FIRST TECH CHALLENGE

Control Award Sponsored by Arm Submission Form

****Please turn in this sheet during your judge interview along with your engineering portfolio****

Team # 20871	Team Name: Eurek@

Autonomous objectives:

- 5+1 autonomous on high junction
- Fully parked using custom signal sleeve to achieve signal bonus.
- Automatic alignment after collisions with other robots

Sensors used:

- Webcam: used for April-Tag sleeve detection
- Through-bore encoders: used for odometry and dead wheel localization
- IMU – Control Hub: provides heading using gyroscope for two-wheel odometry
- Distance sensors: used for checking proper alignment with the pole
- Magnetic sensors: used to bring sliders to home position until magnets are detected and then motor encoder values are set to zero. It also breaks inertia by bringing sliders to a hard stop.

Key algorithms:

- RoadRunner trajectory sequence using encoder and IMU values
- Position locking with periodic trajectory sequence call using IMU's heading after every cycle to make sure the robot is always aligned with the pole, even after a collision with another bot.
- Distance measurement from distance sensors used to detect pole and make sure any irregularity in field does not make the trajectory overshoot or undershoot.

Driver controlled enhancements:

- Field centric motion: Using IMU's heading to keep driver heading constant even with a change in the robot's heading.
- Cubic Function: Cubing the joystick input values reduces the jerk effect for nimble movements
- Slowmode: Reducing the speed constants of linear and rotational motion for precision alignment and placing when the trigger is pressed.
- Passive gripping: A passive gripping state to hold the cone securely in the gripper while traversing the field, and then using another button for transfer to the cone holder and delivery.
- Single button cycling: By sequencing the actuators and their timing, we start cycles on a junction using both intake and delivery sliders with a single click of a button. This has allowed drivers to analyze the field and formulate strategies while the bot is cycling.

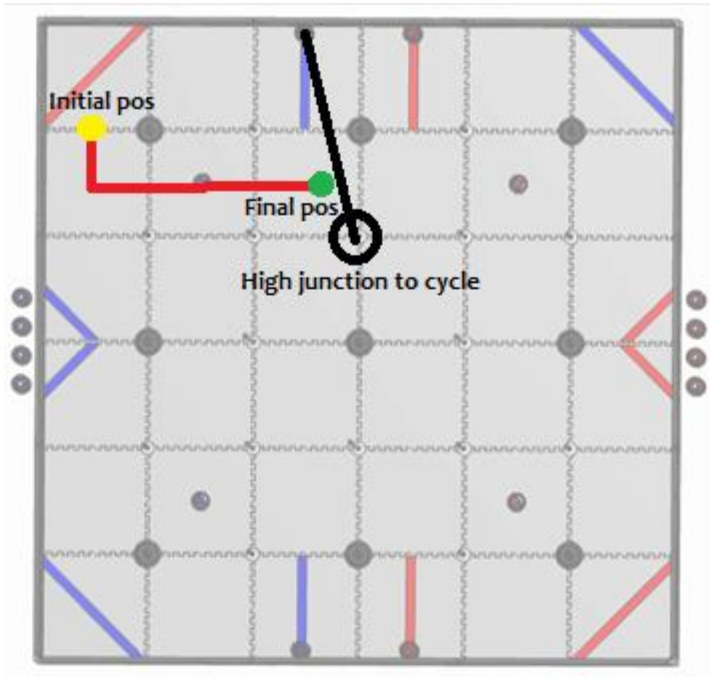
Engineering portfolio references:

- Impact of control components: Addition of distance sensors greatly reduced the overall change in trajectory, even on an irregular field, which was realized during scrimmages on different fields. The addition of magnetic sensors showed that inertia breaking was important for maintaining accuracy during transfer of cone.

- Impact of trajectory locking: the locking algorithm was a failsafe in autonomous, as it made sure that a misalignment for a single cone does not affect the placement of the next cones

- Pg 10 & Pg 11 of Engineering Portfolio describe the control components in greater detail.

Autonomous program diagrams:



- The yellow spot indicates our starting position, and the bot is placed at the edge of the tile for precise alignment before match. The webcam is on the side of the bot for sleeve detection.

- We use through-bore encoder values and IMUs heading to get the position and direction, and we use RoadRunner to build the trajectory, as shown by the red line.

- The trajectory consists of a lineToConstantHeading to get to the center of the tile, and a lineToLinearHeading to get to the cycle position.

- Our cycle position indicated by the green circle is at an angle of 16° from the base x line, so that the stack, the bot and the high pole are placed colinear to each other.

- We set servo positions according to the position of the cone in the stack.

- The sliders slightly extend, to push the stack and prevent it from tipping over due to the angular motion of the four bar.

- After every cycle on the high junction, we run a locking trajectory to make sure the bot's position is unchanged.

- At the end of 5+1, we run any one of the 3 separate parking trajectories according to the parking zone detected by the webcam earlier.