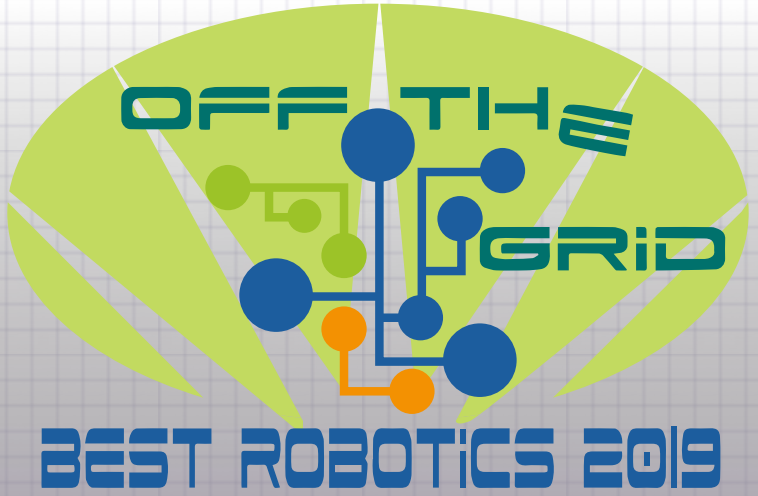
Lipscomb University

The Raymond B. Jones School of Engineering

NISSAN

Game Introduction



TVA

September 21, 2019

Tennessee Valley Robotics
tnvrobotics.org

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Game Introduction
Power Grid

NISSAN

- Electricity is transported via over 200,000 miles of high (345 KV) voltage distribution network and over 5.5 million miles of local distribution lines (138 KV)
- Distribution lines are 3-phases with each line attached to insulators on each side of a transmission line tower
- Supplies (generations) and loads (usage) is carefully managed to balance the grid

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Game Introduction

Power Grid

- Disruptions are inevitable, i.e. hurricane Maria in Puerto Rico in 2017
- Lineman - most dangerous job in the world
- New generation of linemen
  - working with robots
  - act as pilots/drivers
  - interact with the robot by loading payloads and equipment to be installed on the grid

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Game Introduction

- BEST Robotics is looking for an all-purpose system to repair the electric grid in case of catastrophe
- Design a robotic system to
  - repair aerial high voltage lines, residential lines and underground buried cables
  - transport & replace line insulators/transformers
  - to clear/remove ground debris, i.e. trees/limbs
  - autonomously navigate to deliver equipment to the towers in dangerous areas with very high ambient field levels

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Game Objective

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Design/build robot to:

- Clear debris from roadways and dispose of the debris safely
- Re-attach power lines to transmission line towers and residential poles
- Install residential transformer(s)
- Install substation transformer(s)
- Install electrical conduit in underground trenches
- Transport transmission line insulators to linemen in the field

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Game Field

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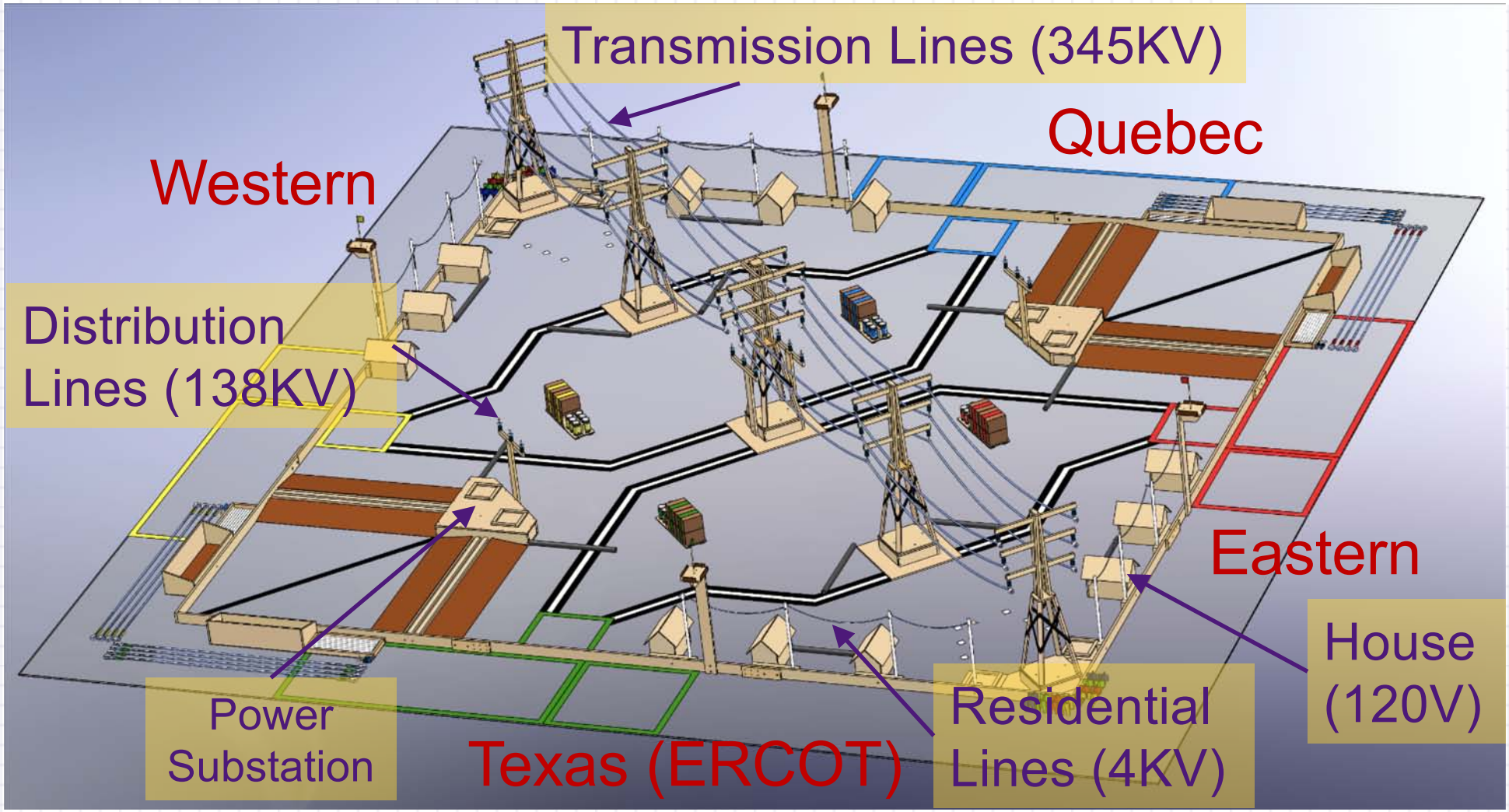

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Field Layout

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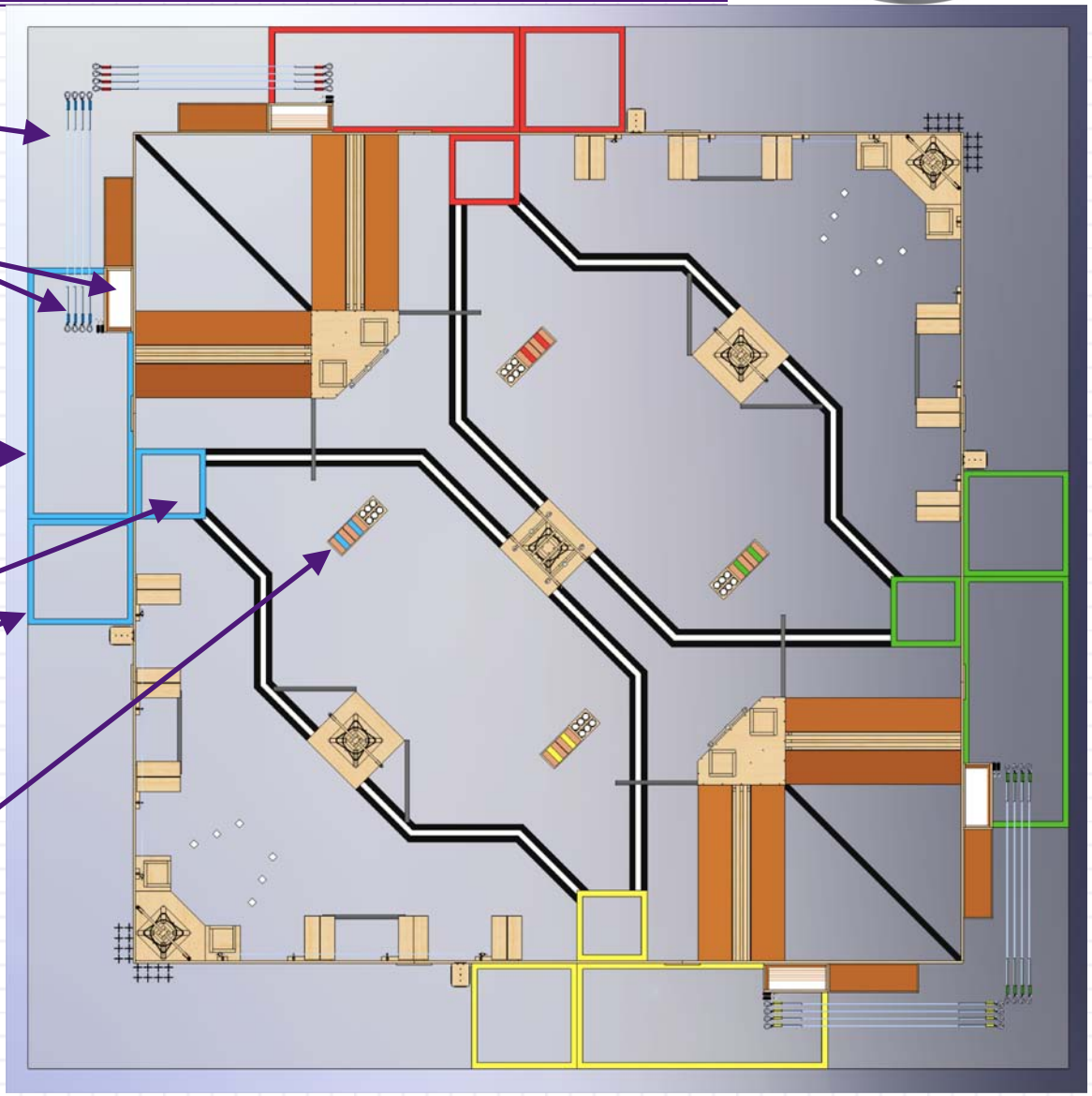
- 138KV Lines
- Insulators & Conduit
- Lineman & Equipment Stores Area
- Robot Starting Box
- Driver Box
- Transformer Skids



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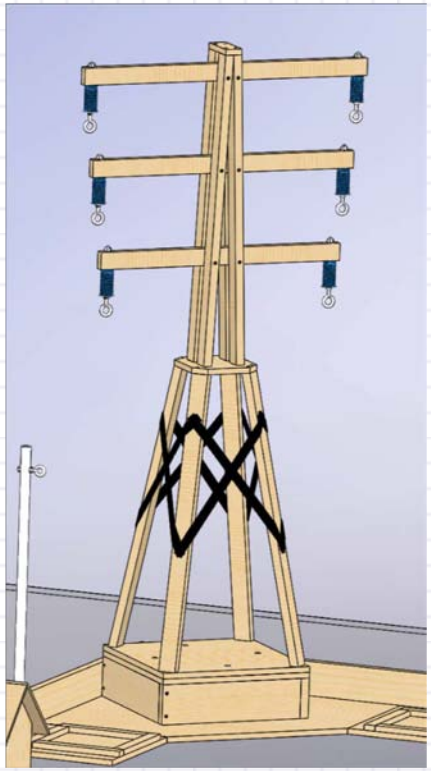
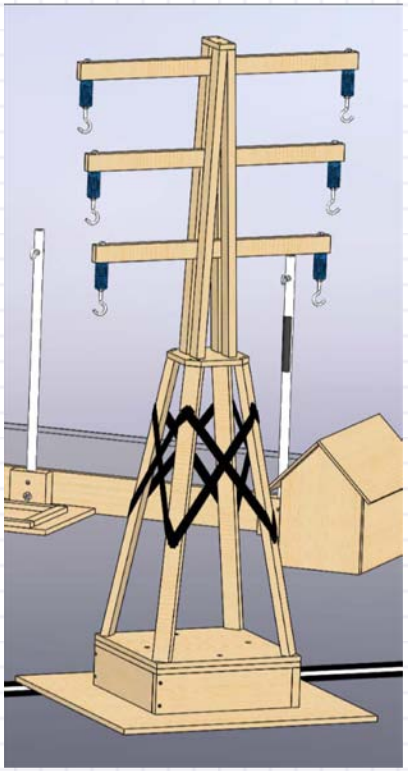
Transmission Line Towers

NISSAN



Corner Tower

- Carry 2 sets of 3-phase 345KV high voltage power lines
- Power lines attach to insulators on each side of a transmission line tower
- Corner:
  - Pre-connected lines
  - Substation transformer receiving pads (base)
- Connections Points
  - 35”, 43”, 51”



Mid Field Tower

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Transmission Line Transfer Tower

NISSAN

- Center of field
- 345KV power lines
  - 35”, 43”, 51”
- 138KV power lines
  - ~26 ¾”