

F.E.T.C.H.

Foliage Extracting Tele-Controlled Helicopter



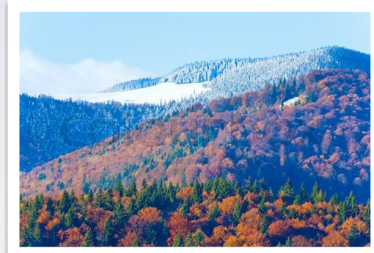
Problem

Find a better method to sample sun
foliage from the tops of trees.

Needs to be cheaper, easier, and safer than a
canopy crane, a tree climber, or a shotgun.

Specifications



- 2 hours of training
- Trees up to 50 meters in height
- 1 or 2 people to operate
- Branches <20 cm in length
- Branches <2.5 cm thick
- Operate in wind less than 10 mph
- Ability to sample in low light



Deliverables

- Quad copter
- Batteries
- Battery Charger
- Transmitter
- Documentation
- Training
- Ground station

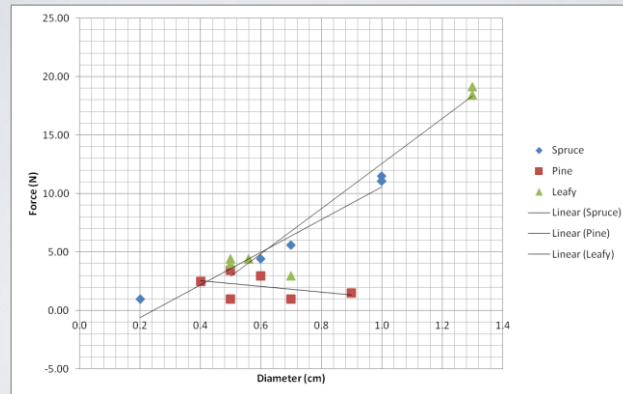
Learning

- Cross Discipline: Electrical Engineer \neq Mechanical Engineer
- Budget Management: \$
- Scheduling and Time Management: 
- Design Process: 

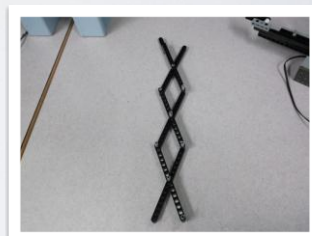
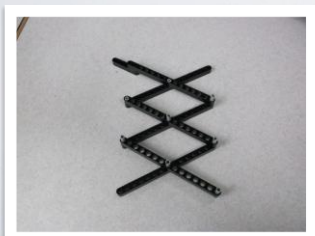
Force Measurement



Force Measurement



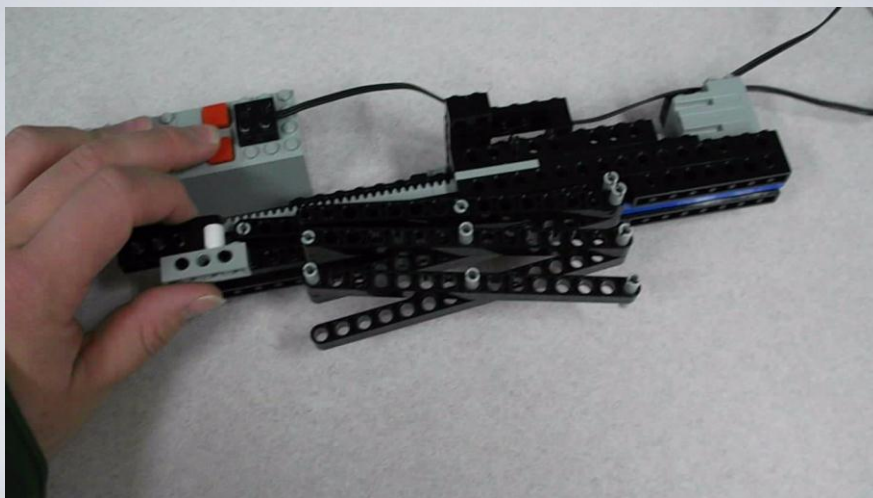
Extendable Arm



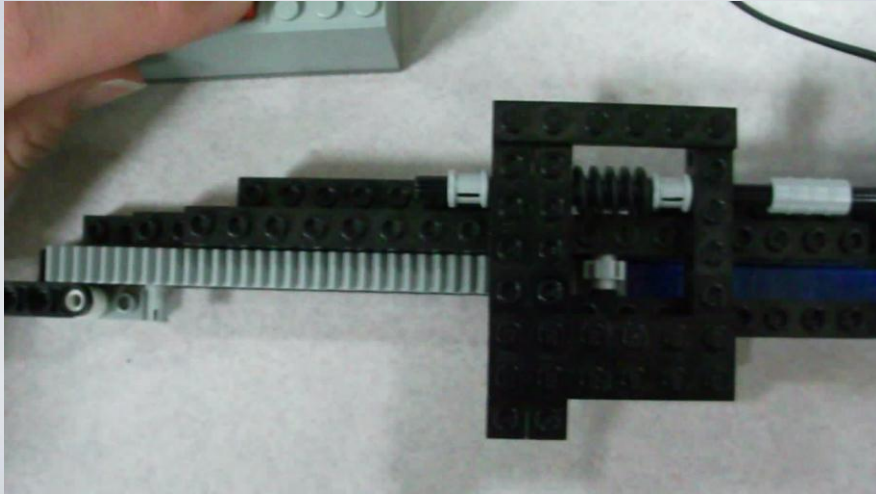
Extendable Arm



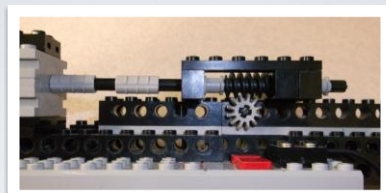
Extension Mechanism



Extension Mechanism

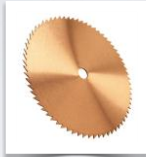


Extension Mechanism



Cutting Mechanism

Saw



Loppers



Powering the Loppers



Vehicle Design

Requirements

- Agile/maneuverable
- Steady/balanced
- Small
- Carry payload

Vehicle Design

Designs Considered

- Helicopter
- Multi-rotors
 - Quad
 - Hex
 - Octo



Vehicle Design

Final Design

- Carbon-fiber frame
- 25A ESC
- Removable arms
- 2200mAh Lipo battery
- Aluminum motor mounts
- Ardu-Pilot Mega
- 620Kv motors
- Barometer
- 10x4.7 / 12x4.7 slow flyer propellers
- GPS

Vehicle Design

Weight

Part	Weight (grams)
Battery	197
Motors	316
ESCs	88
Flight Control Board	25
Frame	280
Receiver	18
Video	36
Extra	150

Total:
1.27kg / 2.8lbs

Vehicle Design

Thrust/Flight Time

Propellor Size	10x4.7	12x4.7
Grams/Watt	11.39g/W	8.8g/W
Static Thrust per Motor	690g	830g
Total Static Thrust	2.76kg	3.32kg
Estimated Flight Time	19.5min	11.8min

Calculated using http://adamone.rchomepage.com/calc_motor.htm

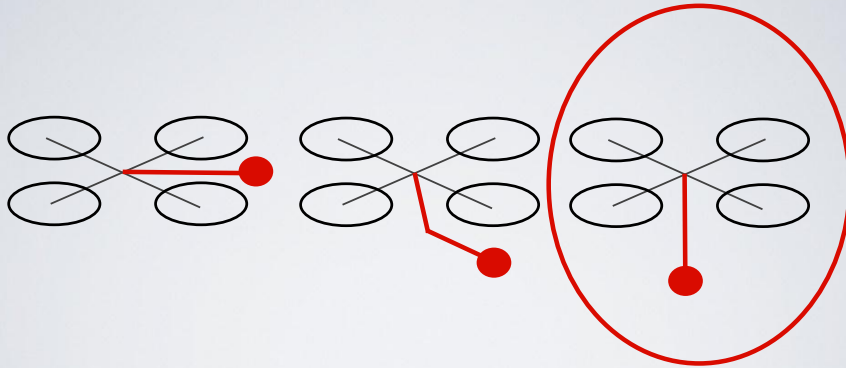
User Interface

- 8 Channel Radio, 3000m range
- 2 CCD Cameras (510x492), wide-angle lenses
- Laptop
- LEDs



Vehicle Design

Payload Mounting



Schedule

- **April**
 - **23rd** Cutter Designed, Arm Extension coded
- **September**
 - **5th** Quad and Arm Built
 - **12th** Testing
 - **26th** Integrating Arm, Testing
- **October**
 - **10th** Integrating Entire
 - **24th** Test Flight with Arm
- **November**
 - **7th** Validate Final Design
 - **14th** Finalize Design Documentation

Budget

QuadCopter				Arm/Cuttlg			
Item	Budget Price	Actual Price	Projected	Item	Budget Price	Actual Price	Projected
Propellers	\$ 11.72	\$ 13.76		Tubing	\$ 48.30	\$ 48.30	
	\$ 17.56	\$ 20.62		Nuts & Buts	\$ 10.00		\$ 10.00
Radio	\$ 54.00	\$ 64.75		Stepper Motor	\$ 200.00		\$ 30.00
Brushless Motors	\$ 126.92	\$ 126.92		Cuttr	\$ 34.00	\$ 34.00	
ESC	\$ 47.96	\$ 49.92		Power Cuttr	\$ 100.00		\$ 150.00
Flight Control Board	\$ 229.99	\$ 179.99		Wireless Video	\$ 57.92	\$ 55.02	
Frame	\$ 50.07	\$ 56.39		Video Lense	\$ 9.76	\$ 9.15	
Lipo Batt y	\$ 38.37	\$ 47.98		LEDS	\$ 20.00	\$ -	
Lipo Charger	\$ -	\$ 32.99		MISC Expenses	\$ 50.00		\$ 50.00
Bullet Connectors	\$ 6.36	\$ 4.38		Shipping	\$ 60.00	\$ 24.74	\$ 35.26
Servo Leads	\$ 19.00	\$ 12.75		Arm Total	\$ 589.98	\$ 171.21	\$ 446.47
Traxxas Connectors	\$ 14.34	\$ 14.34		Project Total	\$ 1,319.35	\$ 898.75	\$ 1,185.53
Low Voltage Alarm	\$ 11.52	\$ -	\$ 11.52				
Servo Wire	\$ 1.56	\$ 1.56					
Shipping	\$ 100.00	\$ 101.19					
Quad Total	\$ 729.37	\$ 727.54	\$ 739.06				

Problems and Solutions

- Weight/Balance
- Wind
- Trees
- Safety
- Mechanical Engineering
- Motor stops on arm
- Signal loss