

Project Scope

- Convert ICE lawn tractor to electric
- Retrofit Kit
- Engineered version with modern battery technology and speed controller

Benefits

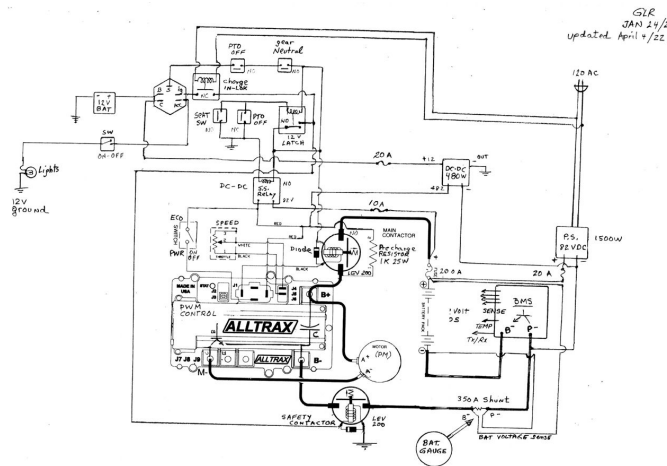
- Provides a second life to previously damaged/non-functional lawn tractors
- Less maintenance, emissions and noise
- Better build quality compared to current retail option

Project Procedure

- Remove ICE Components
- Retain Variator Drive System
- Restore Tractor Components and Chassis
- DC Motor
- Lithium Ion Batteries
- Supporting Components
 - Motor Controller
 - Battery Management System (BMS)
 - Charger/Power Supply
- Auxiliary Components
 - Shrouds
 - Mounts
- 12v Accessories
 - Lights
 - Safety Switches
 - Ignition Switch

2

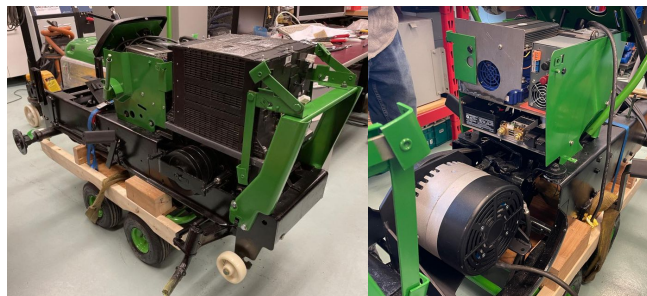
Electrical Schematic



- Circuit diagram of the tractor. This diagram captures all components used and how they interact and communicate
- Drive safety and auxiliary systems

Final Prototype

- Exterior has not changed. All the newly designed and fabricated components can be bolted onto any similar John Deere tractor
- The electronics trays neatly rest behind the steering column
- The batteries and motor reside in the space that previously held the ICE and its supporting components



6



Design & Development of an Electric Garden Tractor

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1

Major Components

Motor Specifications

- Double Brushed DC Motor: Motenergy ME-1004
- Cheaper alternative to brushless DC Motor
- Identical shaft dimensions compared to original ICE engine
- Average operating current 40 - 60 Amps approx. 2 kWh

Specifications	ME-1004 PMDC Motor
Power	8 Kw (11 Hp) Cont. - 16 Kw (22 Hp) Peak
Rated System Voltage	48 V
Speed	3,360 rpm @ 48V unloaded
Overall Size	8" OD, 6.4" Long (w/o Shaft)
Shaft	1"x2.5", 3/16" Key
Overall Weight	32 lbs

Battery Specifications

- LG Chem Lithium Ion Battery (x2)
- Battery obtained from 2016 Hyundai Ioniq
- Battery wired in series during operation (Nominal voltage: 72 V)
- Battery wired in parallel during charging (Nominal voltage: 36 V)
- Alltrax Motor Controller filter down to 48V during operation to the DC Motor
- Estimated run time of 114 mins or just under two hours

Number of cells	10
Nominal capacity(Ah)	78
Nominal voltage	37
Length (mm)	300
Width (mm)	150
Height (mm)	400
Weight (kg)	17.5

Motor Controller

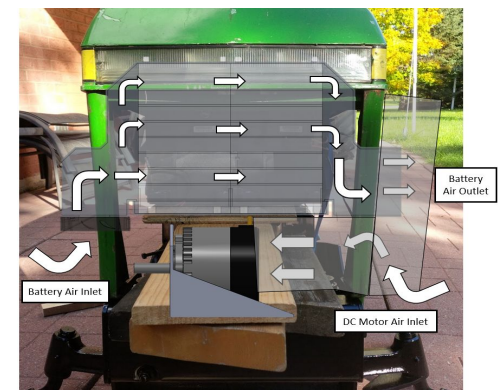
- Adjust the voltage at different battery loads to provide a consistent power output to the DC Motor
- Controller will filter the operating current and increase its efficiency while allowing the option to increase its current as power demands increase
- Alltrax SR72500
- Allows for programmable power ranges



Design

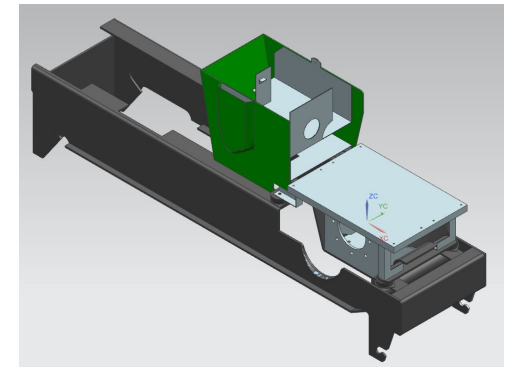
Concept Generation

- Vertically Vs Horizontal Mounted Batteries Concept
- Vertical setup selected as it would yield better packaging and cooling results



CAD and FEA

- CAD representation of fabricated components (silver components) housed in the chassis
- 3 Major components: a motor mount, 2 electronics trays, and a battery tray with mounts.



- Simulate worst case scenario of electric motor at full torque
- 25 Nm Torsional Load
- Fixed Constraints at 4 Bolt Locations
- *Max Deflection: 7.38X10⁻⁴ in*

