



More Than Just a Chopping Board

Final Presentation

About Us



Suzy



Rishabh



Richa

Introduction

Problem

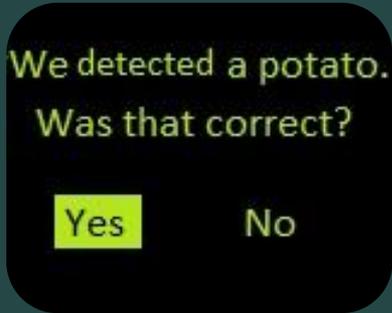
Innovate on a simple yet sometimes dangerous common household chore (chopping vegetables) to improve daily cooking

Solution

Automated chopping board!



Features



Vegetable
Detection

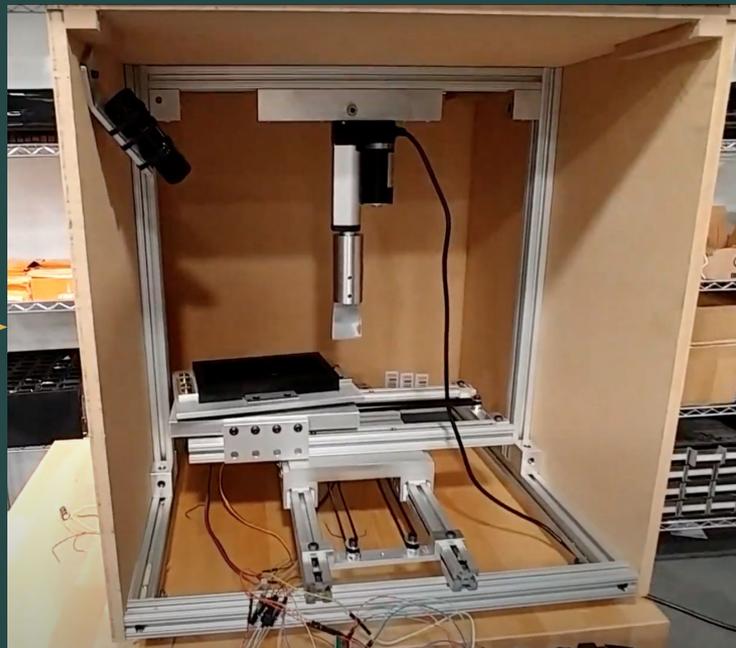
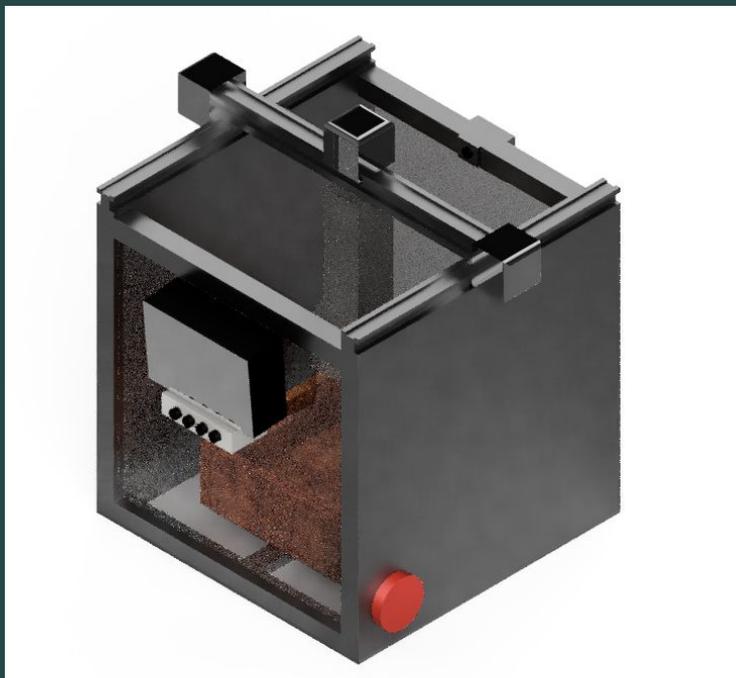


Chopping Style
Recommendation

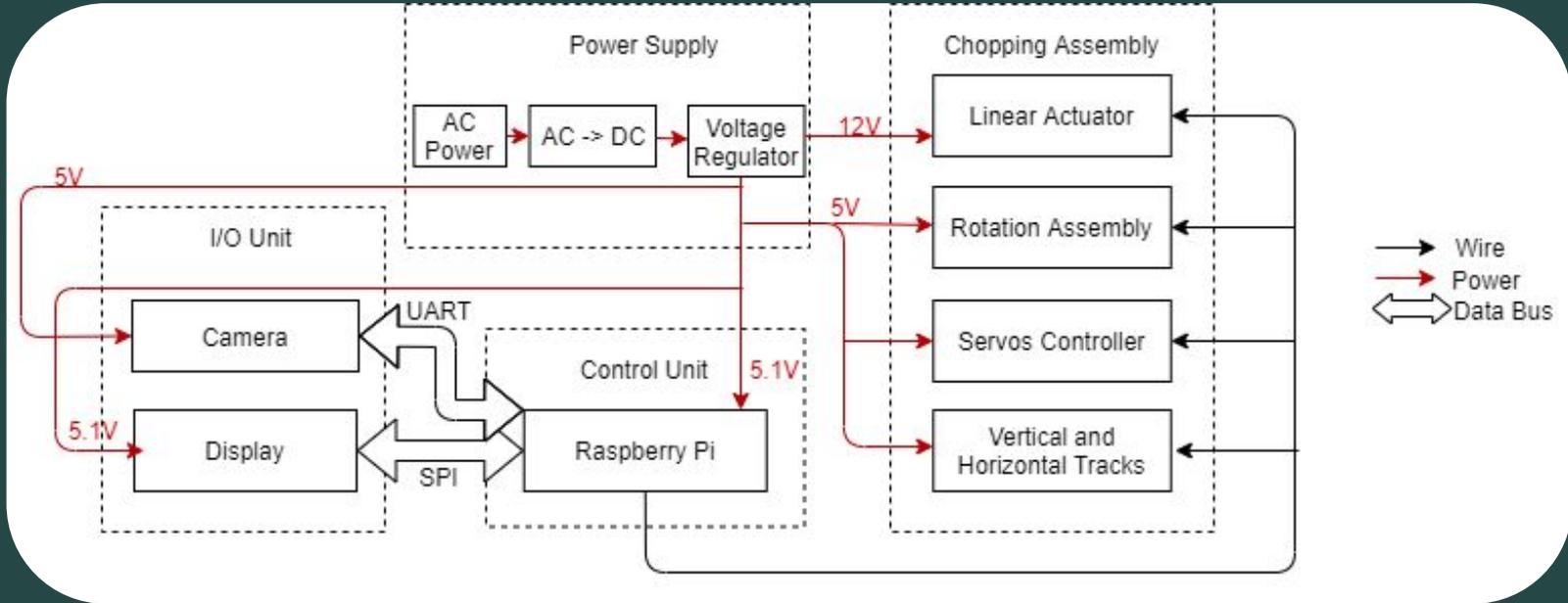


Different Chopping
Styles

Actual Product



Block diagram



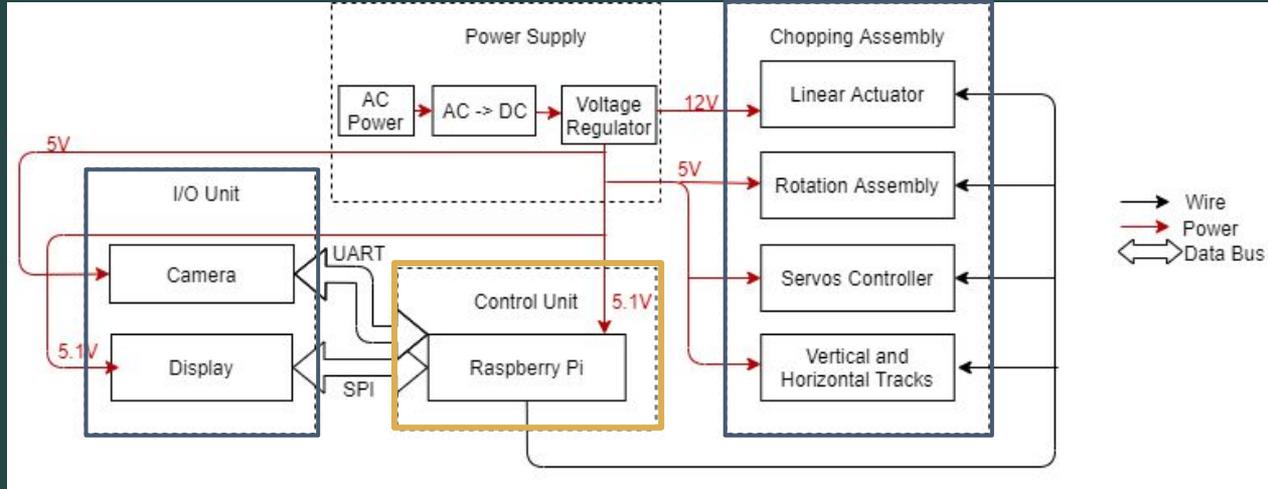
Power Supply

Requirements	Verification
Must supply at least 5.1V at 3A to the Raspberry Pi	Connect the power supply to an outlet and subsequently measure the power draw at the components
Must supply 12V at up to 3A to the linear actuator	
Should supply 12V at up to 3A to the 3 motors and their driver circuits	



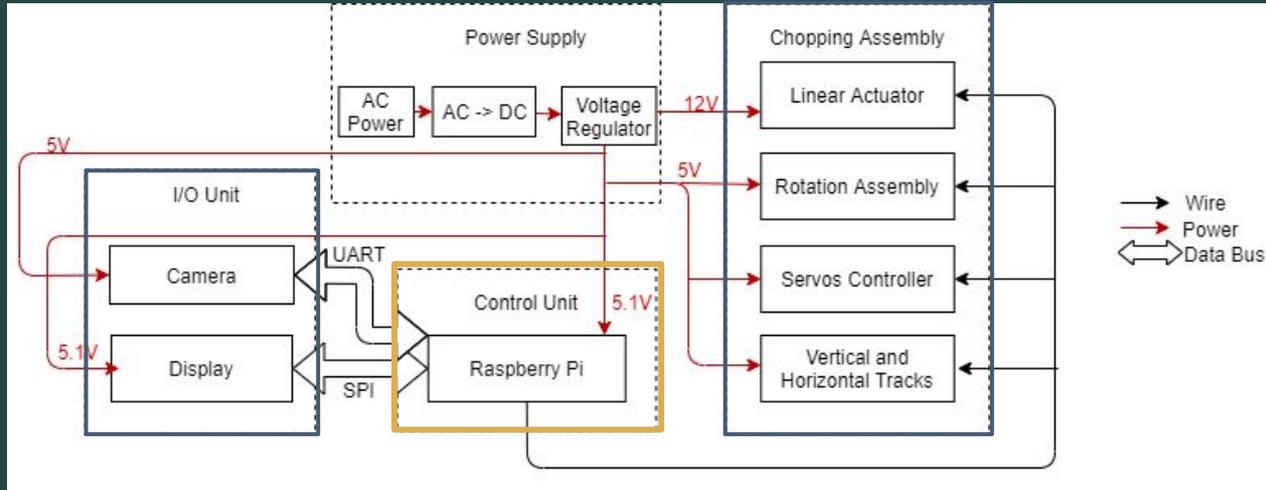
Control Unit Overview

Vegetable Recognition System + Edge Detection



Control Unit Overview

Vegetable Recognition System + Edge Detection



Requirements

Must be able to recognize the vegetable inserted

Send commands to control the motion of the blade for the selected chopping style

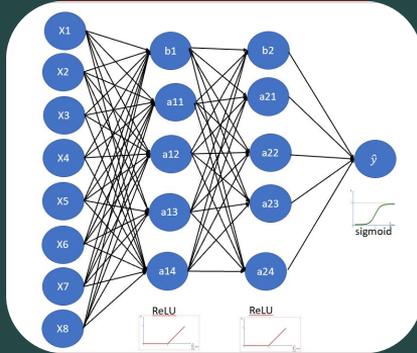
Verification

Insert a vegetable into the assembly and read a signal indicating which vegetable has been inserted

Select and confirm selection. The finished chopping should match with the specified chopping

Control Unit

Vegetable Recognition System



Derived from [medium.datadriveninvestor.com](https://medium.com/@datadriveninvestor)

Train + Test Using Keras framework NN



Derived from [kaggle.com](https://www.kaggle.com)

Dataset with Fruits-360

- + Integration with Camera Module to snap a photo and identify the Vegetable on chopping board

Control Unit

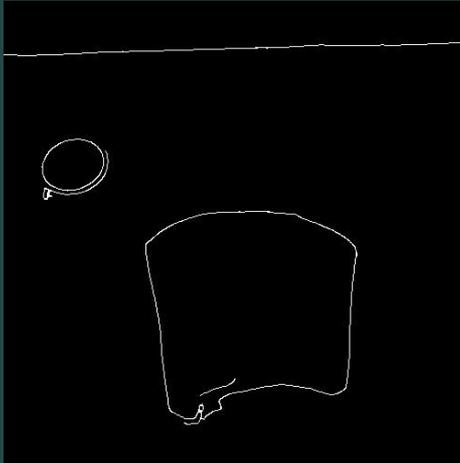


```
pi@raspberrypi: ~/shared/VegeDetection/src/image_classification
File Edit Tabs Help
5.4280068e-08 1.1977232e-08 2.2478941e-09 1.3359605e-08 7.1817462e-05
7.8502471e-10 1.0659356e-10 5.6619259e-11 5.6968156e-07 1.5657482e-07
6.047017e-10]]
Predicted class index: [57]
Predicted class label: Pepper Yellow Pepper Yellow
Object #2:
[[ 44 208]
 [ 37 153]
 [105 145]
 [111 199]]
(array([[ 44, 208],
        [ 37, 153],
        [105, 145],
        [111, 199]]), (74.25, 176.25), 57.47250890078573)
Object #3:
[[181 460]
 [148 239]
 [373 206]
 [405 426]]
(array([[ 44, 208],
        [ 37, 153],
        [105, 145],
        [111, 199]]), (74.25, 176.25), 57.47250890078573)
```

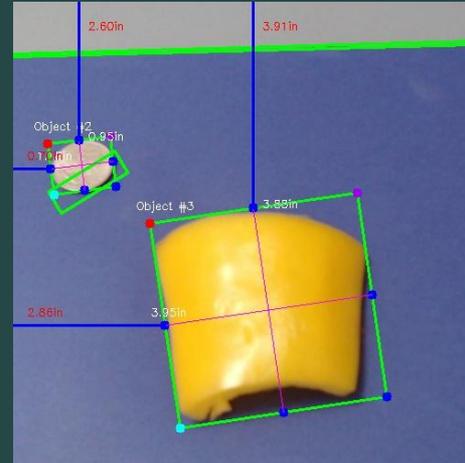
Vegetable Recognition System

Control Unit

Edge Detection (Pre-motor control)



Detects Edge of Objects (CV2.canny)



Detects object size based on reference (quarter) + Calculates Pixel per Inch, displays object size

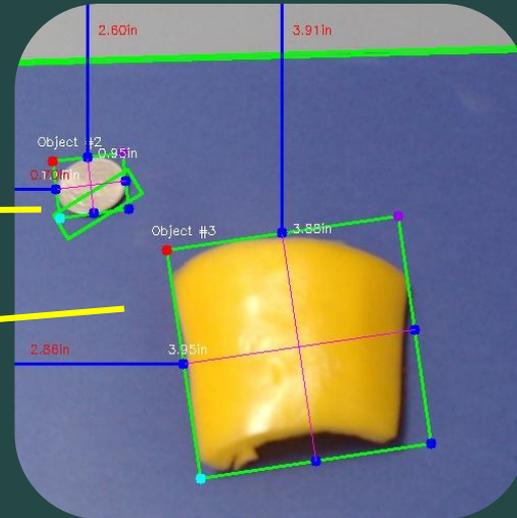
+

Returns the (x,y) coordinate to start the chopping motions

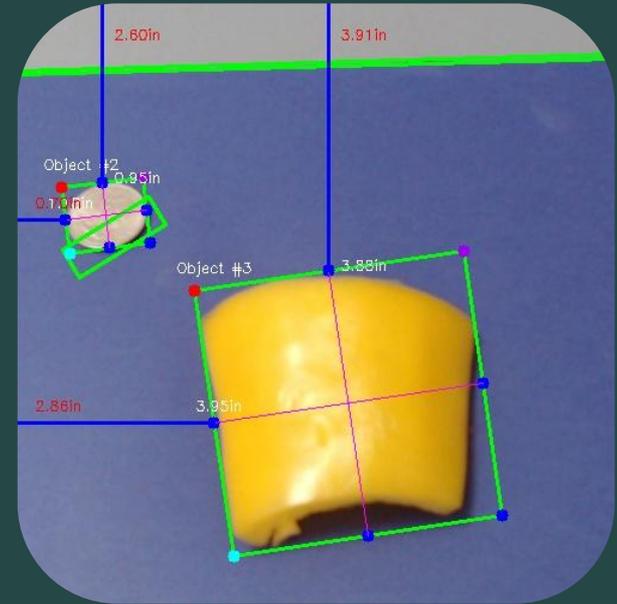
Control Unit

Edge Detection (Pre-motor control)

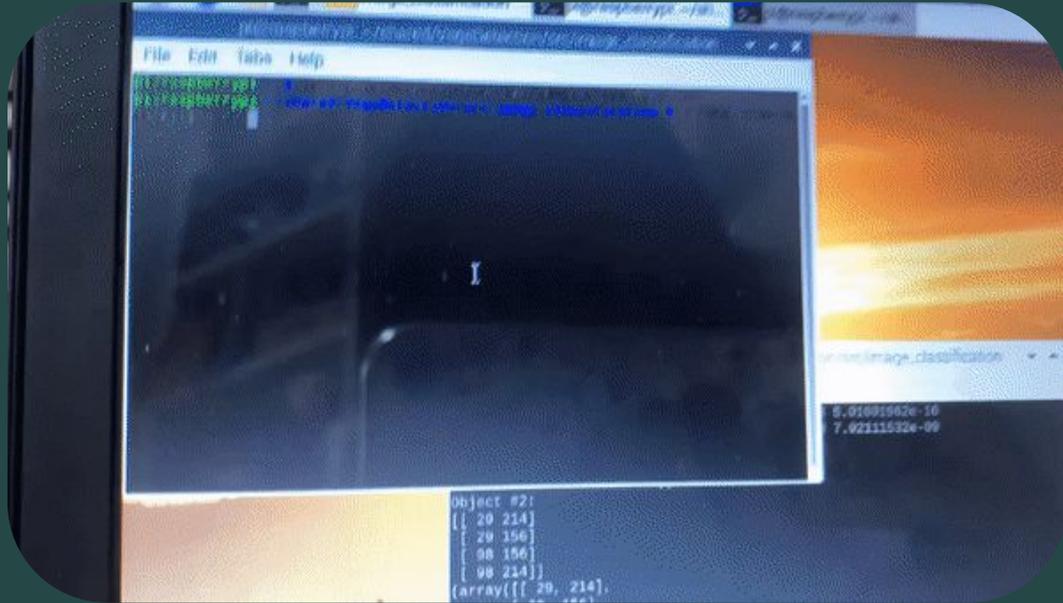
```
pi@raspberrypi: ~/shared/VegeDetection/src/image_classification
File Edit Tabs Help
5.22200000e-06 1.19772320e-08 2.22470941e-09 1.33596050e-08 7.10474620e-05
7.85024710e-19 1.00503550e-10 5.86192590e-11 5.69681560e-07 1.56574020e-07
6.04710170e-19]]
Predicted class index: [5]
Predicted class label: Pepper Yellow
Object #2:
[[ 44 208]
 [ 37 153]
 [105 145]
 [111 199]]
(array([[ 44, 208],
        [ 37, 153],
        [105, 145],
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Object #3:
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        [ 37, 153],
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        [111, 199]]), (74.25, 176.25), 57.47250890078573)
```



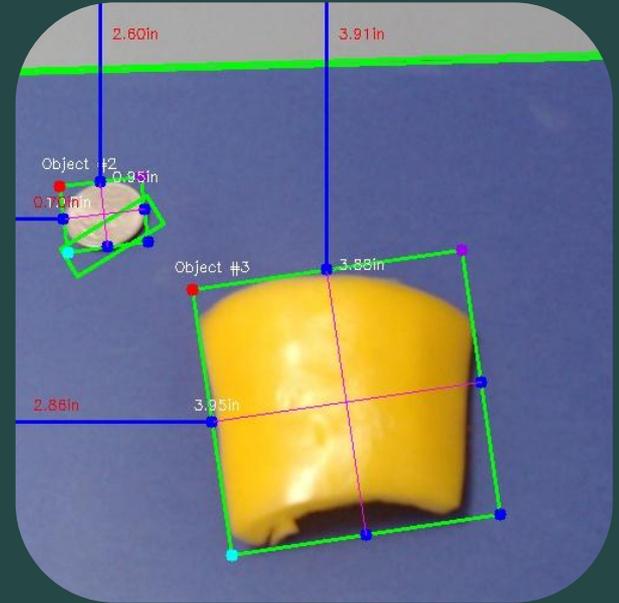
Control Unit



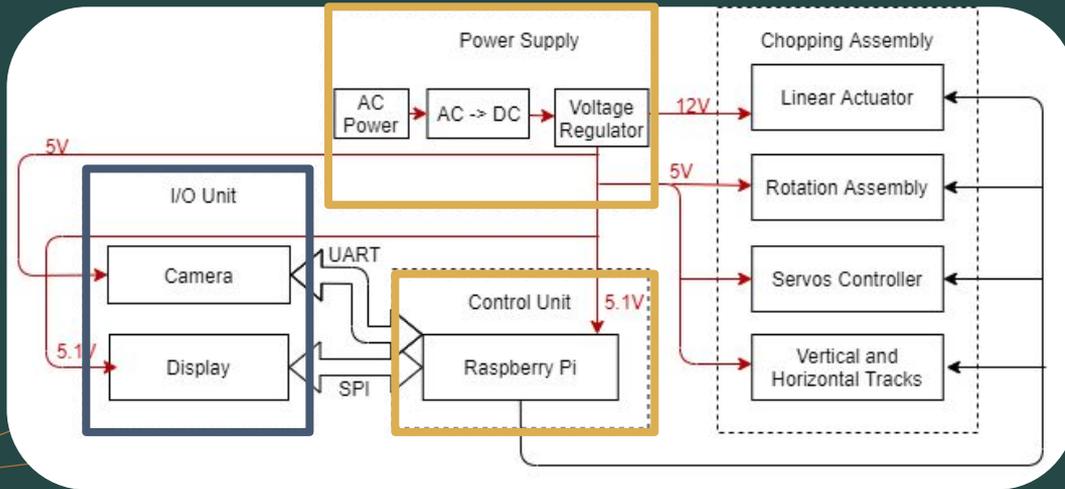
Control Unit



Full subsystem functionality tested



I/O Unit



- The I/O Unit comprises the camera and the display unit
- This camera and display unit are powered by the power supply unit
- It also uses the control unit to implement user interaction through push buttons

I/O Unit



Initial Camera Choice

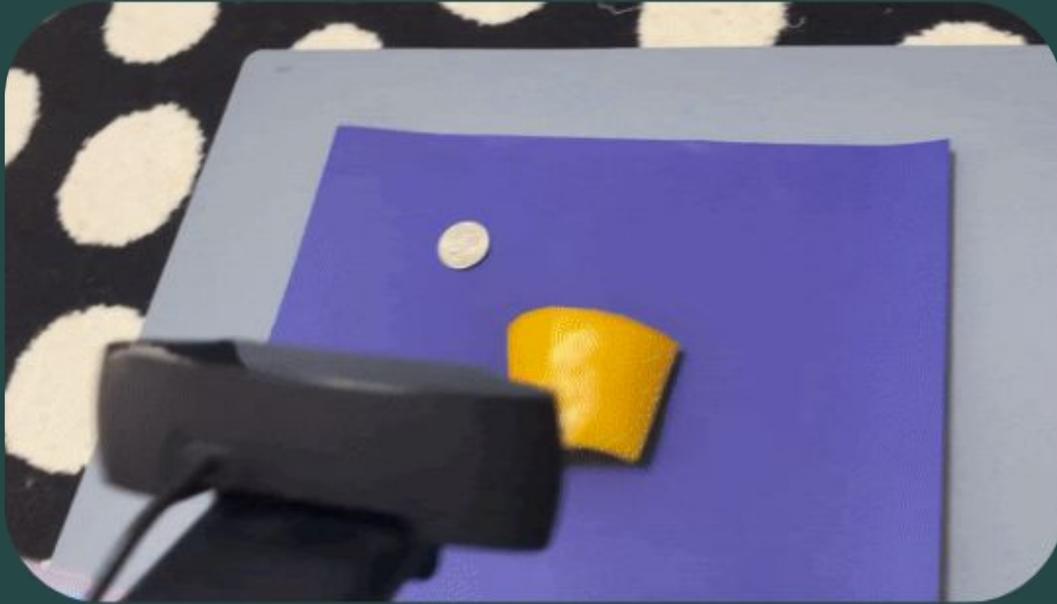
Source: raspberrypi.org



Final Camera Choice

Source: amazon.com

I/O Unit



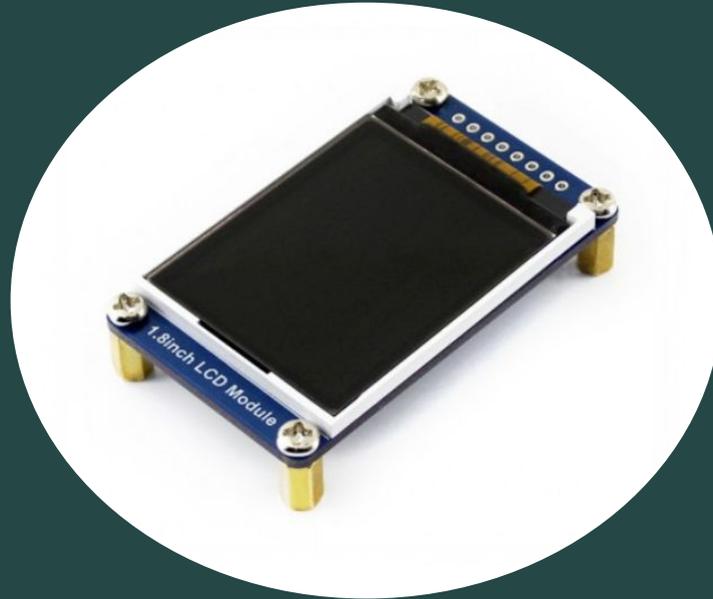
Screenshots to show verification of requirements for the camera

I/O Unit



Screenshots to show verification of requirements for the camera

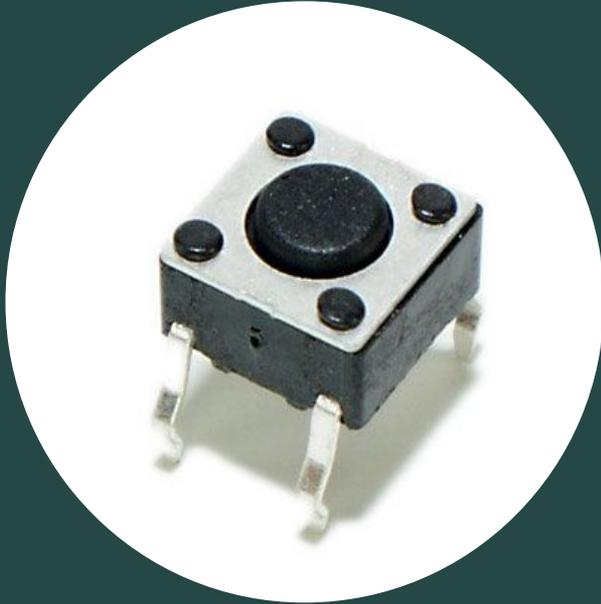
I/O Unit



Display screen used for the system

Source: waveshare.com

I/O Unit

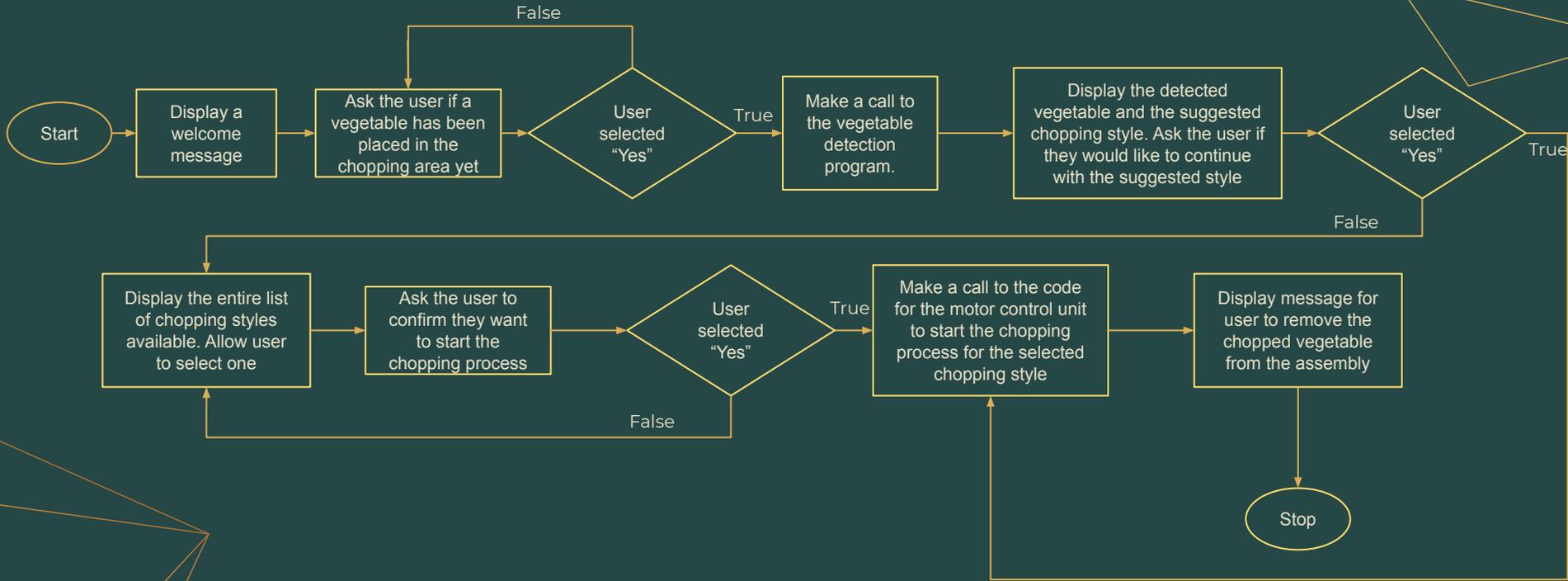


Push buttons used for the system

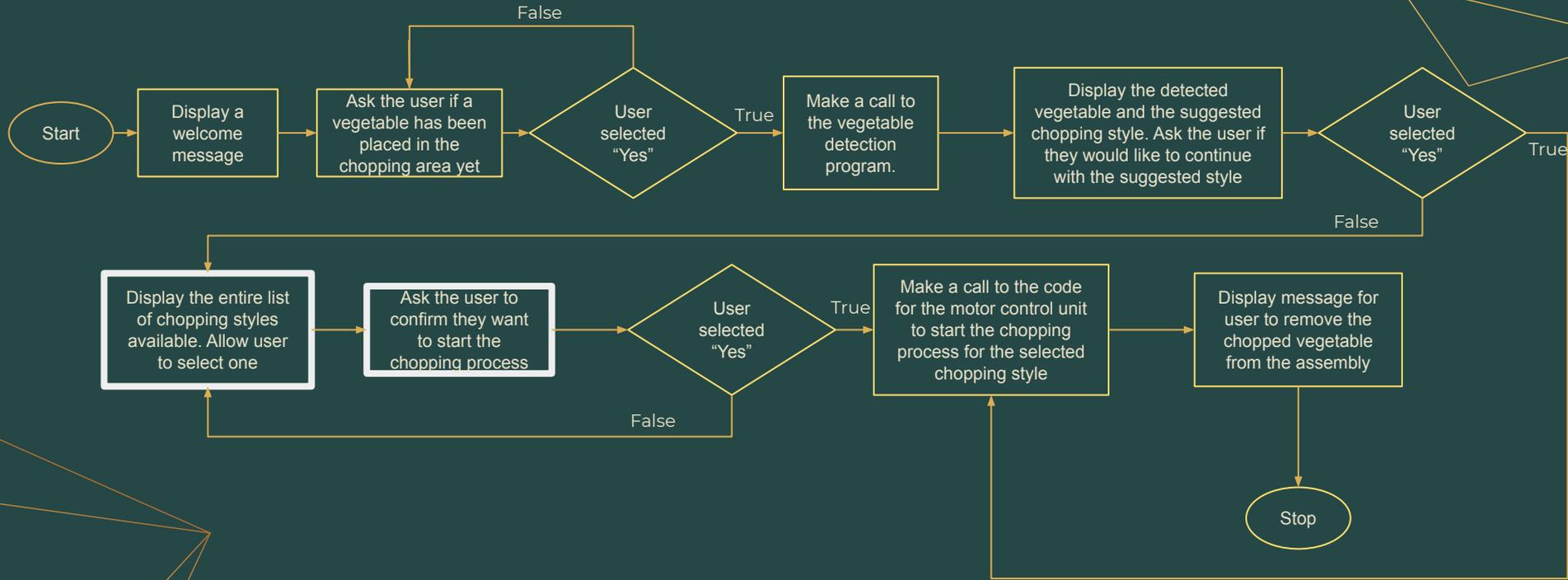
Source: moderdevice.com

- Regular push buttons were used to receive user input
- This was better choice than using a touchscreen display
- Disadvantages of using a touchscreen display
 - waterproofing the screen
 - heavy motions of the chopping assembly

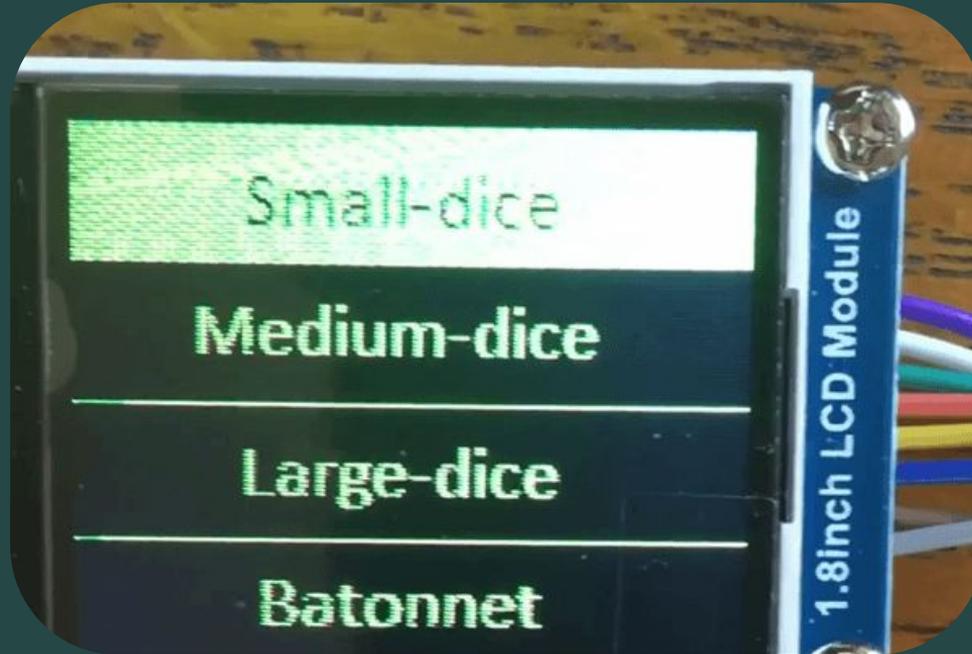
I/O Unit



I/O Unit

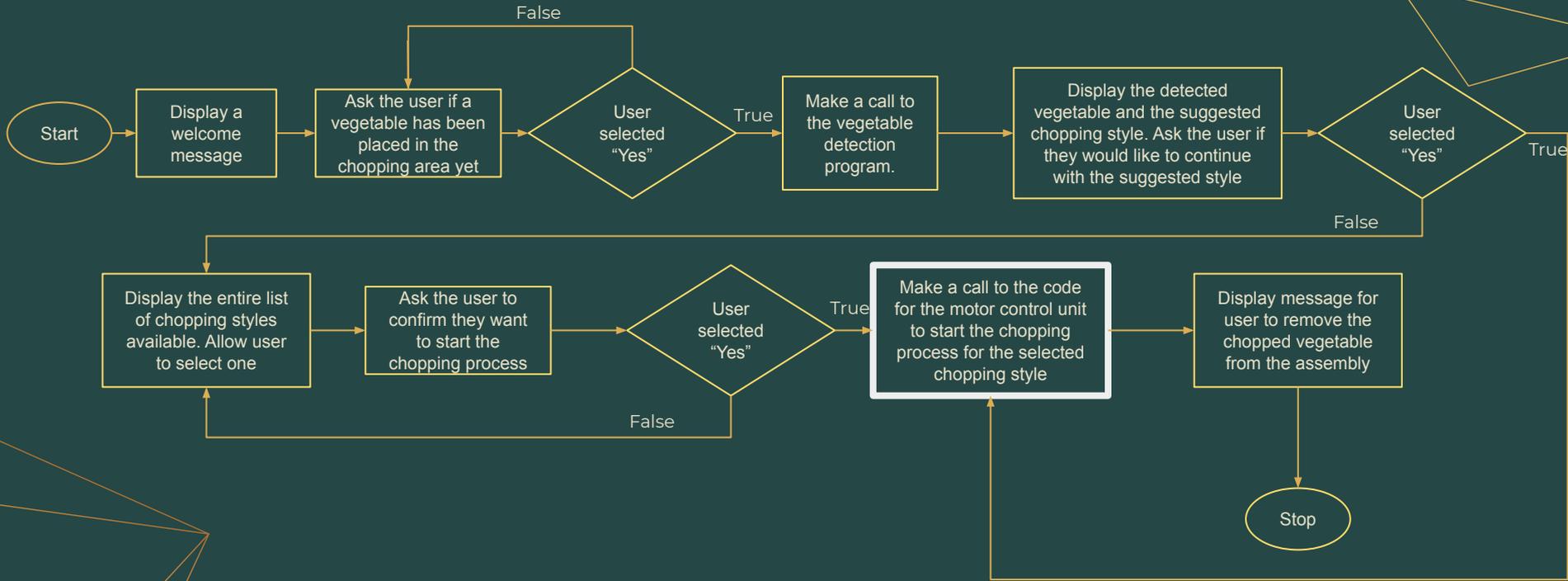


I/O Unit

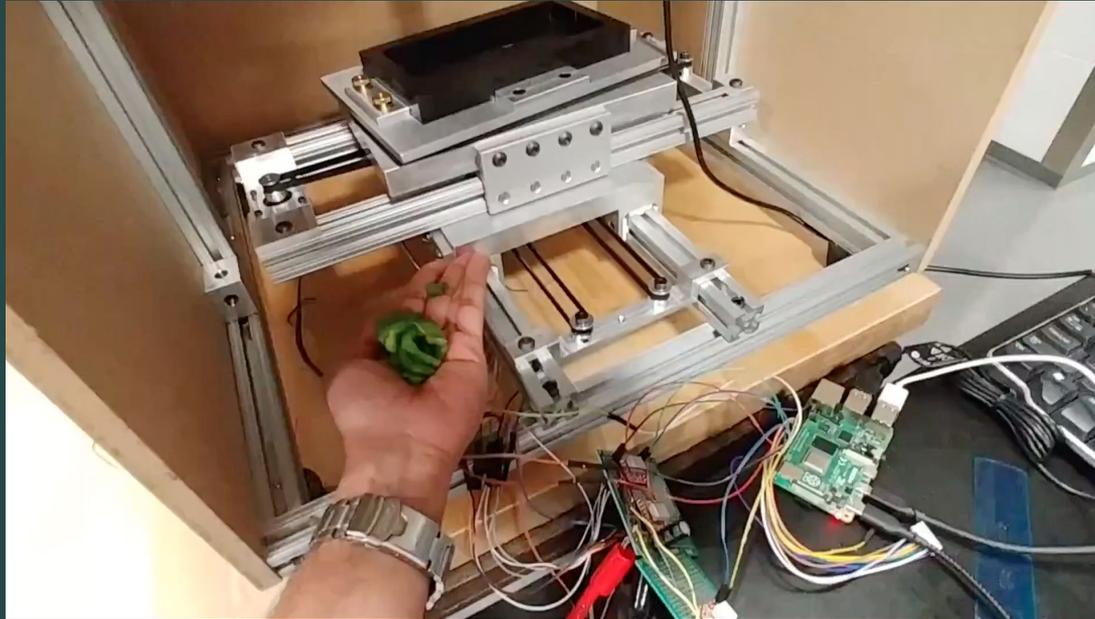


Video to show the verification of the requirements for the display unit

I/O Unit

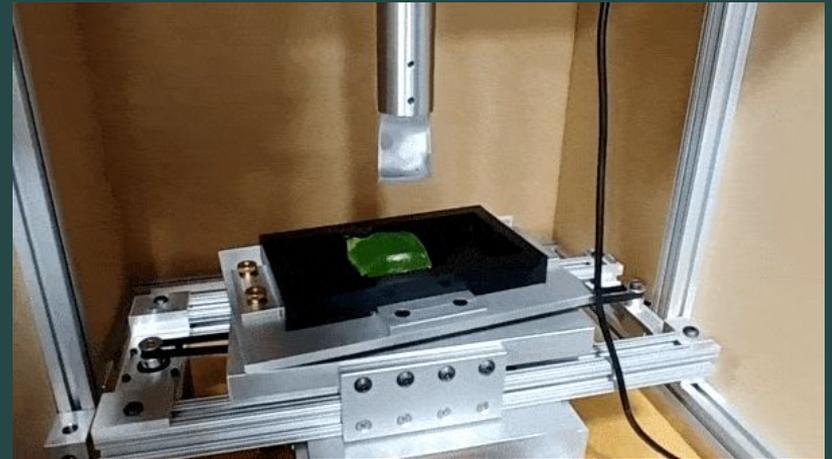


Chopping Assembly



Chopping Assembly

Requirements	Verification
Should be able to exert the required amount of force to cut through a vegetable	Placing a weighing scale under the assembly without the blade to measure the force exerted
Must chop the vegetables within 4 minutes with 75% accuracy in dimension according to the chopping dimension standards set in French Cooking	Measure the chopped vegetables to see if they are the right size and measure the time taken to complete the chopping process for all the chopping styles offered by our system



SWOT Analysis

Strengths

Weaknesses

Opportunities

Threats

SWOT Analysis

Strengths

- Vegetable detection and chopping recommendations
- User can select chopping style
- Easy to clean
- Convenient and hassle-free chopping with minimal manual work

Weaknesses

Opportunities

Threats

SWOT Analysis

Strengths

- Vegetable detection and chopping recommendations
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Weaknesses

- Only four chopping styles offered
- Takes 6 minutes to complete chopping process
- Expensive for the target market
- User safety is dependent on the user's common sense

Opportunities

Threats

SWOT Analysis

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Opportunities

- College students
- Daily cooking

Threats

SWOT Analysis

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Opportunities

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- Daily cooking

Threats

- Meal prep kits
- Pre-chopped vegetables

Future Plans

More safety for the user and the system

- Add an emergency stop button
- Design a circuit breaker
- Improve water-proofing of the system

More options

- Include more chopping styles
- Train the system to recognize more fruits and vegetables

Future Plans (Contd.)

More efficient

- Use a multi-blade design that is able to chop the vegetables in the required dimensions with less cuts
- A conveyor belt system that carries the vegetables across the assembly.
- Reduce the total time taken to complete chopping and increase the overall efficiency.

Moonshot

- Make the device a refrigerator attachment similar to an ice cube dispenser that can dispense chopped vegetables for users.



Thank you!

We will now answer any questions you may
have about our project