andrewwang/Downloads/output.svg

SVG saved to Downloads folder as output.svg

Original filename: pipeline.pdf

Page converted: 1 of 2

Output filename: output.svg

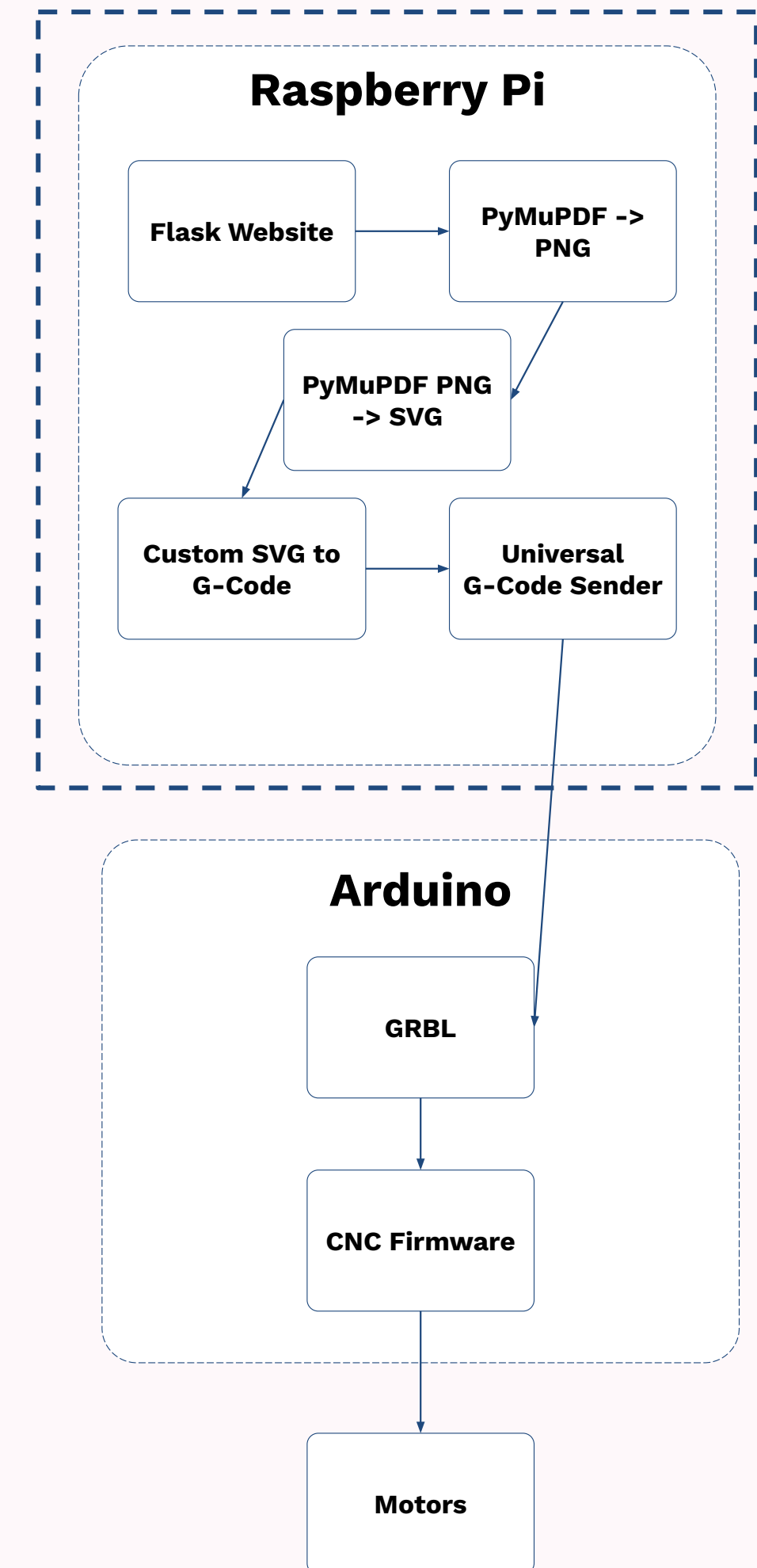
Size: Original PDF dimensions

Run Motors

Convert Another PDF

Parsing Algorithm Testing

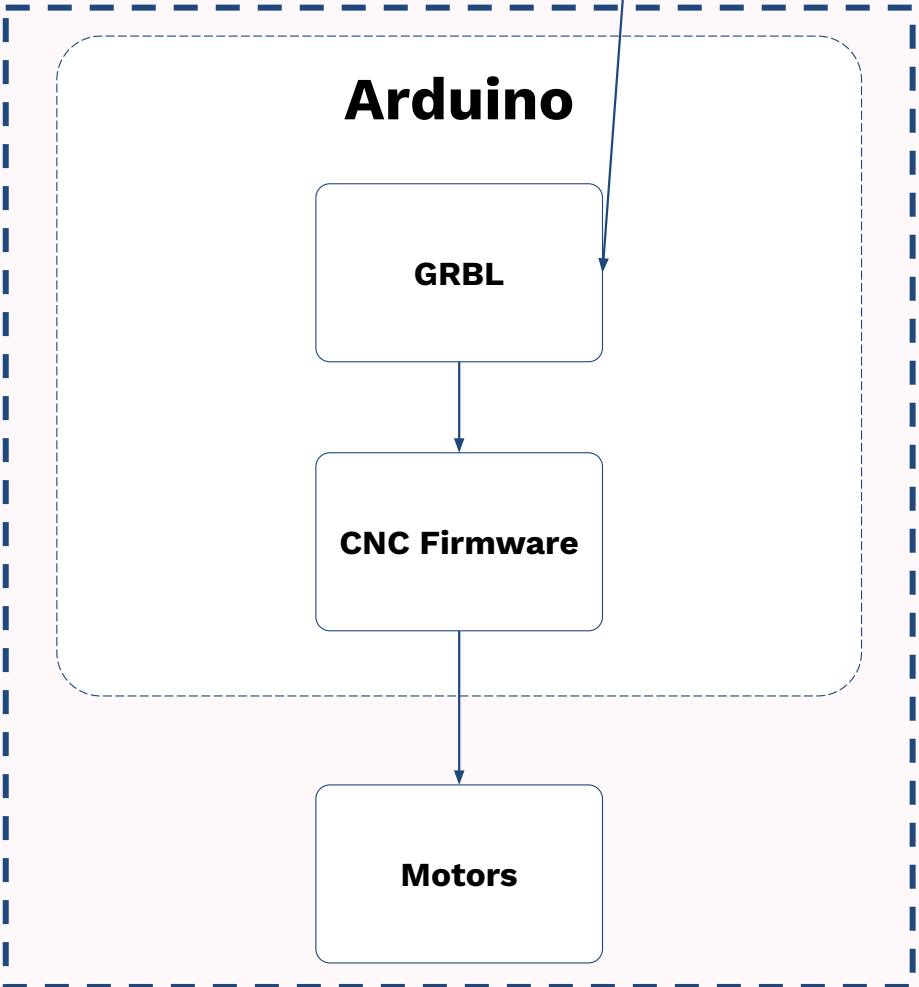
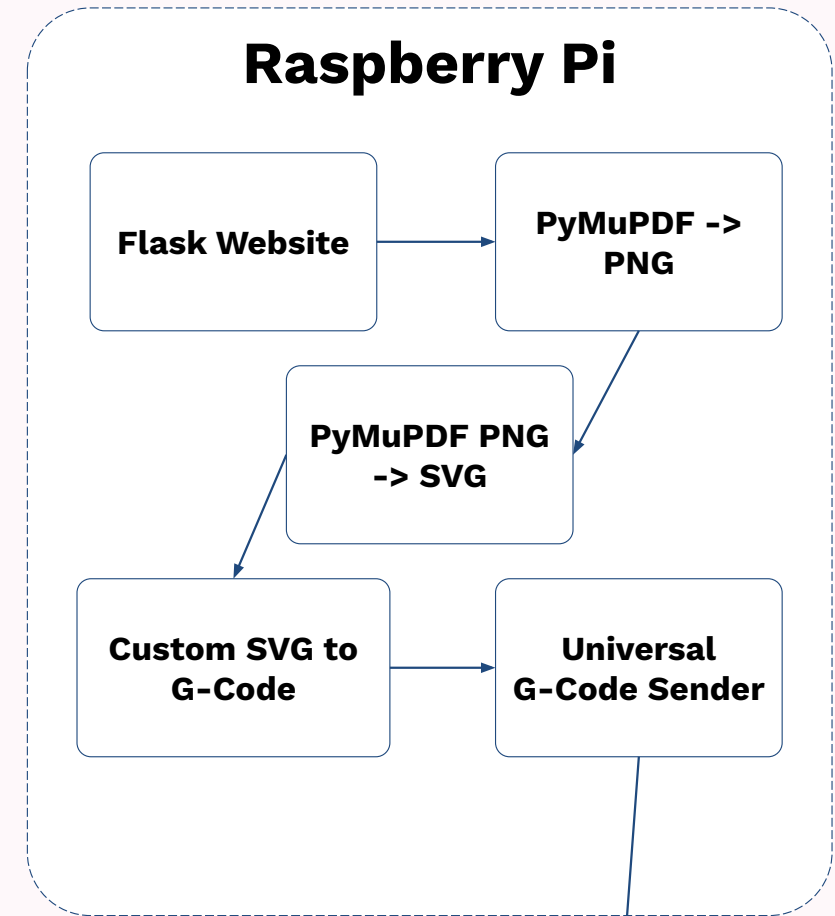
Area	Method	Target	Progress
PDF -> PNG	Upload 20 of PDFs with images, text, & shapes	Verify 95% of outputs visually match inputs	✓
Column Splitting	Upload 20 PNGs with various drawing dimension sizes	Resize PNG to input size & split into gantry drawing width columns with 100% accuracy	→ SOON
PNG -> SVG	Upload 20 PNGs in black & white	Verify 90% of outputs visually match inputs	✓
SVG -> GCODE	Upload 20 SVGs with various images and text	Ensure number of GCode instructions is within 90% of SVG vectors and 90% of outputs visually match inputs	→ SOON






Motor Control Testing

Area	Method	Target	Progress
Manual Gantry	Move manually, measure distance told vs distance travelled	Expected distance within 1% of actual distance moved	✓
Manual Wheels	Move manually, measure distance told vs distance travelled	Expected distance within 1% of actual distance moved	✓
Gantry Speed	Input basic G-Code instructions with words and diagrams, increase speed and acceleration slowly	Maximum possible speed allows for 150RPM (Completes full diagram within time)	➡ SOON

Trading Speed for Accuracy



System Testing (Validation)

Area	Method	Target	Progress
Wheel Movement	Input 20 PDFs such that it needs to move forward to complete the drawing	Wheels always drive within 1 second of gantry section completion	
Full Pipeline	Run 20 PDFs within the use case (diagrams/words) through the full software + hardware pipeline	90% of trials finish without error and text is legible	
Speed	Run 20 PDFs within the use case (diagrams/words) through the full software + hardware pipeline	Upload -> Start < 30 seconds and average movement speed > 10cm/s for all trials	

Lessons Learned

Design Flexibility

Time Management

Task Distribution

Schedule

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Hardware

- Component Selection
- Design Research
- CAD Design
- Part Ordering
- Final Part Ordering
- Raspberry Pi Configuration
- Motor Setup
- Part fabrication
- Hardware+Software Integration
- Structure Building
- Final Structure Building
- Final Integration
- Final Testing

Software

Planning

- PDF to Vector Graph
- Vector Graph to Gcode
- Website Creation

Motor Control

- Individual Motor Control
- Combined Motor Control
- Wheel Motor Control
- Software Integration

