The University of Texas at Austin
Cockrell School of Engineering

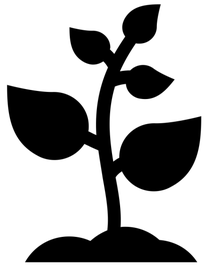
DATA INTEGRATED UAV FOR WILDFIRE MANAGEMENT

The University of Texas at Austin
Assisted by Faculty: Prof. Claudel

BlueSkies 24' Finalist Team, The University of Texas at Austin

Wildfires are expected to increase due to the worsening of climate change

What does this mean for US?

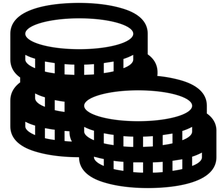


Reduction In Renewed growth

- **Long-term consequences** affecting the ecosystem
- **No regrowth** has doubled since 2000

Increased number of people impacted

- **228,000 displaced** from fires alone
- **339,000 people passed** away due to fired



Increase in cost towards damages

- 7.58 million acres of land burned
- Billions spent in damage cost and only expected to increase

Main Challenges Combating Wildfires

- Low access to aerial solutions

- Communicating up-to-date information to firefighters on ground

- Low staff numbers

TEXAS ENGINEERING

Use-Case

- **Identified Areas to Improve**
  -  Time response efficiency
  -  Intel gathering
  -  Capability of low staffed departments

TEXAS ENGINEERING

Overview

- **Our Solution**
  -  Provides information about location, speed, and movement of fire
  -  Aerial imaging from camera + data from sensors
  -  Use of AI tools
  -  Out-of-season use of drone

Low Smoke
Wildfires

Solution - Data Integrated UAV for Wildfire Management

Autonomous Drones

- Long flight times [gliding]
- Rapid deployment
  - High & low visibility

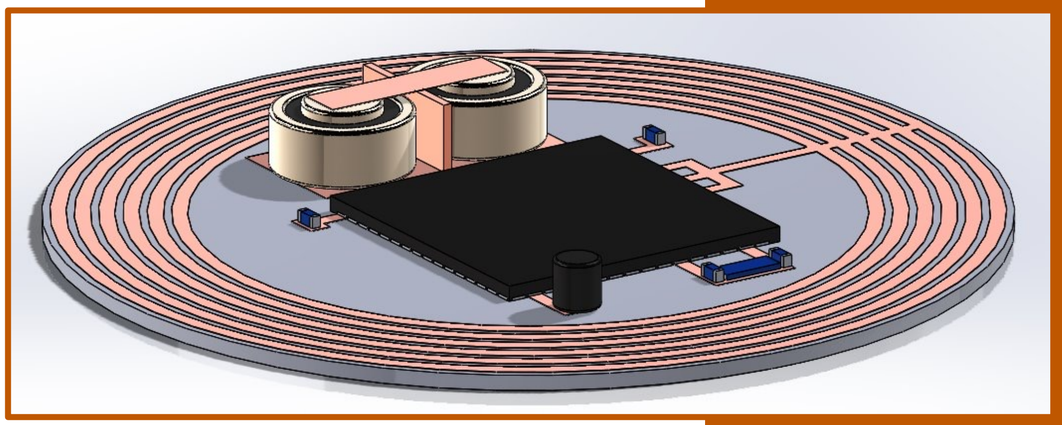
Additional Uses

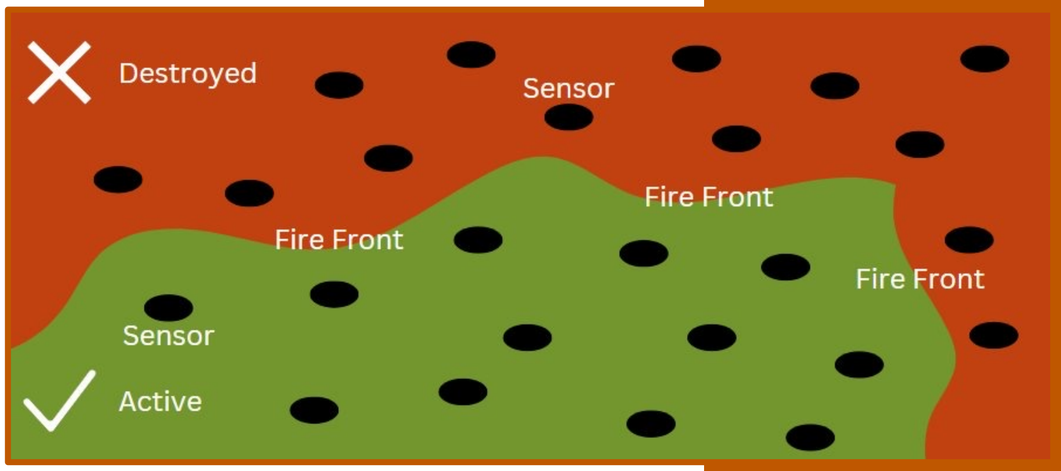
- Develop topography maps
- Search and rescue

High Smoke
Wildfires

Solution for High Smoke - Disposable Sensor Model

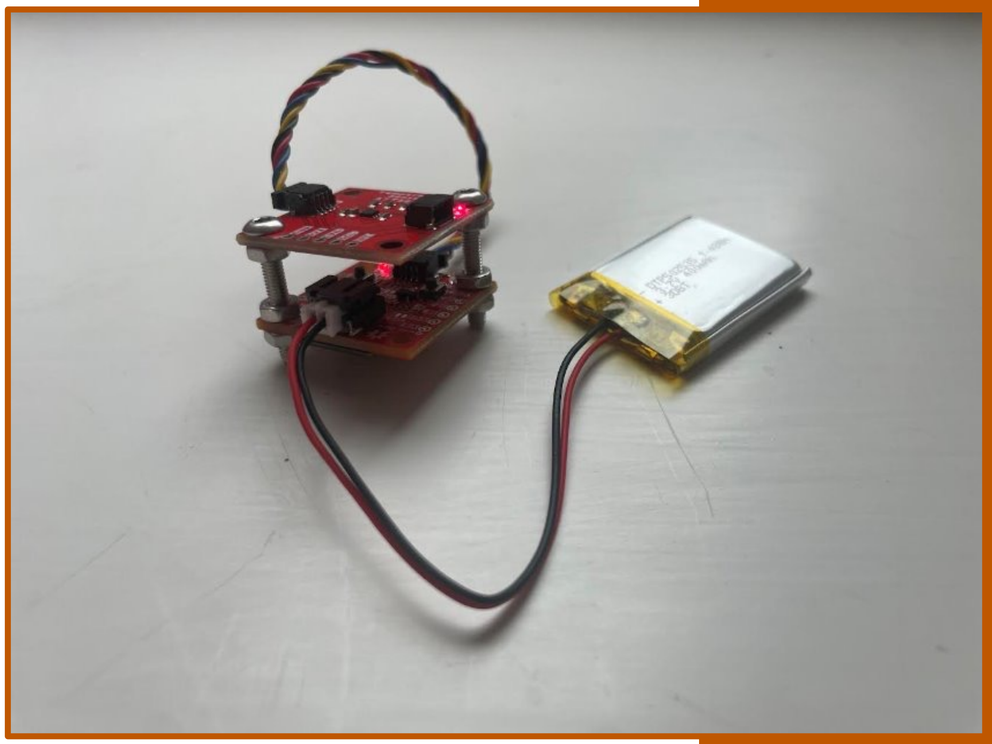
- High Smoke Solution
  - Air droppable from drone
  - Gather temperature
  - Transmit via Bluetooth
  - Map out fire front through smoke





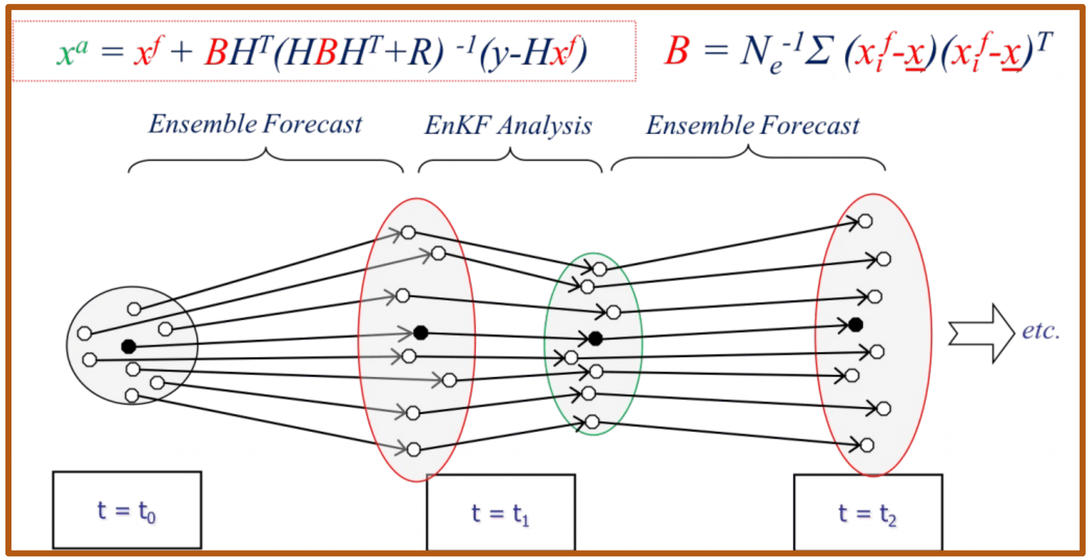
Solution for High Smoke - Disposable Sensor Prototype

- Cheap materials
- Negligible environmental impact
- Concept proven in prototype using readily available materials.



Solution - Data Simulation

- Data Analysis
  - Ensemble Kalman Filter (EnKF)
    - Recursive model
    - Predictive mapping of the fire front
      - Escape routes
      - Better decision making



Solution - Data Simulation

Processing Data

- Reliable databases
  - Microsoft, Google, NVIDIA
- Secure access control
- Encrypted

Cost Breakdown per Fire Department

~$15,000

~$10k-$14k

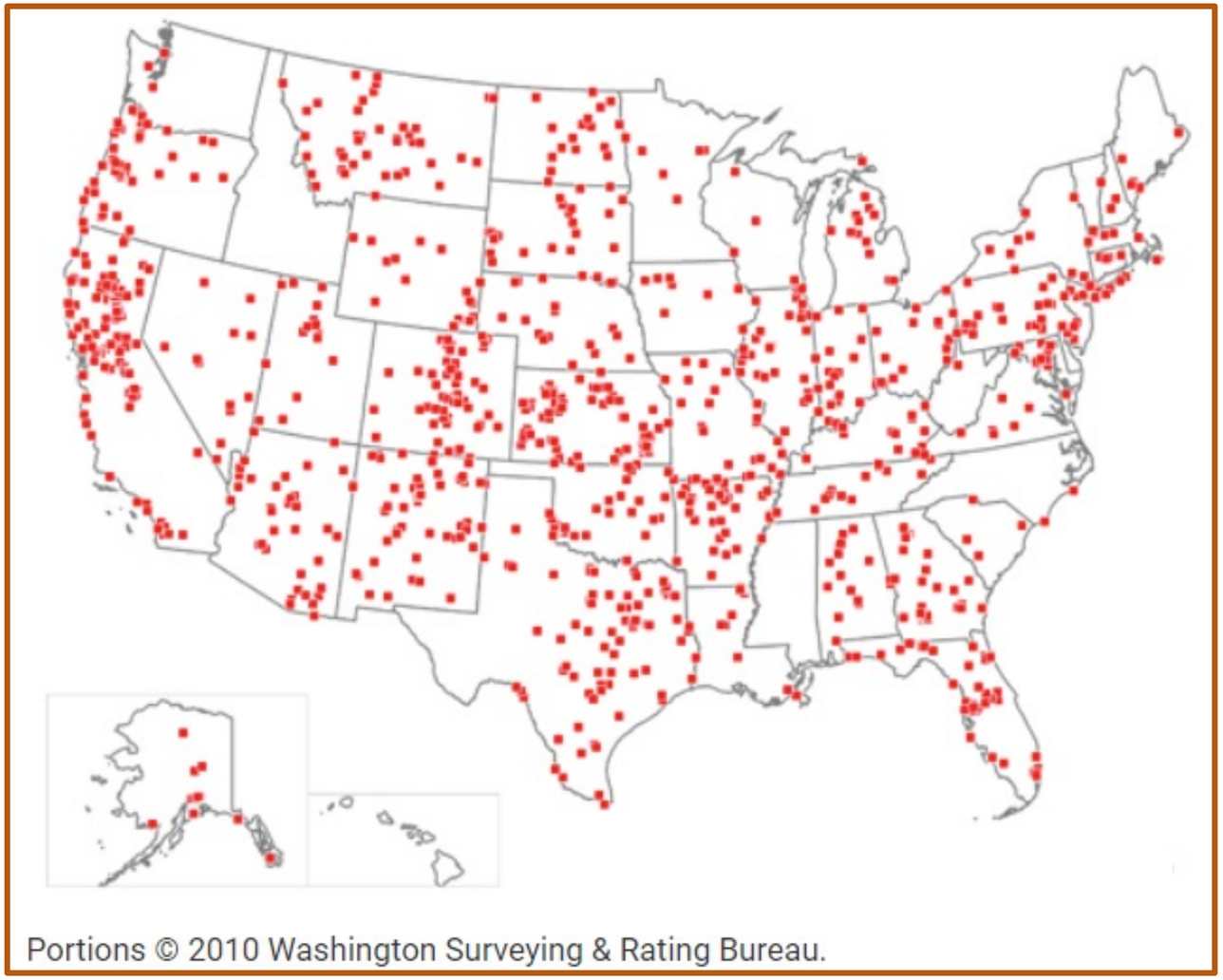
Drone, batteries, equipment installation & maintenance

~$300-$1k

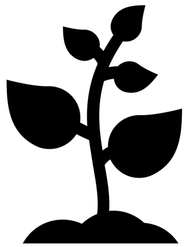
Database infrastructure
Equipment & support

Cost Breakdown

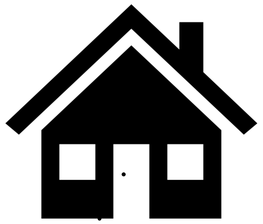
- $300,000/year to maintain data analysis systems
- Spread across thousands of fire departments in the country reduces cost to $100s per department



Primary Return on Investment - (ROI)



Reduction in crops and land damages



Reduction in property damages

- Will save **millions to billions of dollars** in damages
- Even a 1-3% improvement could **drastically** outweigh the cost of the UAV's
- **increases** firefighting efficiency and safety

ROI for Fire Departments

UAV's need to have a multipurpose function for the fire departments to deem it as reasonable

- ROI is typically untraditional for **non-profiting** organizations

Additional ROI

Multipurpose Camera

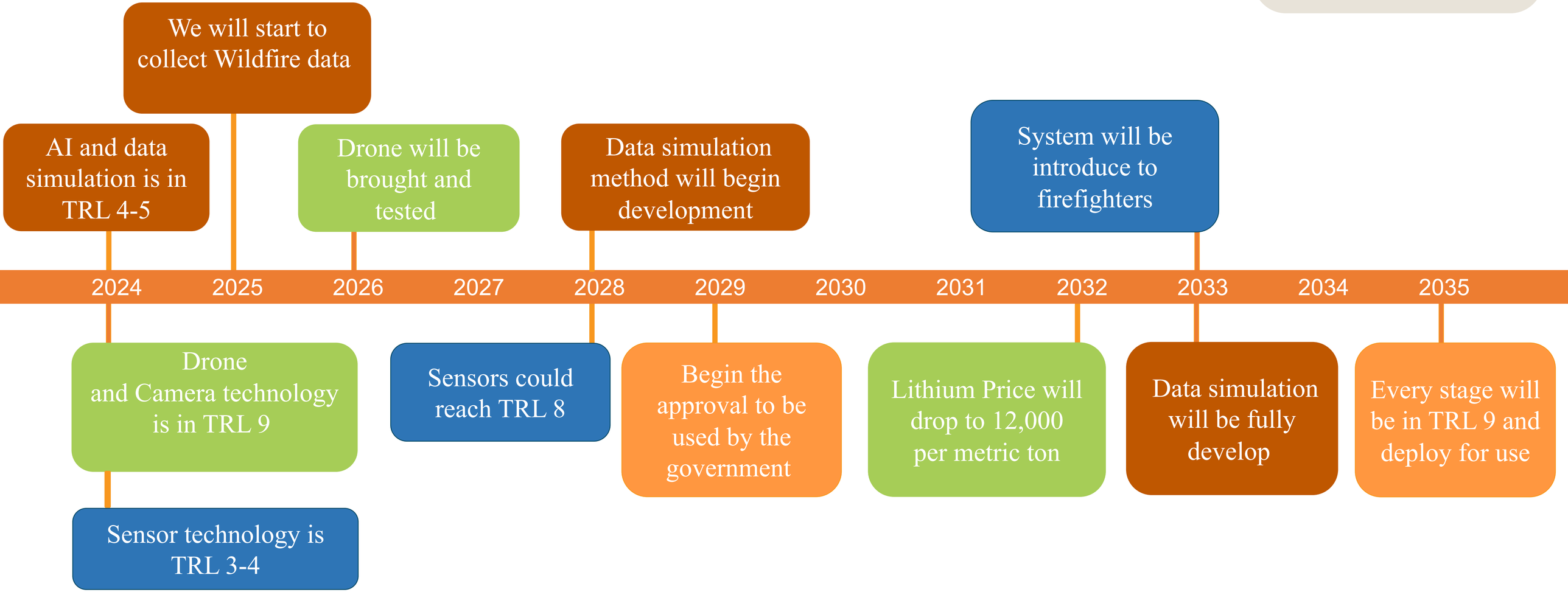
- Beneficial in **rescue operations**
  - Capable of locating missing/injured hikers
  - Ability to scope out **escape routes**

Payload Capability

- Drops off valuable items such as **food, blankets, or care packages during scouting/rescue**

TEXAS ENGINEERING

Timeline of Deployment



TEXAS ENGINEERING

Mateo Renaud
Mechanical Engineering 25'
(Lead)

Mariana Ponce Ramirez
Civil Engineering 25'

Lizbeth Martinez
Chemical Engineering 25'

ENRIQUE LOREDO
Chemical Engineering 25'

Michael Espinoza
Civil Engineering 25'

Zhixin Huang
Mechanical Engineering 25'

Q&A

The University of Texas at Austin
Cockrell School of Engineering

Innovation starts here