

FIRST® LEGO® League

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AN ALTERNATIVE APPROACH TO
FIRST LEGO LEAGUE ROBOTS:
GUIDELINES FOR A COMPETITION ROBOT

HOTSHOT HOTWIRES

ABOUT THE AUTHOR

The Hotshot Hotwires is a community-based FIRST LEGO League team in the mid Hudson Valley region of New York.

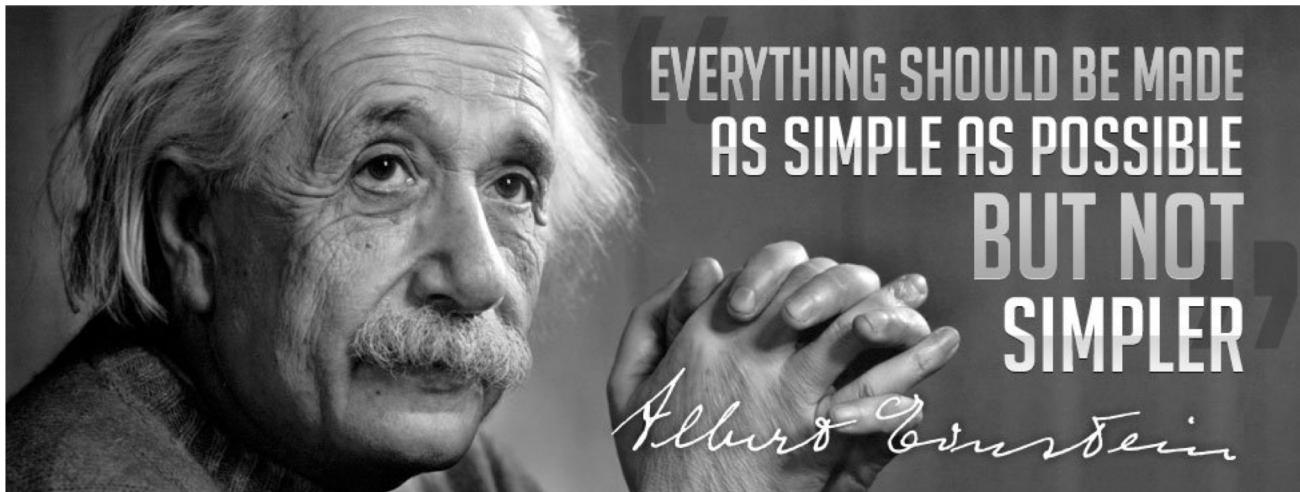
The team started in 2012, although all of the original coaches and students have graduated.

The photograph is of our 2018-19 team, comprised of 5th-8th graders.



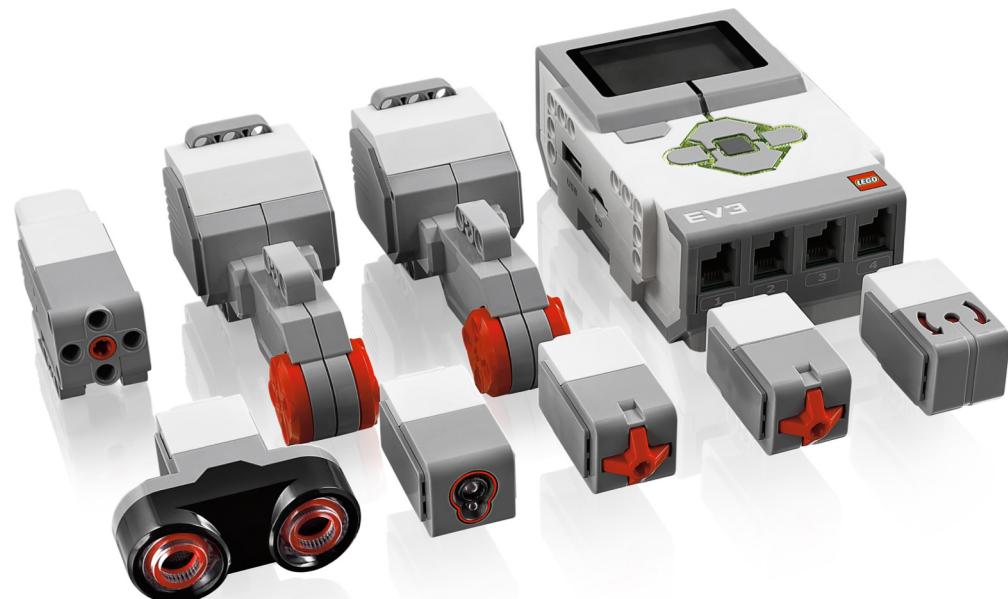
OBJECTIVES

- Learn to build simple robots, which have minimum attachments, and perform reasonably well in competitions



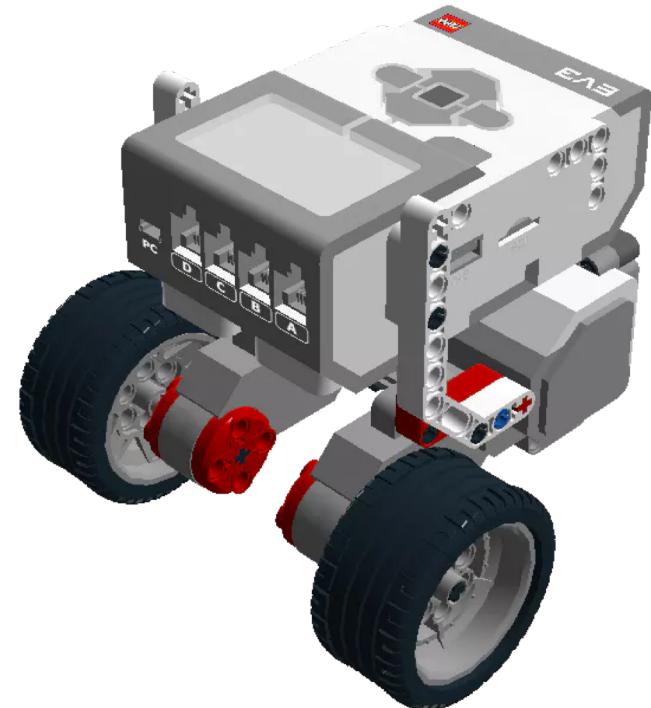
4 MAIN COMPONENTS OF A MISSION-READY ROBOT

- Mobility Mechanisms
- Body
- Sensors
- Actuators:
 - Active and Passive



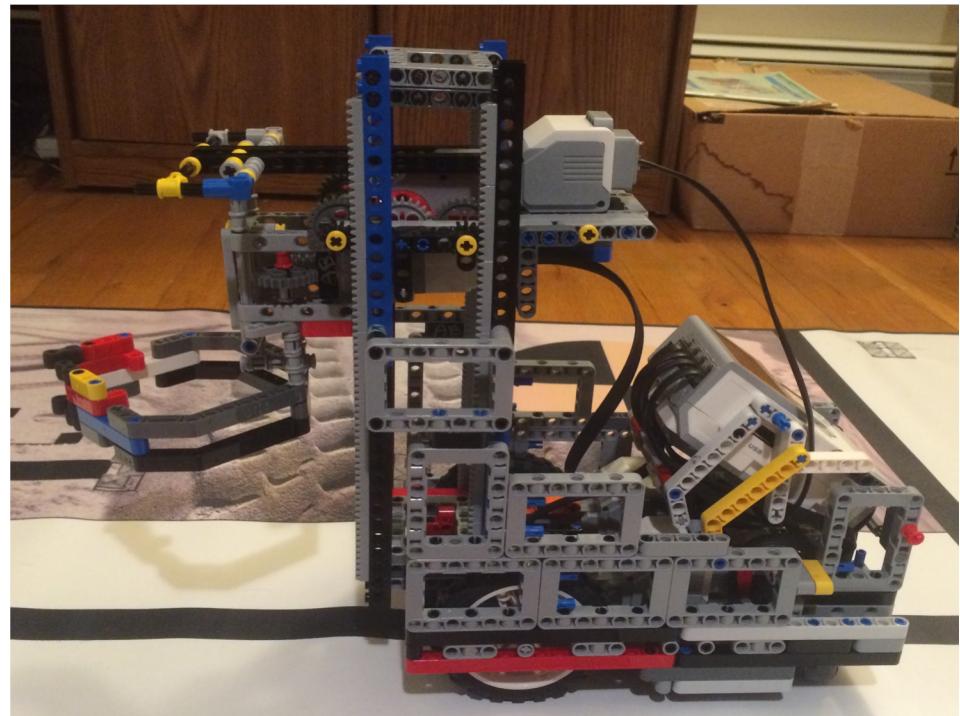
MOBILITY MECHANISMS

- Driving mechanism
 - Drive wheels + motors
 - Evaluate traction and size of drive wheels
 - Two-point contact for drive axles
- Steering
- Rear wheels/coasters - these can affect steering
- Software
 - Gyro sensor input necessary for moving straight reliably, and for accurate turns



BODY

- Size (must consider the field and missions).
- Sturdy structure - use frame pieces and L-beams
- Appropriate center of mass (between front and rear axles, but closer to the drive axle for good traction)
- Easy access to brick buttons, all ports, charging port, and battery compartment
- Provision for attachments (minimize attachment change)



SENSORS

- Light/color and gyroscopic sensors are most useful
 - The EV3 ultrasonic sensor is not super accurate, but worth experimenting with for certain applications
- Remember: all four motors can also be used as sensors
- Since motors can detect obstacles, generally the touch sensors can be avoided
- Sensors must be connected firmly - no wobble (to ensure consistency)



ATTACHMENTS/ACTUATORS

- Attachments are what you add to your robot
- Actuators are the tool you use to complete the task
 - Actuators can be **active** (have power source) or **passive** (no power)
 - Actuators can be **simple** (perform one task) or **compound** (perform more than one task)
- Strive to minimize attachment changes during robot game – try to make the actuators as general purpose as possible for a given season
- There could be many great ways for solving each mission. Think of ways of sharing motions, and therefore, actuators between missions.

SIMPLICITY AND MINIMALISM IN DESIGN

- Simplicity and minimalism are well-respected design principles.
- Build the simplest robot/attachments with as few parts as possible that you think will do the job.
- If things don't work (and they often won't), then try solving the problem with smarter programs first.
- Add more parts only as a last resort.

	Beginning	Developing	Accomplished	Exemplary
Durability		Evidence of structural integrity; ability to withstand rigors of competition		
N D	quite fragile; breaks a lot	frequent or significant faults/repairs	rare faults/repairs	sound construction; no repairs
Mechanical Efficiency		Economic use of parts and time; easy to repair and modify		
N D	excessive parts or time to repair/modify	inefficient parts or time to repair/modify	appropriate use of parts and time to repair/modify	streamlined use of parts and time to repair/modify
Mechanization		Ability of robot mechanisms to move or act with appropriate speed, strength and accuracy for intended tasks (propulsion and execution)		
N D	imbalance of speed, strength and accuracy on most tasks	imbalance of speed, strength and accuracy on some tasks	appropriate balance of speed, strength and accuracy on most tasks	appropriate balance of speed, strength and accuracy on every task

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CREDITS

- This tutorial was created by Hotshot Hotwires
 - Facebook Page: <https://www.facebook.com/hotshothotwires/>
 - YouTube Channel: <https://www.youtube.com/channel/UCC2U3CBy-QDIDr09WZRx2Ug>
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