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Team #3526	**Team Name:** Marlbots

https://drive.google.com/file/d/1yWcDcRS1KgrZKmYiEMV7fnehK4cm1ZTM/view?usp=sharing

Autonomous objectives:

- Scan Team Scoring Element (TSE) position (and grab TSE on duck side)
- Score in the correct level of hub (and score 1 additional freight on warehouse side)
- Get duck off duck spinner on duck side
- Park in the storage unit or warehouse

Sensors used:

- Encoders
    - Encoders are used on our drivetrain motors as well as our lift motors. Having encoders on our drivetrain motors ensures the most accurate movement during matches. With the encoders on our lift motors, we are able to automatically go to specific shipping hub levels with the press of a button and have top and bottom limits to not break the slides.
- Logitech C920S Pro HD Webcam
    - We use our camera to scan our team element during autonomous and use that information to score at the right level of the alliance shipping hub so that we can get extra points in the autonomous period. This also allows us to change our autonomous path so as to not run into the team scoring element or the other robot in our alliance.
- Rev Touch Sensor
    - We have a touch sensor at the bottom of our slides so that when the final stage hits the touch sensor, the motor for the lifts automatically stops and resets the encoder to 0, allowing us to not lower our slides more than they can travel and setting a consistent 0 for the height of the slides, allowing us to also create a top-limit for the encoders so the slides don't overextend.
- Rev Color Sensors
    - One color sensor is on the top of our scoring box and is used to detect if there is more than one freight in our scoring box, automatically causing the intake to reverse direction in order to avoid penalties.
    - Another color sensor is on the bottom of the back of the robot and detects the white dividing line for the warehouse and the rest of the field. When it detects the white line in Auto, the encoders reset and the robot begins its turn to the alliance-specific hub to score another freight.

Key algorithms:

- Tensorflow training
    - We used the FIRST Machine Learning tool to train our webcam to be able to accurately detect our team scoring element during autonomous. The tool can recognize unique patterns like stripes, as well as the elements already in the game, such as the duck, so we put tape on our team element, giving it gold and black stripes.
- Lift runToPosition() function with state machine
    - In our code, we have four states for raising the slides, one for each level on the shipping hub as well as a manual override function to lower the slides after scoring in the different levels. We also

have code that states that after reaching the target level on the shipping hub, the state switches to the manual override to allow us to bring our slides down quickly.

- encoderDriveLift() function
    - The drive-lift function allows us to drive and lift our slides at the same time, and set each wheel to a specific encoder value. This makes smooth turns possible in the autonomous period allowing us to quickly score freight in the alliance-specific hub.
- driveIntake() function
    - This function allows the robot to drive and intake at the same time in autonomous, using the color sensor to detect if the robot has intaken freight. Once it detects freight, the function causes the intake direction to reverse and the robot to exit the warehouse.

Driver-controlled enhancements:

- Using the lift function
    - On the controllers for driver B, we use three buttons to automatically lift our slides to the set positions of the alliance shipping hub, bringing ease to our drivers and providing the fastest scoring and cycle times.
- Duck Spinner Speeds
    - We have two speeds for our duck spinners, “turbo” and regular. The regular speed is used to get the duck the majority of the way around the carousel, but once it is far enough that we know it will not fly off, we use the turbo speed to quickly score the duck so we can move on to the next. This allows us to save time in end game so we can cap our team scoring element and park.
- Color sensor
    - Using the color sensor helps us not get penalties for holding more than one piece of freight by automatically out taking the intake when it detects more than one freight in our scoring box.
- Touch sensor
    - Using the touch sensor helps our drivers not over-extend the slides in either direction, automatically stopping the motors on our lifting mechanism if the sensor is pressed at the bottom.
- TSE scoring mechanism
    - We coded the servos holding the TSE scoring mechanism to respond to a joystick instead of a button, incrementing the servo’s position according to the motion of the joystick. This allows smooth control over the mechanism for easy capping. We also have the claw automatically set to closed, so the driver has to hold down the button to open the claw to grab or release the element. This allows the drivers to focus on scoring tasks, and then only have to think about the claw positioning when actively needing to change its position.
- LED lights
    - We use LED lights along with our sensors to indicate to our drivers when the robot has a freight in the scoring box. This helps prevent penalties for controlling multiple freight and lets the drivers know immediately when they can begin driving to score the freight.

Engineering portfolio references:

- Pg. 10, 11, 12, 13, 14, 15

Autonomous program diagrams: