99909A

Rising Phoenix

Capital Robotics Club

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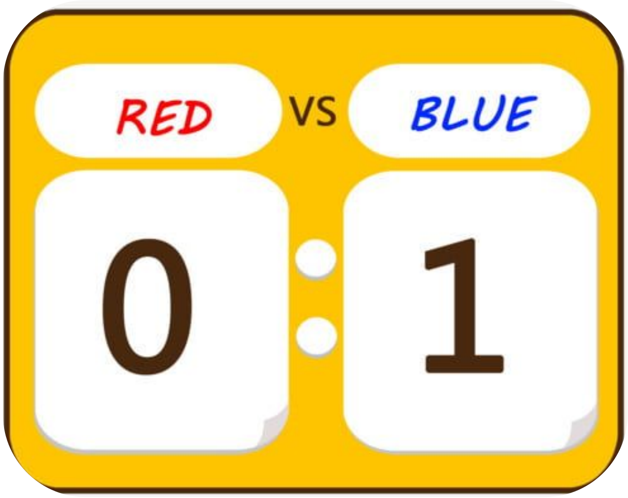
VRC Game: Over Under! (Part 1)

Scoring:

- ❑ Each triball in a goal is **5 points**
- ❑ Each triball that made it into the offensive zone is **2 points**
- ❑ Team who scores the most during the autonomous round earns **8 points**

Robot measurements are 18” X 18” X 18”



Name: Zoe Pak

About Our Team

Zoe - Hello! My name is Zoe Pak, and I am a 9th grader on the team. Some of my hobbies include playing basketball, piano, and reading in my freetime.

Sammy - I am a freshman in high school

Vaishnavi - I am a freshman in high school

Vaishali - Hi, my name is Vaishali Alapati and I’m in the ninth grade. I enjoy painting, cooking, playing tennis, trying to learn new languages, and listening to true crime, history, and educational podcasts.

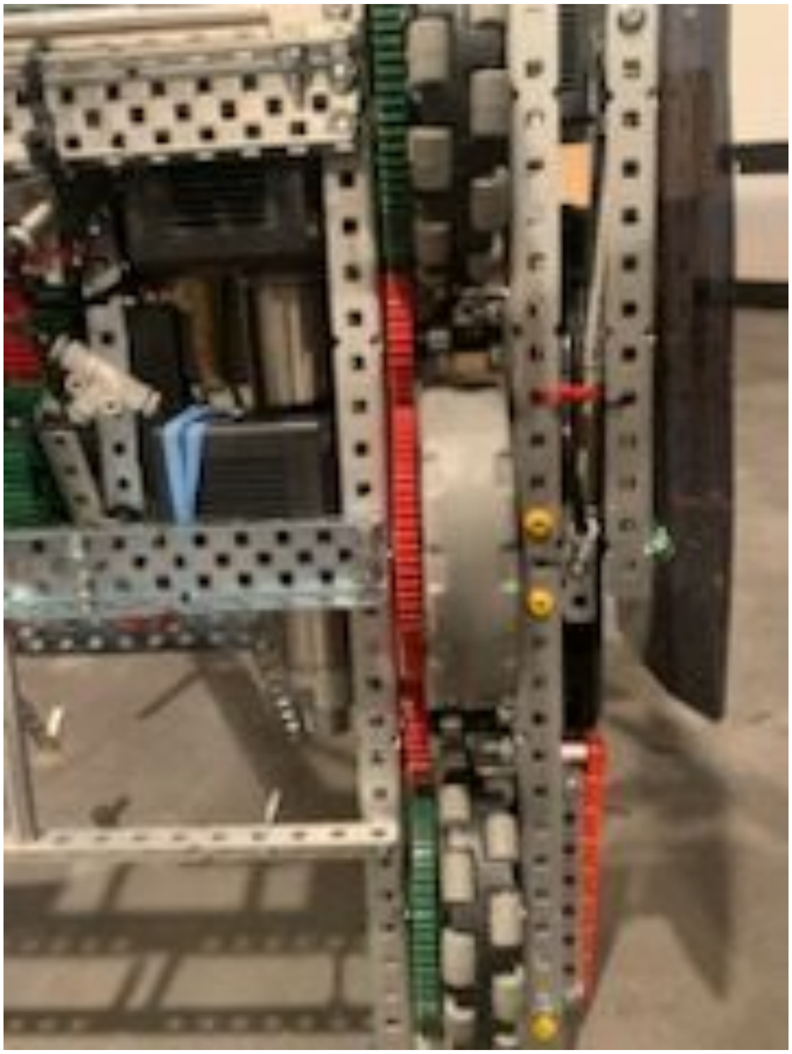
Justin - Hello! My name is Justin Lee and i'm an 11th grader currently attending TJHSST. I have been programming for five years, in particular with Python and C++. My hobbies include weight lifting and programming.

Cristina - I am a senior in high school

Daniel - Hi, my name is Daniel Wu and I am currently a junior at TJ. I have been on the team for four years. My hobbies are robotics, swimming, and Boy Scouts.

Drivetrain

- 4 motor drivetrain
- Six wheels
- Large gear ratio for faster movement
- Middle wheel is more rubbery in order to get over middle bar
- Green Gearset to balance both speed and torque.



Name: Justin Lee

RETRACTABLE WINGS

The wings will be able to extend out through the pistons.

- Gussets were used to secure the wing to the side of the robot.
- One approach is to use a collar around the piston and a standoff to connect it to the robot.
- Try to use a locking mechanism that is connected by a rubber band to the robot and piston.
    - This part would connect to the russet
    - We could create a catch to protect the rubber band when the wings push inwards

PICTURE

Name: Vaishnavi

RETRACTABLE WINGS PT.2

Problems:

- Pumping the pistons enough
- Using enough air pressure in order to “lock” the pistons in place
- Have some type of flexible plastic to easily fit under the goal and adjust to the robot

Solutions:

- Have a certain person on the team that pumps the air pressure/checks it regularly
- Make sure the air pressure is at 100.0 in order to have a secure locking system
- Use the black plastic to have a strong structure, while protecting the robot from incoming triballs

PICTURE

Name: Zoe Pak

Catapult

Catapult Intro!

Goals for our robot:

- Be able to find a certain size in order to allow the catapult to have a “Snug” fit
- Find the exact amount of rubber bands in order to have a good amount of power
- Be able to have a wide shooting range and be able to adjust to different places on the board

Problems/challenges:

- Finding the right amount of rubber bands
- Finding the right angle for the triballs to be launched
- Have fast hands and practice for game speed during a match!

PICTURE

Name: Zoe Pak

CATAPULT V1

Goals:

- Be able to find a certain size in order to allow the catapult to have a "Snug" fit and for the robot to fit under the scoring zone
- Find the exact amount of rubber bands in order to have a good amount of power
- Be able to have a wide shooting range and be able to adjust to different places on the board

Description:

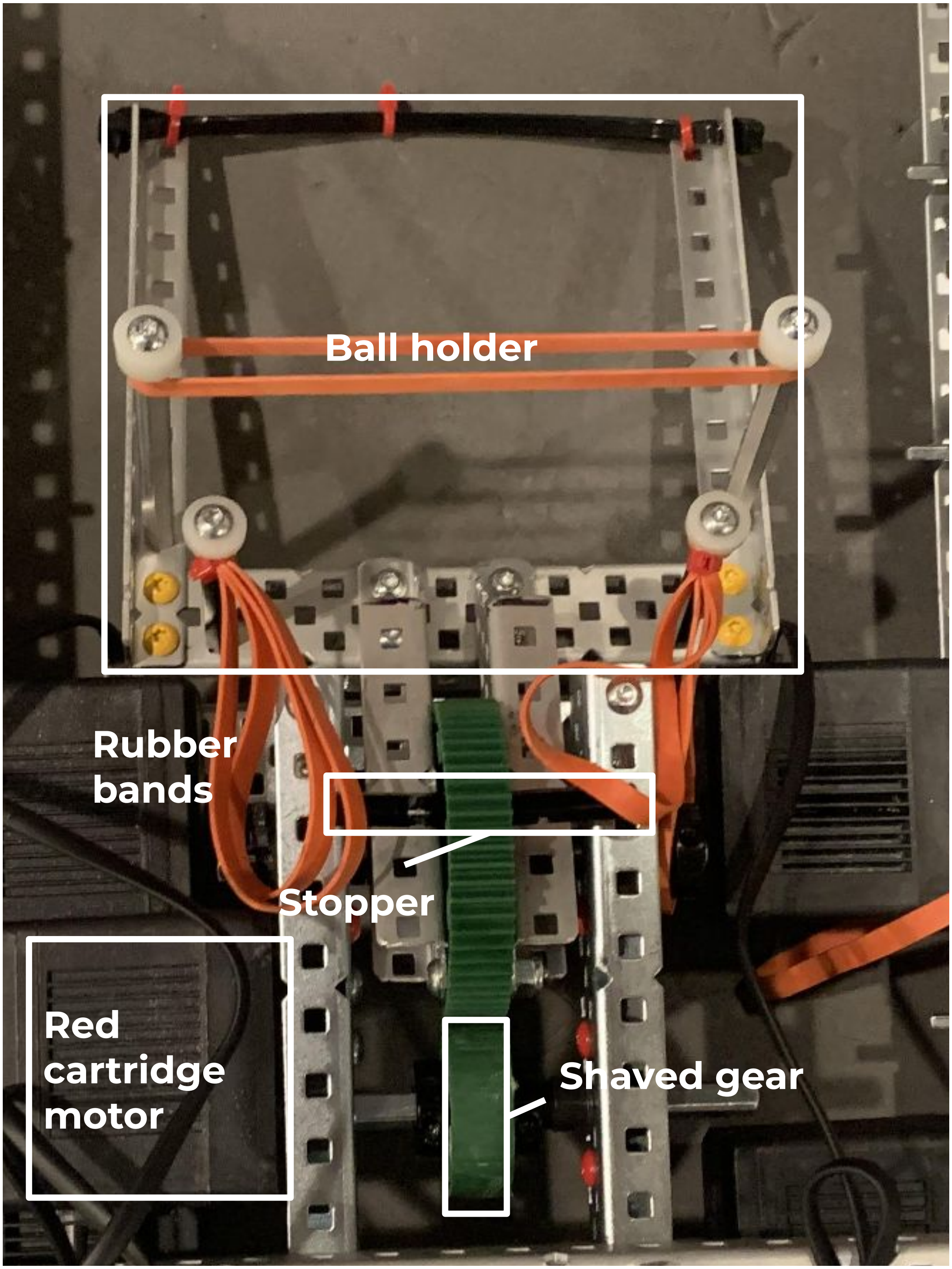
- Small catapult powered by rubber bands
- Cranked using a shaved off gear
- System is powered with a red cartridge motor

Problem:

- Does not launch ball at desired angle
- The stopper bends because of too much stress
- Ball sometimes falls out of catapult

Name: Daniel Wu

CATAPULT V1



Name: Daniel Wu

CATAPULT V2 (Current)

Goals:

- Fix the problems from the previous version of the catapult
  - Launch at higher velocity
  - Adjust launching angle

Modifications:

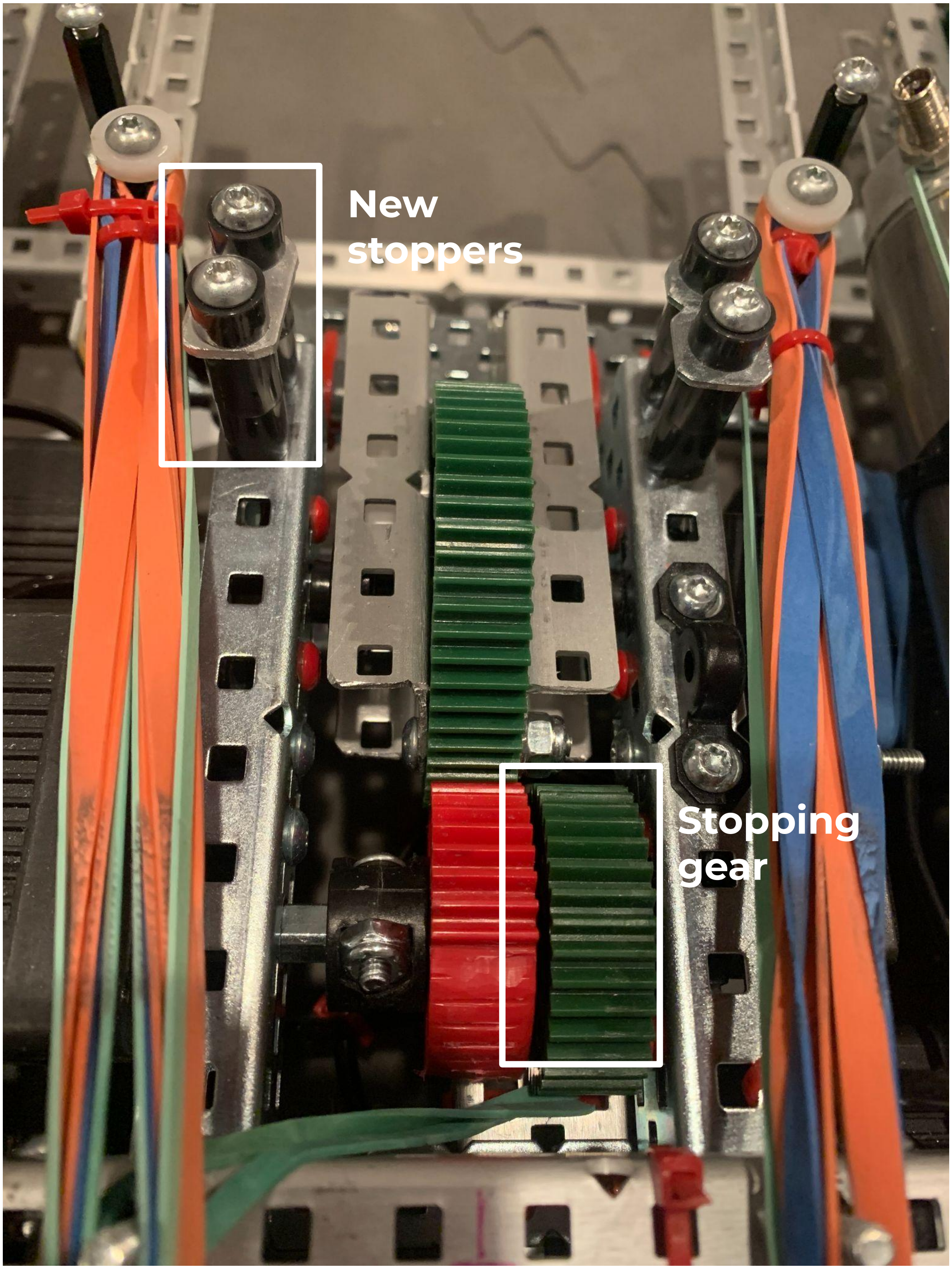
- Changed the stopping mechanism from a standoff on the gear to standoffs on the side so they don’t bend
- Remade the shaved gear so it had more teeth and could turn more before releasing
- Added a stopping gear

Problem:

- Ball holder isn’t completely reliable
- Ball needs to be placed in exact position to be launched all the way

Name: Daniel Wu

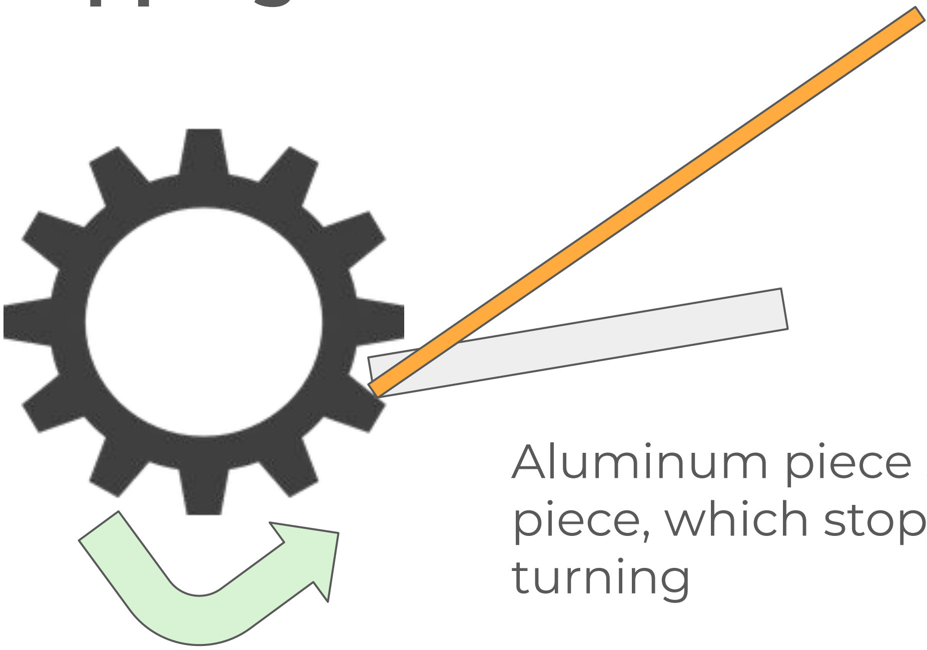
CATAPULT V2 (Current)



Name: Daniel Wu

CATAPULT V2 (Current)

Stopping Gear



Aluminum piece stopped by a piece, which stops gear from turning

Gear has tendency to turn to the right

Purpose:

Without stopping gear, motor has to hold in place, using a lot of power and motor might overheat

With stopping gear, motor won’t overheat and does not have to run to hold the catapult in place

Name: Daniel Wu

Side wings/Other mechanisms

Kicker Mechanism

Goal for the kicker mechanism:

- Be able to kick across the field into a reliable spot
- Have a good time limit
  - Allow the kicker to reset every time we kick a triball into the desired location
- Make sure the kicker does not exceed the height limit of 18 inches

PICTURE

Name: Zoe Pak

Flywheel

Problems

- Having such a heavy mechanism in order to shoot
- Not reliable since the flywheel would have to be at a certain angle for it to work
- Goes against the current of going up while hanging

Potential Solutions:

- Using thinner wheels but a stronger motor
- Could use another motor in order to help angle the flywheel like a tank machine (Not very reliable)

PICTURE

Name: Zoe Pak

Pistons

What are Pistons?

A piston is a mechanism that is powered by air pressure causing it to expand and contract. For the team's purposes, we are using a piston to take less space, and allow us to use our motors for another component of the robot.

How they Work:

Pistons are powered through air pressure and expanding gas. In a silver cylinder connected to the mechanism, there is compressed air allowing a 'valve' to open and close depending on when we want the piston to open and close

What are we using them for?

These pistons will be used for the side wings to decrease our opponent's points during a competition. We also decided to use them for for the convenience of the driver and programmer to have more space on the field.

Picture:

Name: Zoe Pak

Implementing Pistons

Problem:

- Finding enough room for the pistons to fit in the robot
- Having convenience for replacing or fixing during a competition
- Figuring out how to connect the pistons to freely extend on command

Pros:

- Pistons will allow convenience for the driver during a match
- Allows us to use one more motor
  - Perhaps for the climbing mechanism

Cons:

- Amount of space needed to use the pistons may be an issue
- The piston may fail during a competition if not checked
  - Motors may be more reliable in this case

Solution:

- Moving the connecting beam between the left and right sides of the drivetrain to create more space
- Having a collapsible mechanism that folds inward
  - This can help create more space for convenience
- Testing to see if the piston will fit on the inside or outside of the beam

Put Picture

Name: Zoe Pak

Pistons Problems

Problems:

- Pistons retracting too easily
- Being too flexible
- Placing the piston in a place where the wings can still fold inward

PICTURE

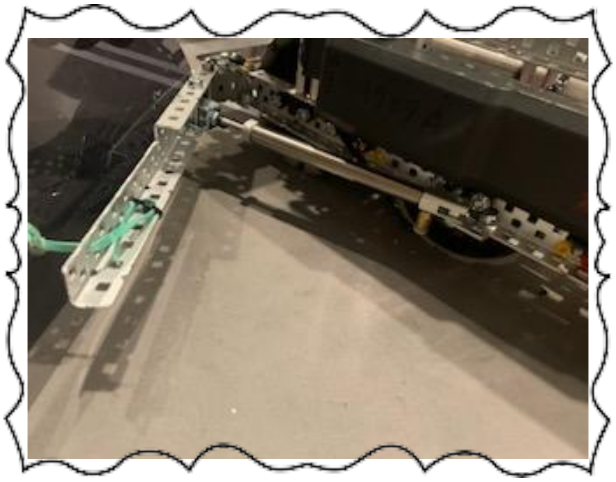
Solutions:

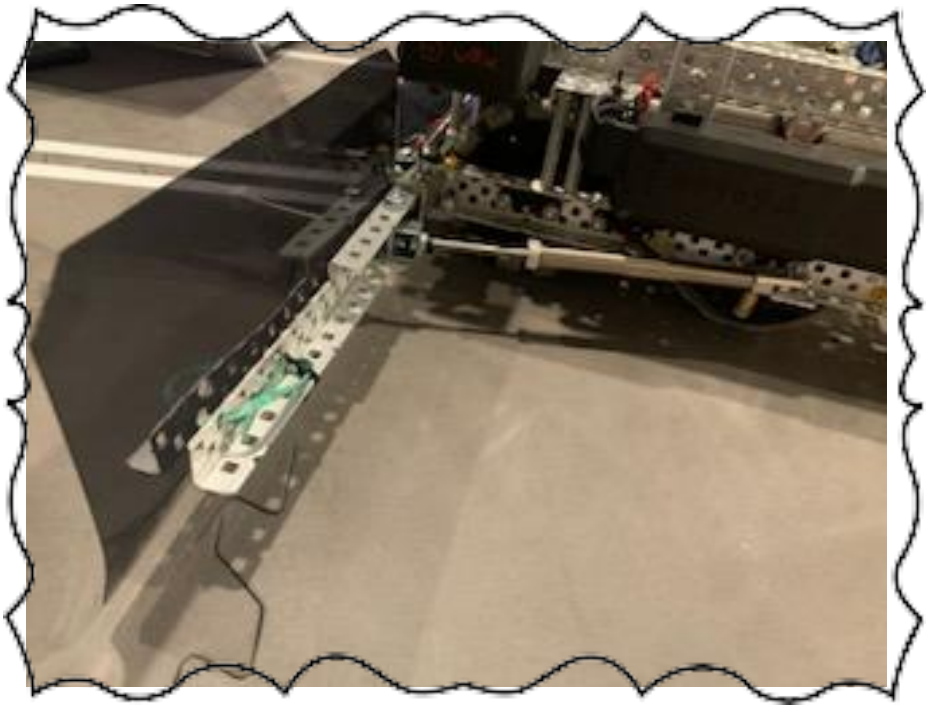
- Have the pistons tank in the inside of the drivetrain allowing it to be in a “hidden” space
- Have a reminder to constantly have our air pressure tank filled to 100.0 for the pistons to lock in place

Name: Zoe Pak

How Do Pistons Work?

- The way pistons function involves sending the force output of expanding gas in the cylinder to a crankshaft, which in turn gives the flywheel rotational momentum.





- A piston can only consistently transform heat energy into work by going through a cyclical process.

Name: Vaishnavi Alapati

Flipper collectors

PROS:
- Can be a fast collector
- Stable
- Allows a nice base and reliability for the triballs for the robot

CONS:
- Why do we need to be fast if we can only obtain 1 triball at a time?
- Can be a nice base, but also includes one wheel, causing it to be very heavy

PICTURE OF FLIPPER COLLECTORS

Name: Zoe Pak

Flipper Collector Pt. 2

This design is an effective way to pick up triballs. It takes up less space because it both picks up and dispenses triballs. It makes the robot more compact as there are less components but also places concentrated weight on one area.

* Picture

Name: Vaishnavi Alapati

Gear Ratio

Programming

Code Quality Choices

No global mutable states (i.e. externs)

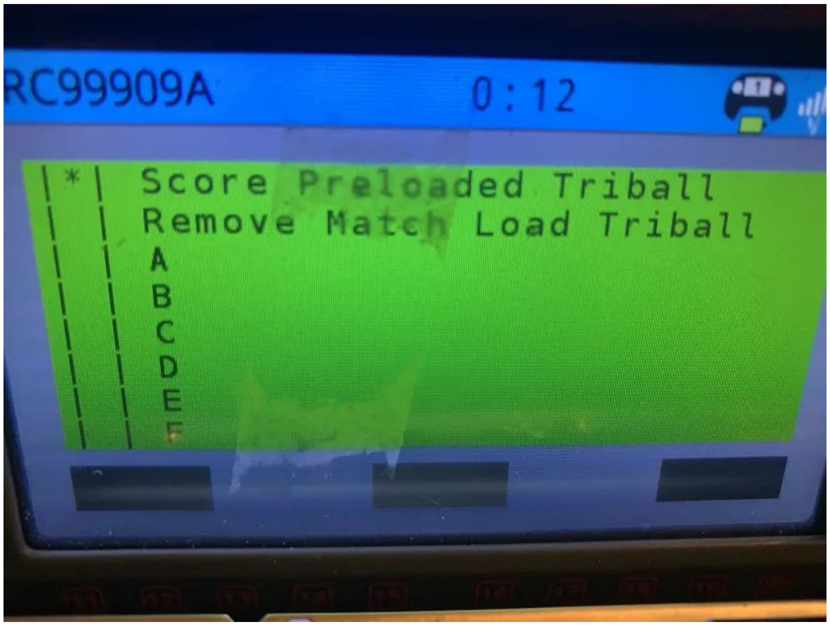
Task for each component of robot

Components work both with driver control and being called by other programs (i.e. autonomous)

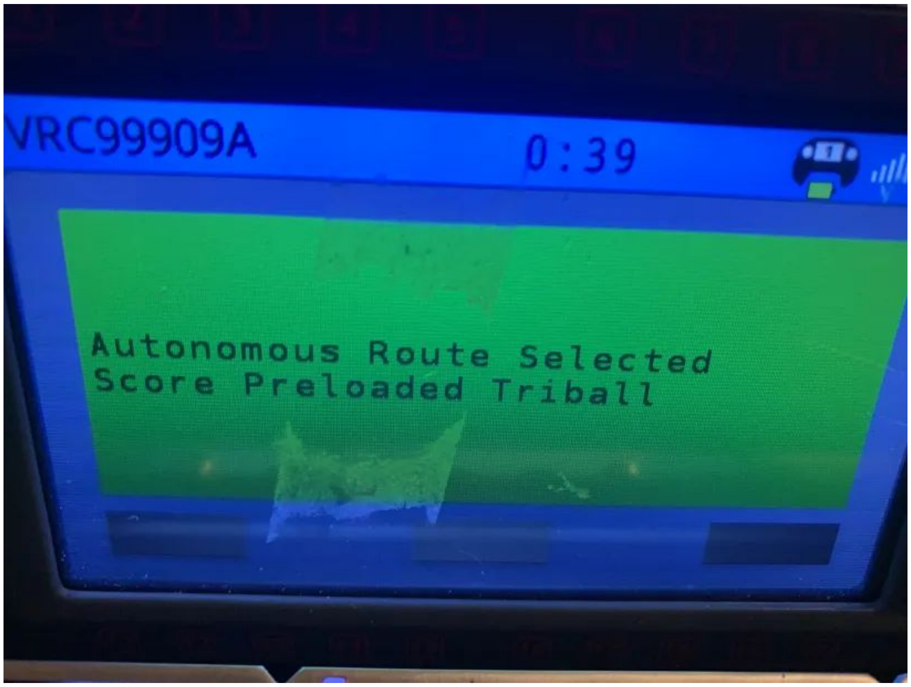
Object Oriented Programming

Autonomous Route Selector

- Left Button moves cursor up
- Middle button moves cursor down
- Right button selects route



```
|*| Score Preloaded Triball
| | Remove Match Load Triball
| | A
| | B
| | C
| | D
| | E
| | F
```

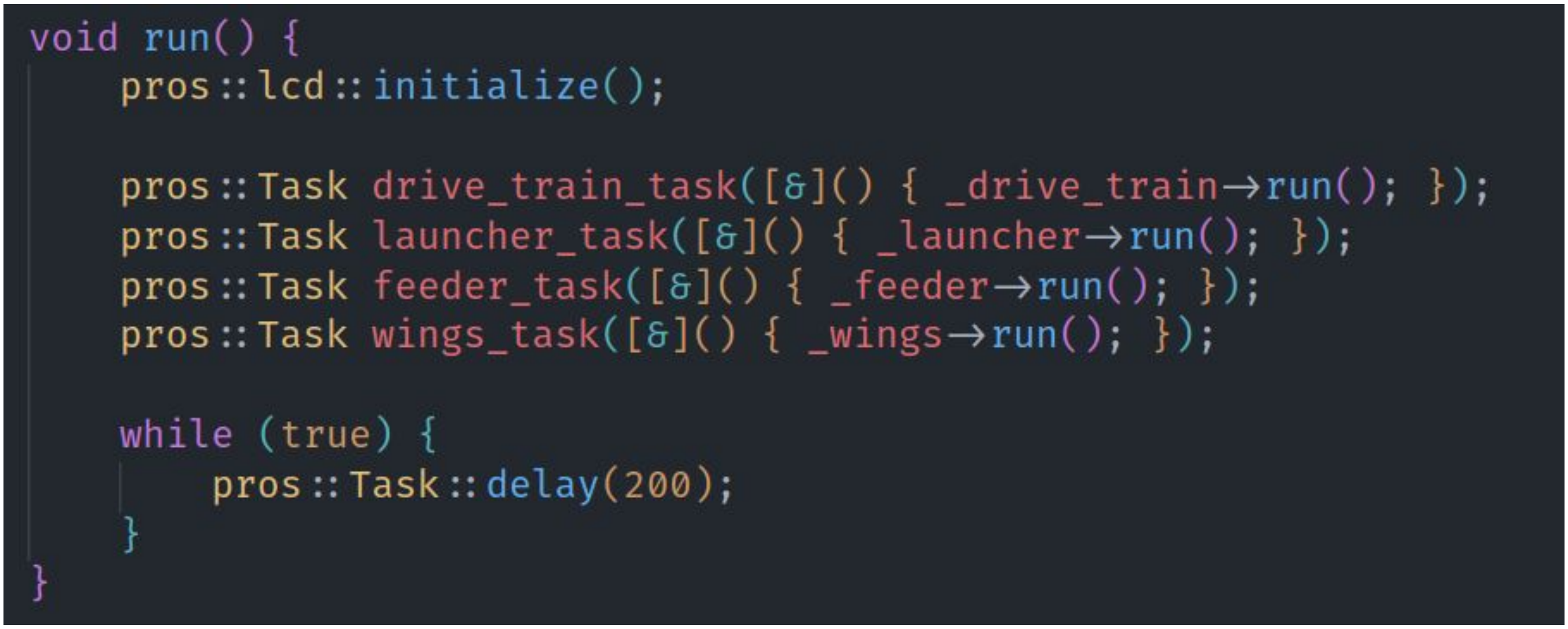


```
Autonomous Route Selected
Score Preloaded Triball
```

Autonomous Routes

- Grab match load triball, remove from goal, touch elevation bar
- Score preloaded ball
- Do both

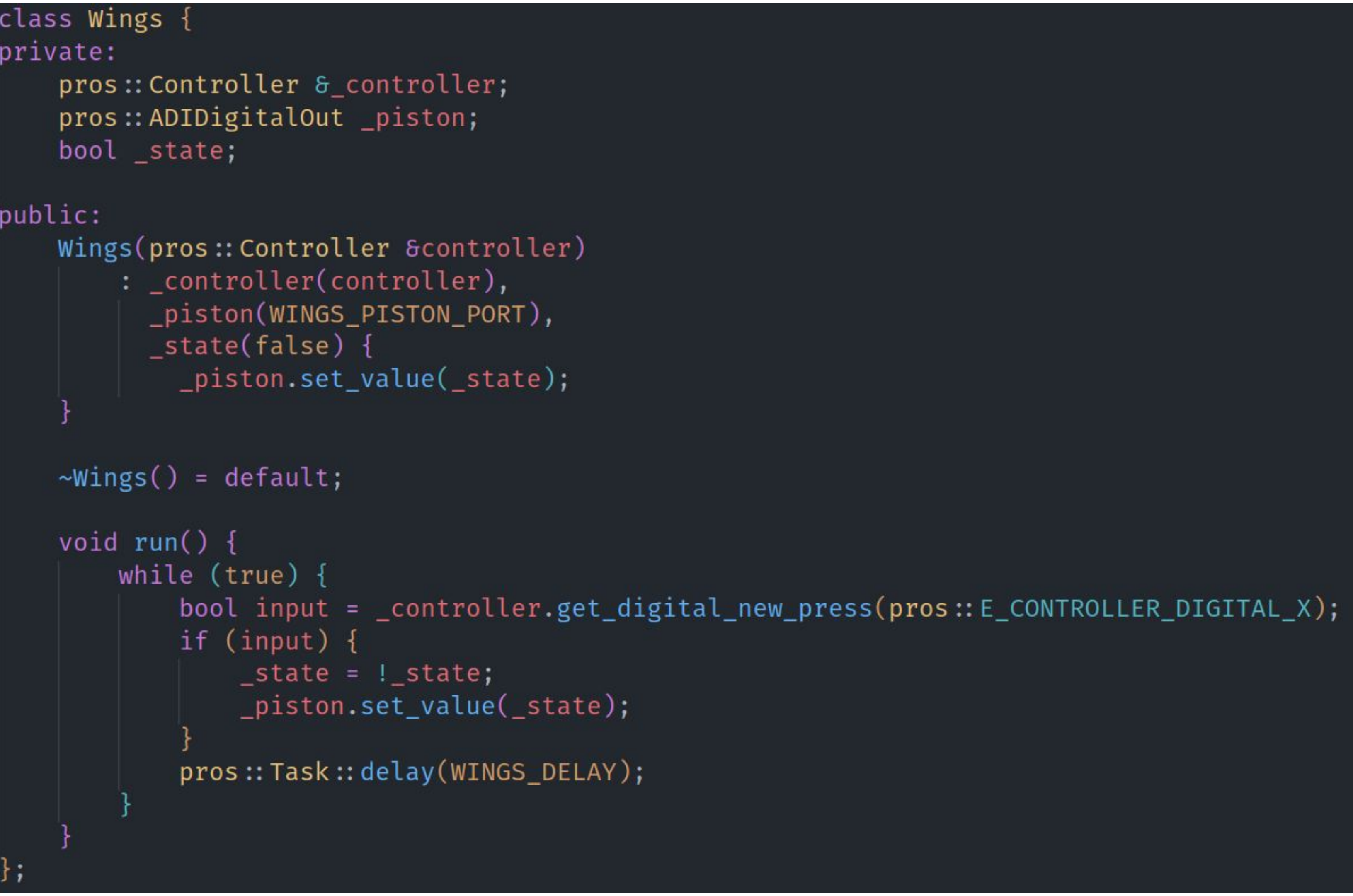
Code for Driver Control



```
void run() {
    pros::lcd::initialize();

    pros::Task drive_train_task([&]() { _drive_train->run(); });
    pros::Task launcher_task([&]() { _launcher->run(); });
    pros::Task feeder_task([&]() { _feeder->run(); });
    pros::Task wings_task([&]() { _wings->run(); });

    while (true) {
        pros::Task::delay(200);
    }
}
```

Runs a task for each component of the robot, i.e. the driver train, launcher, feeder, wings, etc

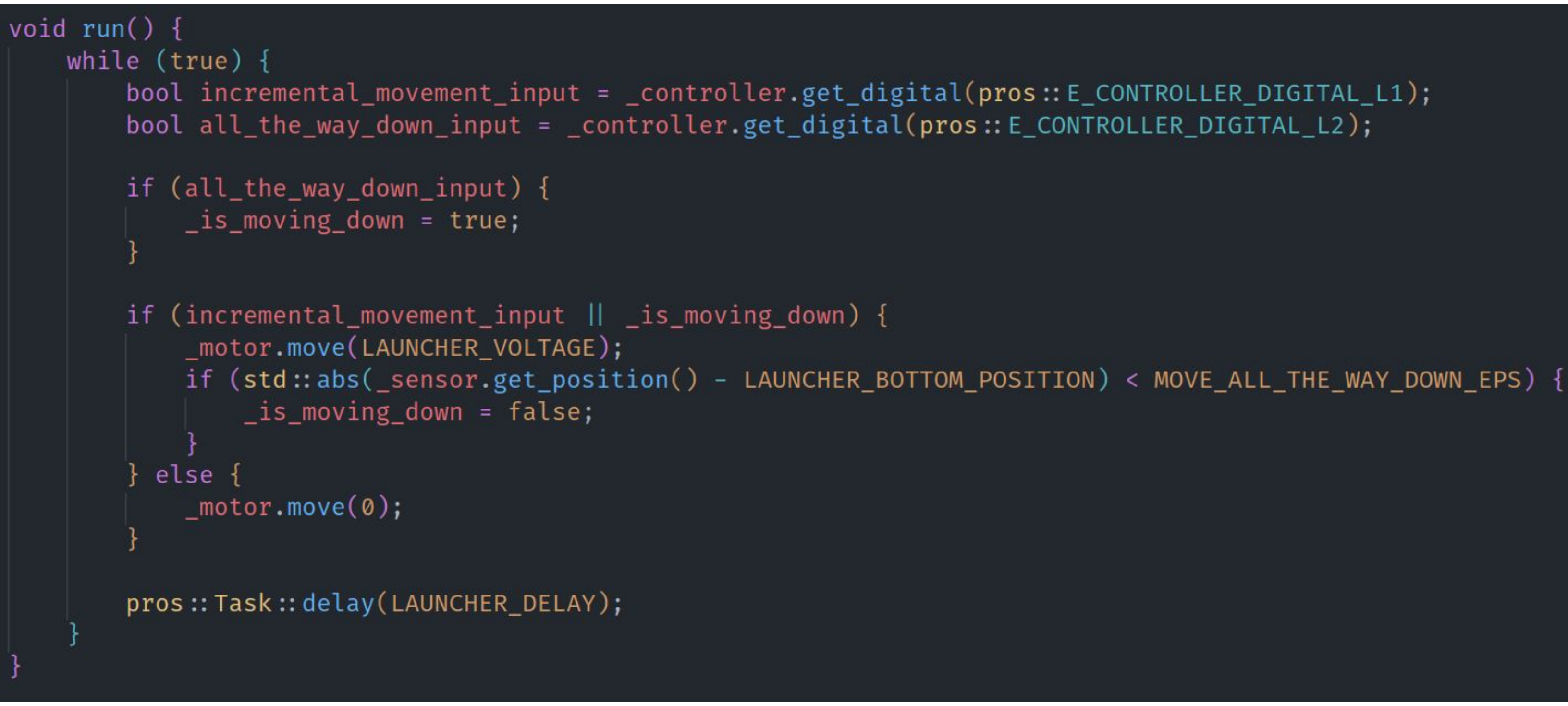
Wings Controller



```
class Wings {
private:
    pros::Controller &_controller;
    pros::ADIDigitalOut _piston;
    bool _state;

public:
    Wings(pros::Controller &controller)
        : _controller(controller),
          _piston(WINGS_PISTON_PORT),
          _state(false) {
            _piston.set_value(_state);
    }

    ~Wings() = default;

    void run() {
        while (true) {
            bool input = _controller.get_digital_new_press(pros::E_CONTROLLER_DIGITAL_X);
            if (input) {
                _state = !_state;
                _piston.set_value(_state);
            }
            pros::Task::delay(WINGS_DELAY);
        }
    }
};
```

Opens / closes wings based on X button on controller

Launcher Controller



```cpp
void run() {
    while (true) {
        bool incremental_movement_input = _controller.get_digital(pros::E_CONTROLLER_DIGITAL_L1);
        bool all_the_way_down_input = _controller.get_digital(pros::E_CONTROLLER_DIGITAL_L2);

        if (all_the_way_down_input) {
            _is_moving_down = true;
        }

        if (incremental_movement_input || _is_moving_down) {
            _motor.move(LAUNCHER_VOLTAGE);
            if (std::abs(_sensor.get_position() - LAUNCHER_BOTTOM_POSITION) < MOVE_ALL_THE_WAY_DOWN_EPS) {
                _is_moving_down = false;
            }
        } else {
            _motor.move(0);
        }

        pros::Task::delay(LAUNCHER_DELAY);
    }
}
```

L1 button acts as a “trigger”, giving driver full control over feeder
L2 button moves to a set position to prime the launcher for shooting

Competition Reflections

Parts List

Motors: 8 - 11W V5 smart motors
2X25 C channels - 10
2X35 C channels - 8
3X25 C channels - 4
V5 Rotation sensor: 1
V5 Pneumatics pistons: 3
4” omni-directional wheels: 4
4” traction wheels: 2
Gears - 36T high strength: 8
Gears - 36T standard: 4
Gears - 84T standard: 4
Sprockets - 30T: 1