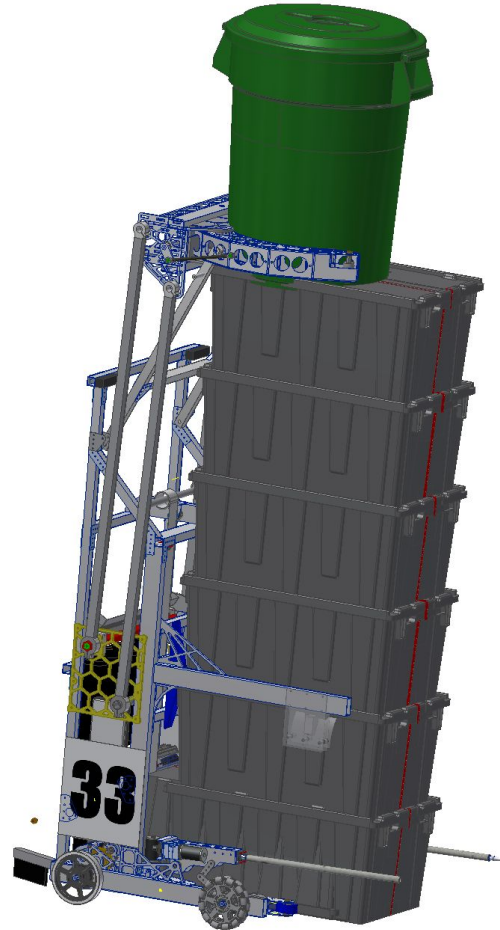


2015  
BEHIND THE  
DESIGN  
BLZZ XX

# BUZZ XX



# INITIAL DESIGN PROLESS

After Kickoff, we immediately began the design process by reviewing the game rules with the entire team. During this step, we also looked over the field specifications. We continued development by determining primary functional objectives for the machine. These were determined by analyzing cost and benefits of game tasks relative to point value. We also created a scoring matrix to evaluate which actions provided the most return.

[illegible]

### Functional Requirements:

Need- Low center of gravity

## Need- Fast

## Need- Acceleration

## Need- Nimble

## Need- Rigid/Robust

## Need- Repeatability/Accurate

**Need-** Create stack of 6 w/  
container

Need- Fast floor collect out of pile

Need- Grab garbage can  
off step

Need- Drive over ramp

## Need- Straddle ramp

**Need-** Don't let litter slow you down

**Need-** Don't get stuck on ramp

Want- Create stack of 3 in auto

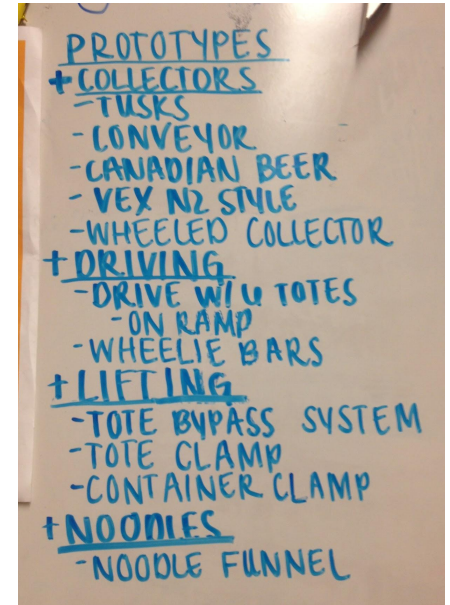
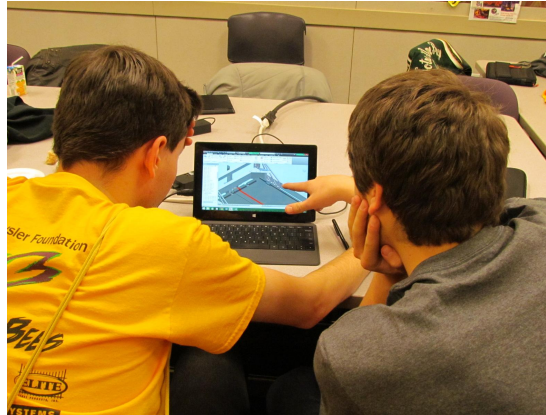
Want- Make stacks of stacks

Want- Move litter into  
Landfill

Wish- Stack ~3 and take container from step

# DEVELOPMENT OF DESIGN

During week one, we held brainstorming sessions where students and mentors conveyed their design concepts and ideas to the entire team. At this time, a list of functional objectives was compiled for the machine. The CAD process began during this time, allowing younger students and mentors to easily collaborate on the design process. The team began the prototyping process in various groups, focusing on ways to separate, lift, and stack the cans and totes.

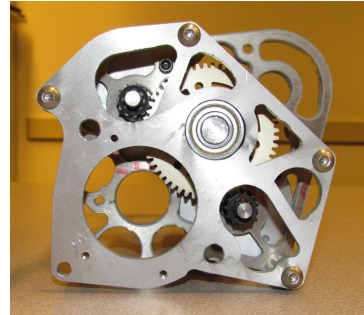
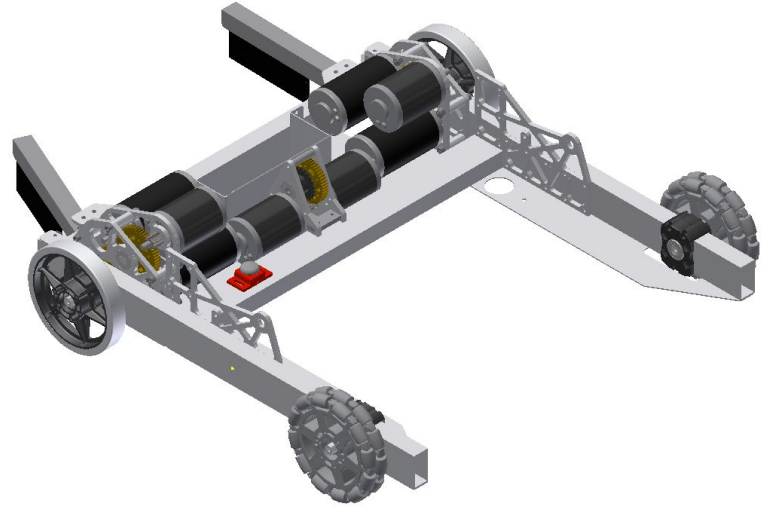




# DRIVETRAIN

The chassis is a key part of the design of our robot. A prototype chassis was designed and built during the offseason to test the wheels, gear ratios, and overall design concept. This prototype chassis also provided vital driver training. After Kickoff, we decided that a lighter, 4 wheeled version of this concept was feasible to accomplish our primary functional objectives.

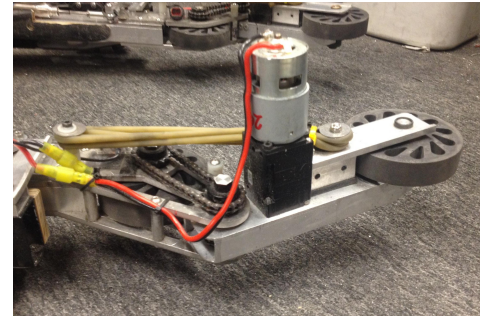
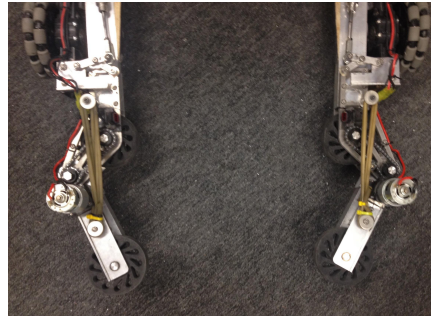
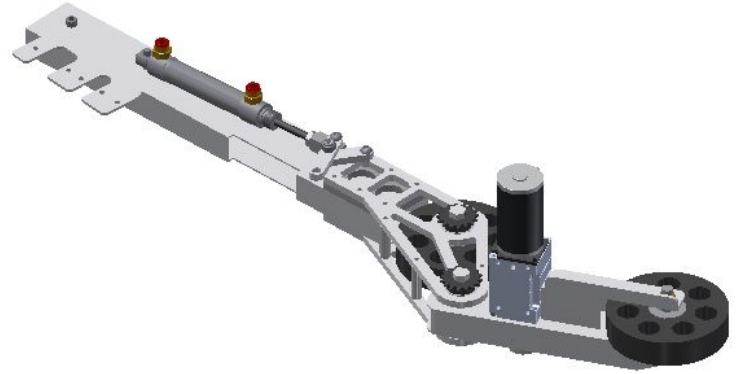
- 4 6" Omni wheels
- C-base frame allows for internal tote collection.
- Custom gearbox accommodates up to 3 CiMs.
  - Each side of the drivetrain has 2 Mini CiMs.
    - Geared for 8 feet/second.
- 25 pitch chain runs through the chassis base.
- Spring-loaded wheelie bars support the robot.



# TRANSVERSE WHEEL INTAKE

Originally, we used a combination of actuating transverse wheels and spinning rubber “tusks” to orient and collect totes. After Week One competition, we redesigned our intake to be faster and more efficient when collecting from the landfill. Our initial prototyping looked to determine the best material for these wheels and the optimal amount of pinch on the totes.

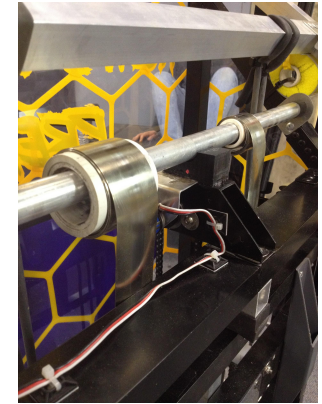
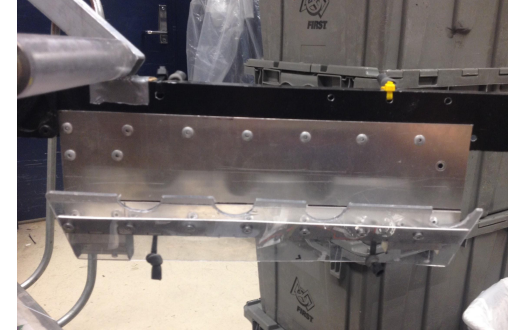
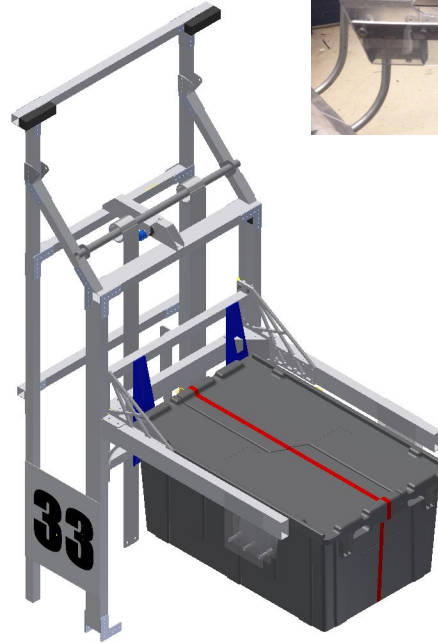
- 2 BaneBots 775 Motors with VersaPlanetary gearboxes
- Rubber wheels provide the best grip when removing totes from the landfill.
- SICK Optical sensors control the actuation of transverse wheel assemblies.



# ELEVATOR & STACKER

Having built elevator lifts in years past, we were confident that we could design an elevator and stacker that would meet all of our primary functional requirements. The frame of the robot incorporates the elevator, stacker, and other features such as the electronics board.

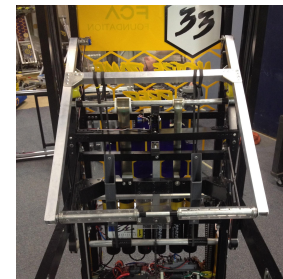
- Gearbox accommodates 2 CIM-type motors. To save weight, our elevator uses 1.
- 25 pitch chain drives the stacking mechanism.
- Adjuster nuts in the elevator slides allow for fine-tuning of the mechanism.
- Lightweight polycarbonate “fingers” are a bypass mechanism that hold the stack of totes.
- Closed-loop controller monitors the stacker’s position.



# STACK CLAMP

The lightweight stack clamp steadies the stack of totes within the robot. The stack clamp also inputs the number of totes carried into the overall state machine for Buzz XX.

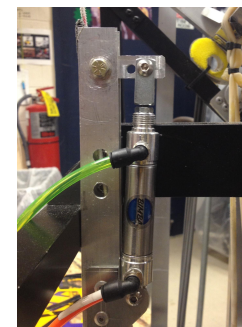
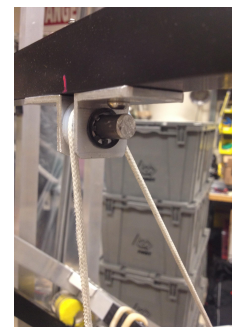
- Rotary potentiometer measures number of totes held in stacker.
- 1.25" polycarbonate tubing on bearings reduces friction between the container and the totes.
  - When scoring, the stack clamp slides out from underneath the container without upsetting the stack.



# STACK CLAMP BRAKE

During Week One competition, we found that when scoring stacks of six, our stack clamp could occasionally unnest the top totes and disrupt the stack. To prevent this, we designed a stack clamp brake, similar to a rope jammer used in climbing. The brake arrests the stack clamp in the "up" position, preventing it from slamming down as a stack is being scored.

- 2" piston

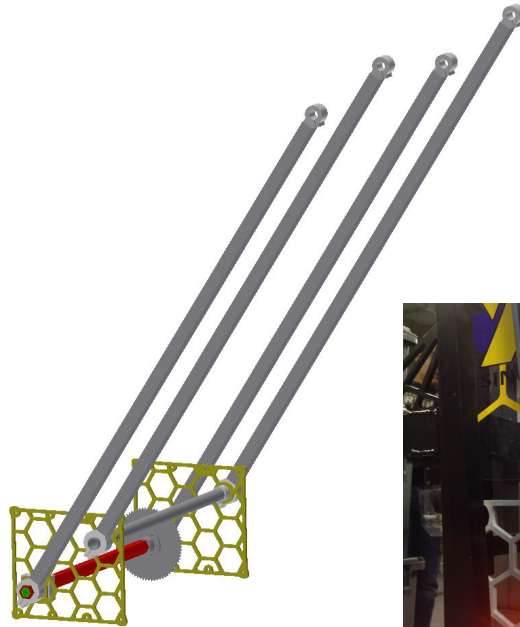




# FOUR BAR LIFT

Manipulating the containers from auton and from the step was a primary functional objective. Because the four bar manipulates the container separately from the rest of the stack, Buzz XX is able to cap stacks within the robot and those made by alliance partners. Originally designed for 25 pitch chain, the four bar is now powered with 35 pitch chain.

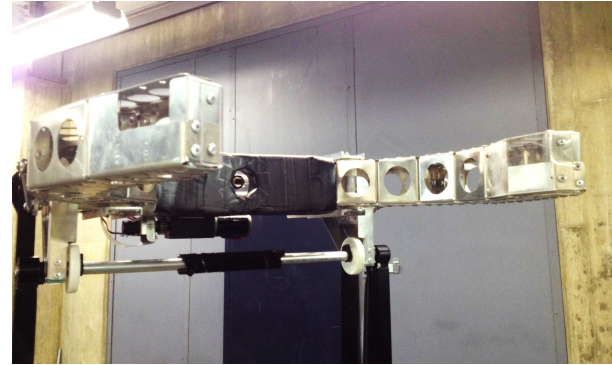
- Mini CiM motor with a VersaPlanetary gearbox, 40:1 gear ratio
- 35 pitch chain drives the four-bar.



# CONTAINER CLAW

During the prototyping phase, we explored several options for a container claw and found that a pinching-style claw worked best. It was designed to be able to accommodate two transverse roller wheels at the edge of the claw. If needed, these modular wheel assemblies can be added later.

- BAG motor with Versaplanetary gearbox - 125:1 gear ratio.
  - Potentiometer on the motor allows for preset claw positions. In addition to a manual override, the operator has options for open, partly open, closed, and “tote collect” positions.
- Overcenter locking linkage to prevent backdriving.



# ELECTRONICS

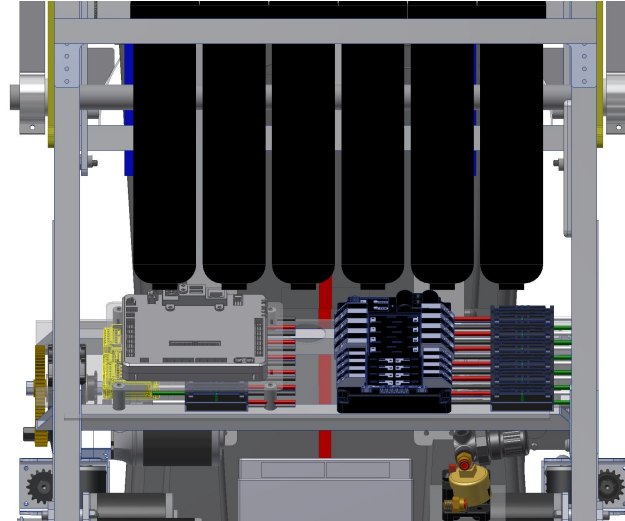
The placement of the electronics panel was rendered in CAD prior to the assembly of the robot. The board was built up with main electrical components outside of the robot in order to expedite the wiring process.

## Motors & Motor Controllers

- 9 Victor SP Motor Controllers
- 1 CiM (elevator)
- 5 Mini CiMs (4 - drivetrain, 1 - four-bar)
- 1 Bag Motor (claw)
- 2 BaneBots 775 Motors (intake)

## Sensors & Encoders

- 1 VEX Yaw Rate Gyroscope Sensor V1.0
- 4 Potentiometers (four-bar, stacker, stack capper, and claw)
- 2 VEX Bumper Switches (tote intake)
- 2 Absolute Encoders (drivetrain)
- 3 Sick Optical Sensors (2 - transverse wheels, 1 - claw)

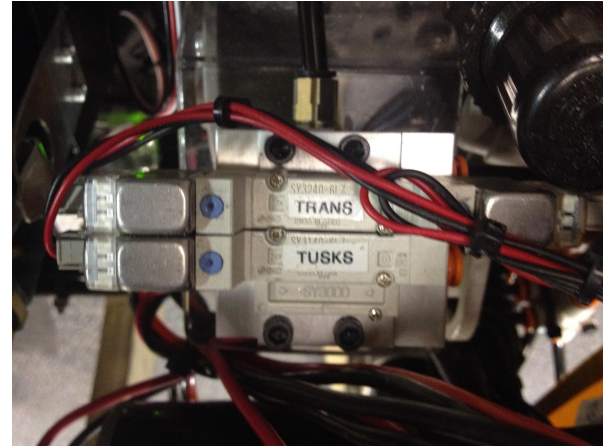


# PNEUMATICS

Pneumatics are integral to our design. They are optimized for all mechanisms on the robot to provide quick actuation for aligning and collecting totes.

An offboard compressor saves weight. The pistons for Buzz XX are smaller than previous years and are cycled less, so an onboard compressor was unnecessary.

- 3 2" pistons (2- intake, 1- stack clamp brake)
- 5 Clippard 574 ml air tanks





# PROGRAMMING AND LOGIC

Buzz XX was programmed with LabView. The state machine manages all robot operations aside from the drive train. This allows for complex interactions between the various subsystems to be easily coordinated within the programming.

- Closed-loop controllers on the stacker, claw and four-bar.
- Arcade drive interface on the drivetrain.
- Input from sensors on the stacker, elevator lift, four-bar, and claw feed values into the state machine.

