3958 Robot Presentation

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Team #3958 Green Mountain Gears

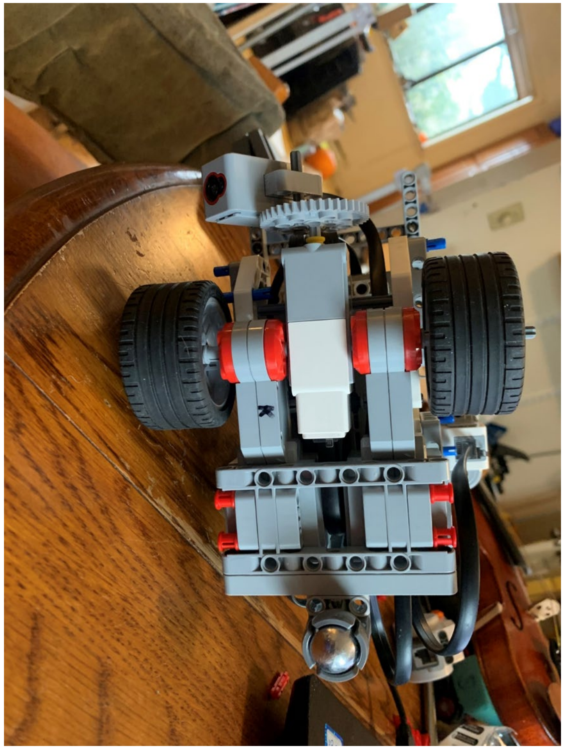
Robot Design 1. Robot Facts

- 90 lego parts
- 2 large motors
- 1 medium motor
- 1 color sensor
- 1 infra red sensor
- 1 attachment

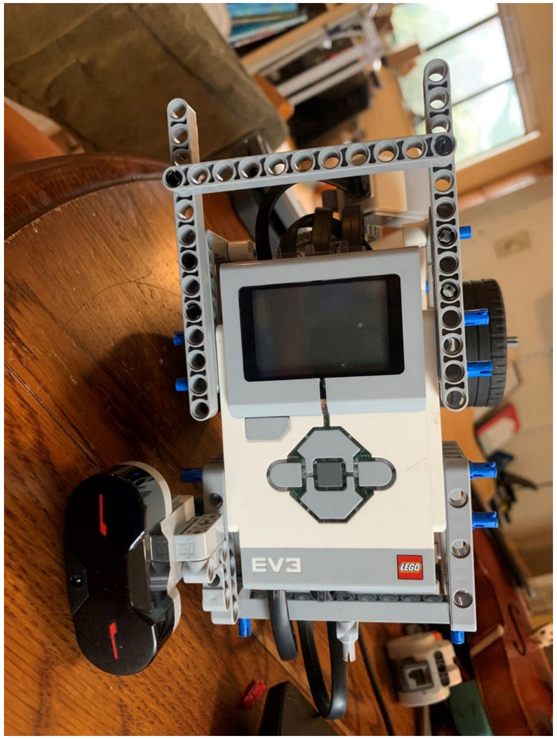
- Programmmed in Mindstorms
- 4 programs, 4 myBlocks
  - Pusher 1,2 (stacks for points)
  - Pusher 3 (innovation design)
  - Bridge and Flags
  - Control Program
- Pusher Missions (1-2)

Robot Views

Bottom

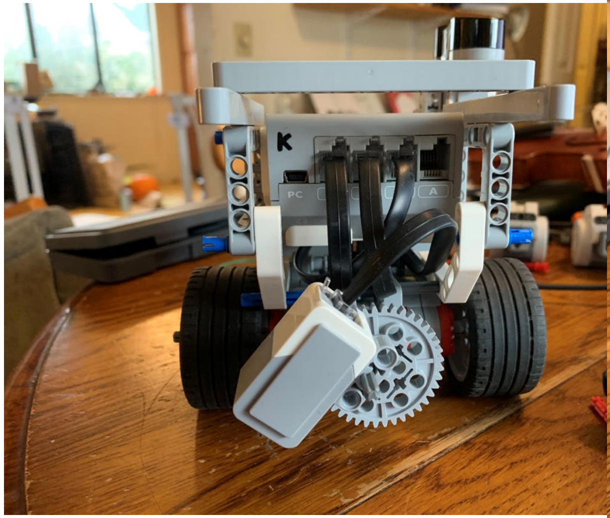


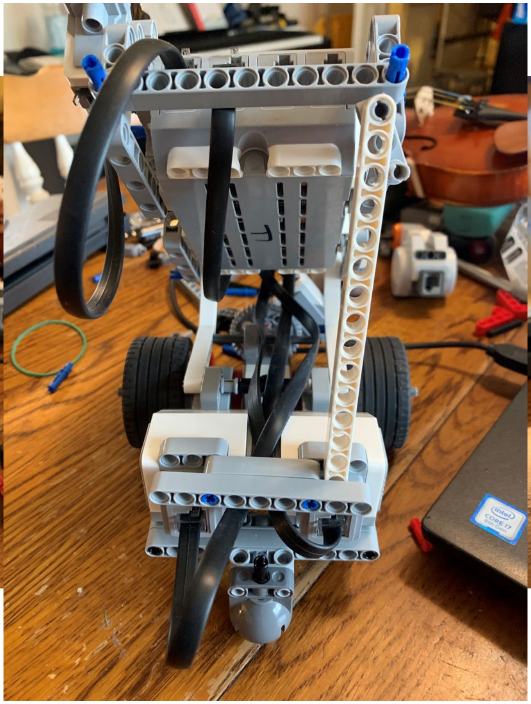
top



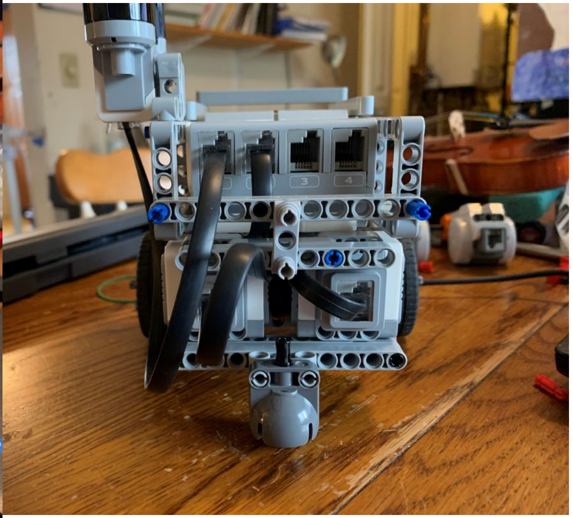
Robot Views

front





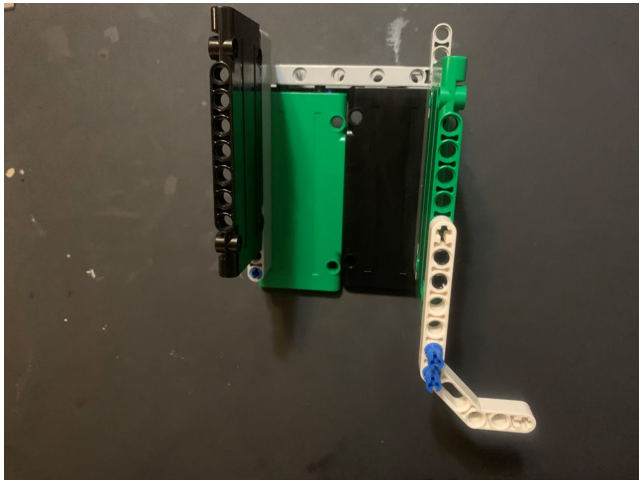
back



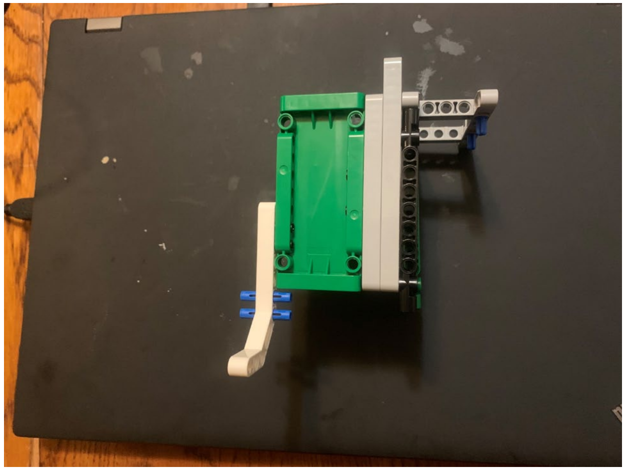
Pusher Attachment

- Had to be tall enough to keep pieces stacked
- Had to be small enough to place close to black line
- Had to be wide enough to hold stack
- Had to be balanced so it didn't push over the stack

Front View

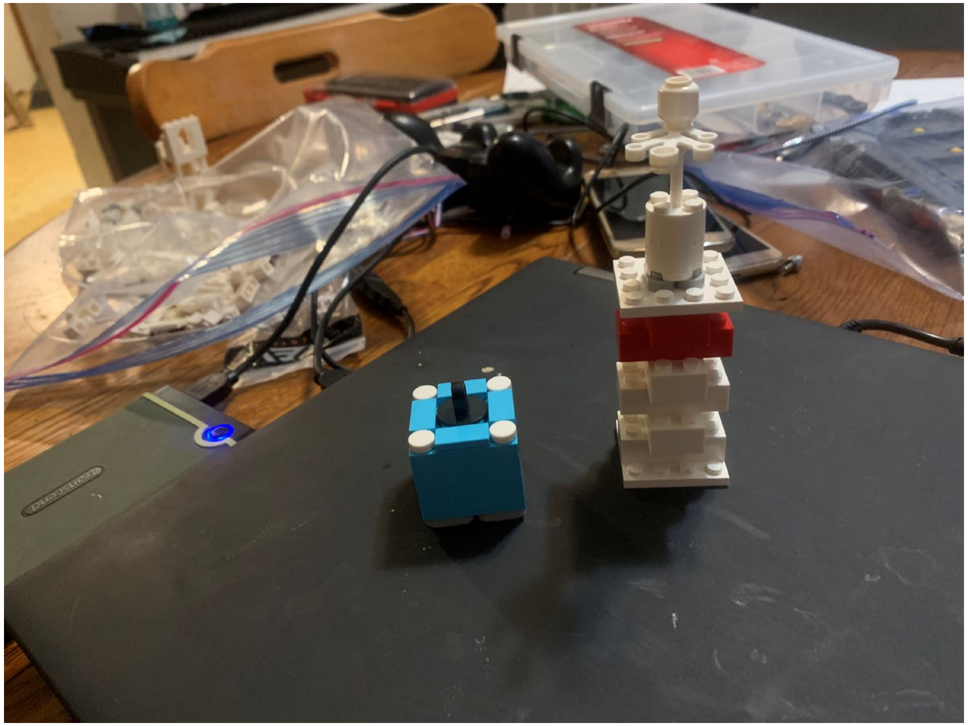


Side View



Innovation Design

- Had to be made from the bricks in white bag
- Had to be bigger than Blue piece
- Had to be as small as possible (to reduce changes of having an edge outside of circle)
- Had to be tall enough to work with pusher



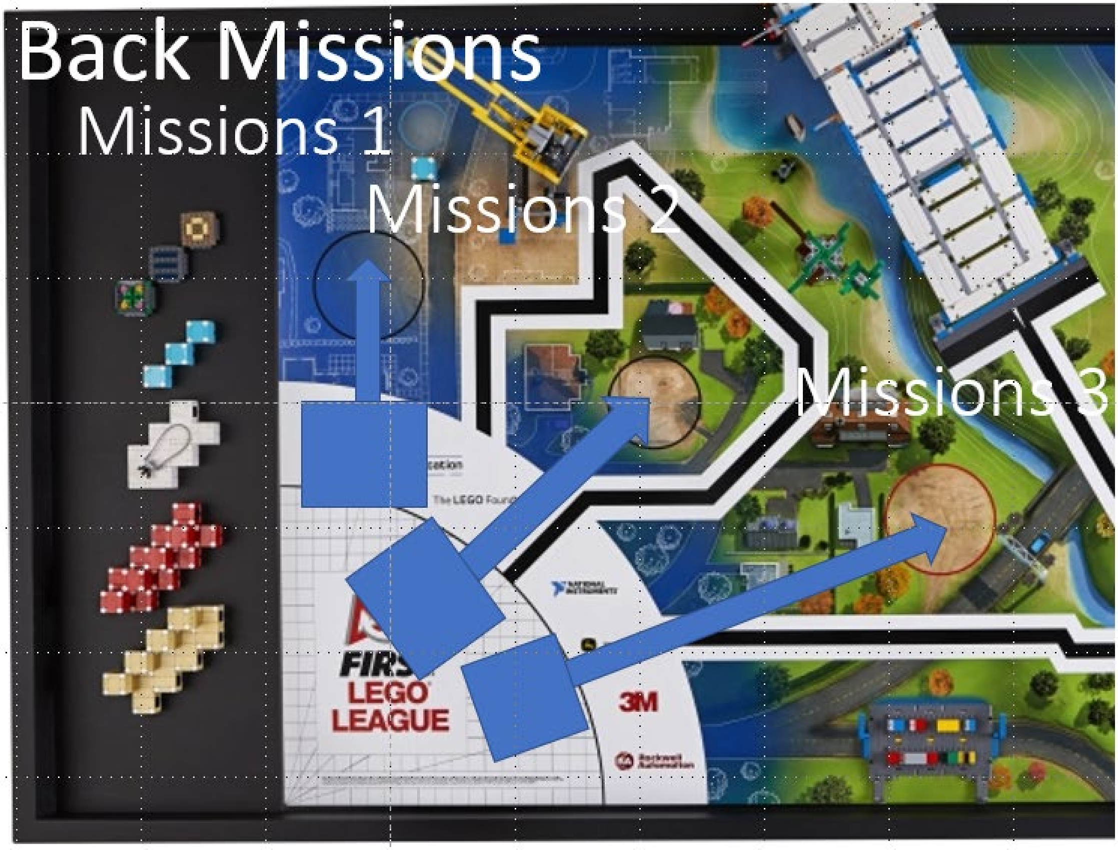
Design Details: A-Fun/Interesting

- Clam design, to replace batteries, was pure accident but would be used again on purpose!

Design Details-B Strategy

- Close to starting position
- Required few turns
- Did not require powered attachments to score points
- High degree of success for first few missions
- Take chance on big points for final mission
- Selected the missions to move stacked parts to the three circles close to base first-These work all the time
- Select the bridge and flags because it had a line to follow, 1 turn, and it did not require powered attachments to the robot. This works much of the time

Out and Back Missions

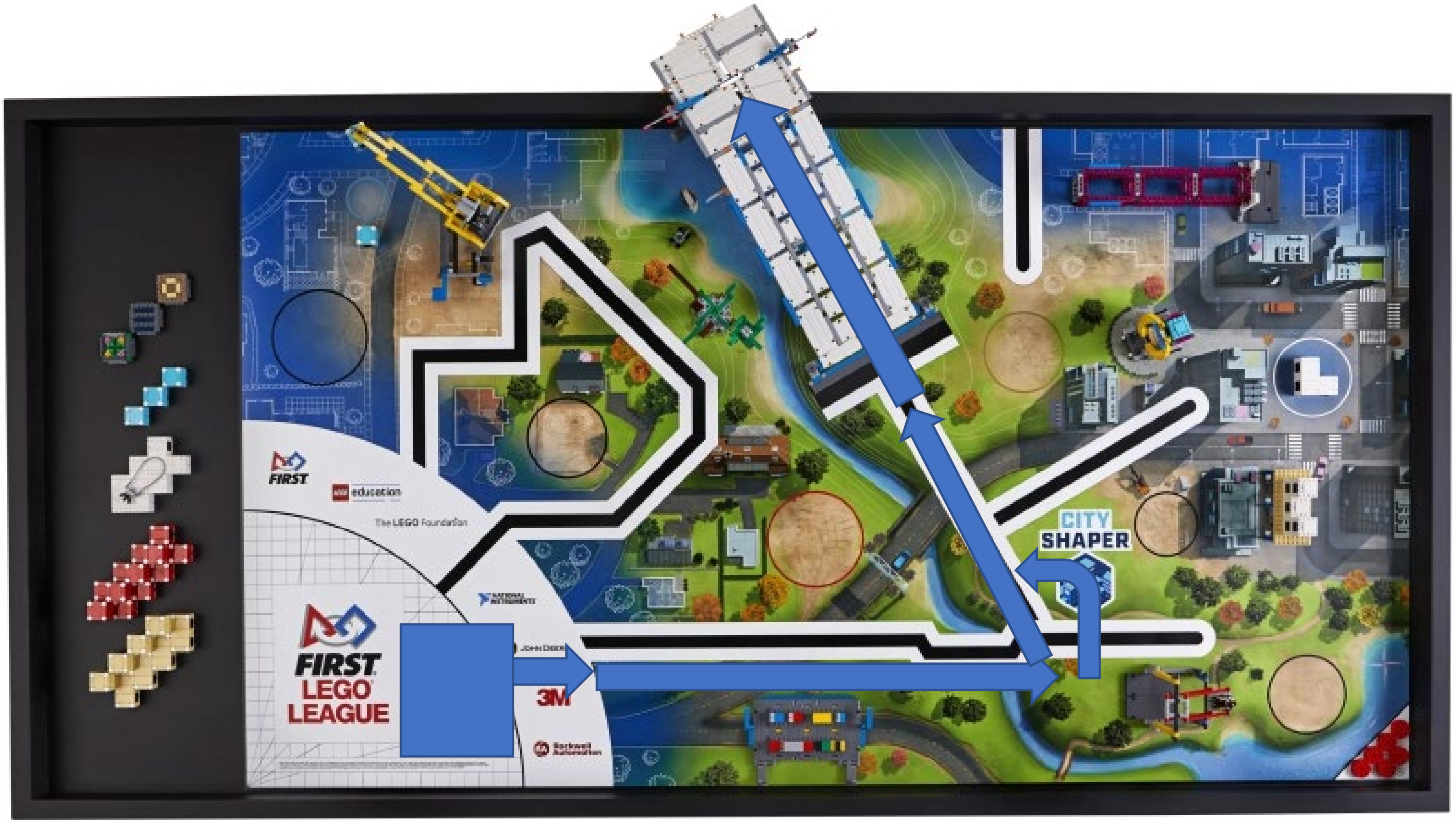


Missions 1

Missions 2

Missions 3

Run 4


FIRST
education
The LEGO Foundation
NATIONAL INSTRUMENTS
JOHN DEERE
3M
Rockwell Automation
FIRST LEGO LEAGUE
CITY SHAPER

Design Details-C Design Process

- First design was as simple as possible.
  - Brick faced upward to make it easy to see.
  - Motors were mounted vertical to the sides of the bricks because this was easy and could be done with very few parts.
  - Sensors were attached in the front for line following
  - Rechargeable battery
  - Tested using attachment->worked great
  - Designed line following programs->worked great
  - Tested everything on board and robot was too high/too wide
- Second design responded to problems with testing
  - Motors were placed horizontal, under robot
  - Square frames were used to make connections easy
  - Medium motor was placed between large motors to move sensor
  - No rechargeable battery because it took up too much space
- Cailin did the work on the first and second robot. Molly built a back-up robot

Design Details: D-Mechanical Design

- Build simple and intuitive-b motor on left, c motor on right
- Motors horizontal for lower center of gravity for bridge climb
- Motors close together so robot can use line follower without hitting traffic
- Brick horizontal for lower center of gravity for bridge climb
- Color sensor mounted to gear on medium motor to move sensor into position for line following and out of position for bridge climb
- Axles with stoppers to reduce axle sliding
- Use of bushings to present rubbing between tires and other legos
- Use of castor to balance robot while moving
- Keep robot small and light so motors can drive robot up bridge
- Keep wires contained so that they do not get caught on game elements
- Easy access to battery
- Easy access to USB port
- Added axle/pin connectors over pins so no “stick” when removing pusher

Design Details E-Programming

- Simple, intuitive-always more than (1) way to program something
- Proportional Reason and MyBlocks-In order to understand PID
  - Go straight(distance)
  - Turn(angle)
  - Zig Zag Line Follow
  - PID Line Follow
- Remote Control and Port View
- Building Runs into MyBlocks
- MyBlocks into Master Control Program

Design Details E-Programming

- Find a starting place
- Use remote control to drive motor to the desired location and record motor encoder values in Port View. Enter these values into tank blocks for driving straight or turning.
- If needed, use line follower in Port View with remote control to stop robot. Read motor encoders values in Port View.
- Combine way points for a single run into a myBlock
- Place all of the myBlocks into a Master Controller

Successes

- Mission 1-always works
- Mission 2-always works
- Mission 3-always works, sometimes only partial points
- Mission 4-sometimes the robot misses the line, sometimes the robot takes more turns than other times and it goes up the ramp but misses the flags

Design Details F-Innovation

- Clam Shell-robot can pivot and open like a clam to allow access to the batteries and the bottom of the robot. Held together with an H connector
- New PID Algorithm with FTC team #9721-this is the most simple PID algorithm so far and it works great. Much better than Zig Zag.

3. Trial Run