SDSU College of Engineering

Robotic Palm Elevator Design

ME & ECE Project

MAX Engineering

Project Overview

This project aims to reduce fatal accidents during palm tree trimming, one of the most dangerous jobs in landscaping. The Robotic Palm Elevator is a remote-controlled system designed to reduce fatalities and climb palm trees safely and efficiently. Using three motorized traction wheels and a winch-based tension system, it adjusts to tree trunks between 9 and 16 inches in diameter. Built with a sturdy frame and powered by Arduino-based firmware, it features load sensing and automatic adjustments for smooth, stable movement. The project combines mechanical, electrical, and software engineering, and was successfully demonstrated as a working prototype for palm tree maintenance.

Meet the Sponsor

Max Marek Winiarz is a retired engineer and founder of Max Engineering, an entity dedicated to pursuing innovative engineering projects driven by passion and purpose. One of his key initiatives is the development of a robotic palm trimmer *with the vision of saving lives by enhancing the safety and efficiency of palm tree maintenance*, also helping towards the prevention of wildfires.

Meet the Team

ME Lead:
Renz Tan

ECE Lead:
Ryan Maiden

Controls Lead:
Lukas Velasco

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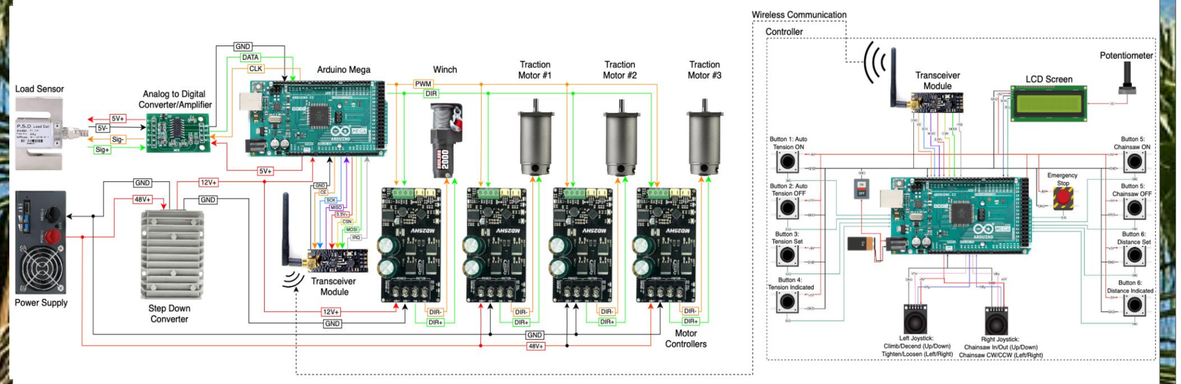
Sebastian Gonzalez
(ME)

Dante Monsalve
(ME)

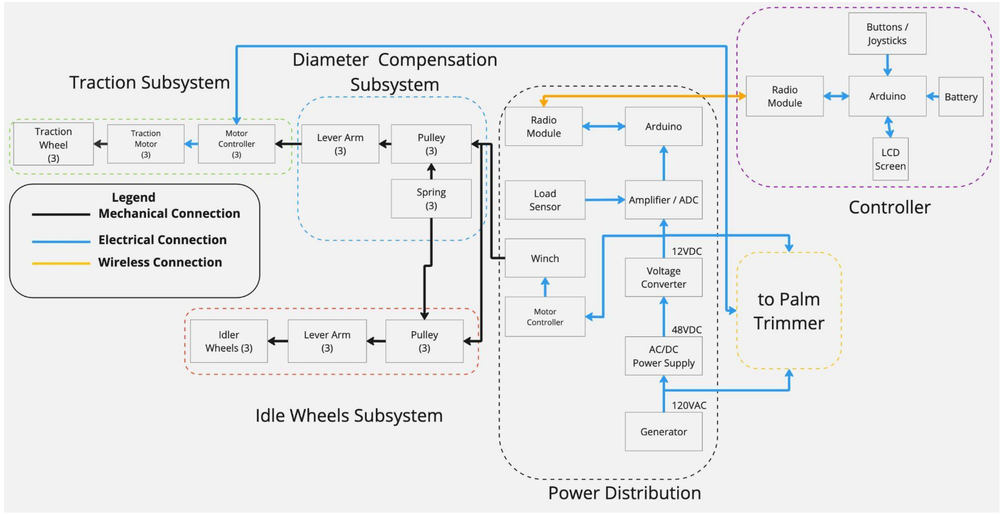
Duy Huynh
(EE)

Raheed Isaak
(EE)

Block Diagram

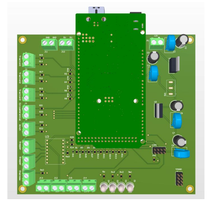


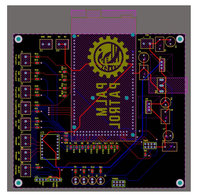
System Level Diagram

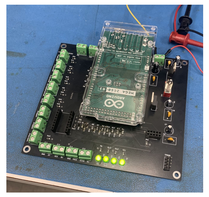


PCB Models

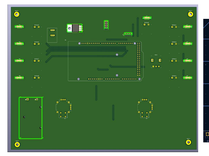
Electrical Box:

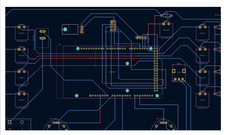


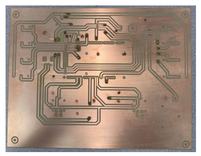




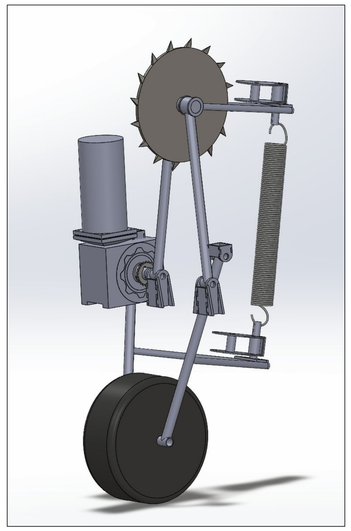
Wireless Controller:



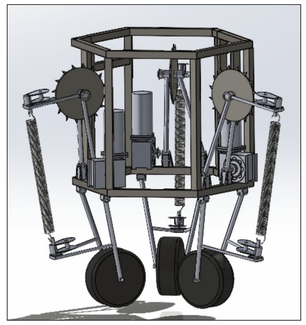




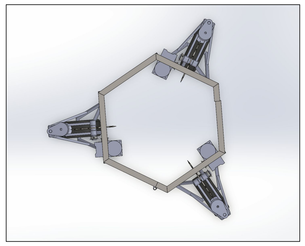
Assembly



Swing Arm & Idler Arm



Palm Elevator



Top View of Elevator

Key Components

Traction Motor:
Provides the driving force to move the robotic elevator system, ensuring smooth and efficient motion. Its high torque output ensures reliable performance even under heavy load conditions.

Traction and Idler Arms:
Facilitate the movement of the system, with the traction arms driving the motion and the idler arms stabilizing the system. Together, they ensure precision in movement while minimizing pitch and yaw as it climbs.

Control System:
An Arduino-based controller uses sensor feedback to maintain traction, adjust tension, and manage motor speeds. A wireless remote allows real-time control of climbing and cutting operations with built-in emergency stop functionality.

Arduino Mega2560:
The central microcontroller that manages the system's operations, processing inputs and controlling outputs to ensure smooth functionality. It offers ample I/O pins and processing power to handle complex tasks required by the robotic elevator.

RF Transceiver:
Enables wireless communication for remote control and monitoring, providing real-time data transmission to and from the machine. This allows for continuous connectivity with external systems and enhances operational flexibility.

Acknowledgments

We would like to extend our gratitude to the following staff for their support in the creation of our project:

Dr. Scott Shaffar, Dr. Barry Dorr, Mr. Max Marek Winiarz, Mr. Michael Lester, Mr. Mark Bruno, Mrs. Louisa Burrus, Ms. Selena Jarin

Spring 2025