TEXAS A&M UNIVERSITY

NRI: **CASS:** **Configurable**, **Adaptive**, and **Scalable Swarm** of ground and aerial robots for collaborative smart agriculture

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NIFA


Large farms with large machinery for minimizing cost and labor
Long-term economic and environmental concerns
Needs for innovative approaches employing low-cost, small robots

towards a **deployable** and **easy-to-use** **swarm** system serving as a **universal platform** for **broad agriculture applications**

Cloud Computing & Data Storage

for extended computing and management & storage of big data collected from CASS

UI Devices

to be directly used by human operators

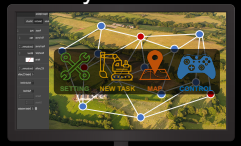
Task description; objectives for simulations

Visualization; simulation results

Dual **Digital-Twin** Simulator

Low-fidelity Swarm Simulator

for swarm-level simulations and real-time telemetry visualization



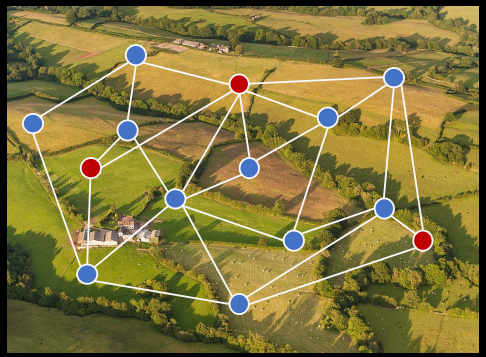
Executable Task plan

User inputs and commands

Visualization of CASS or its digital twin

CASS Platform

with UGVs + UAVs for task performance



Control inputs

Sensor & status data

ROS 2 Middleware

Node 1 | Node 2 | … | Node n

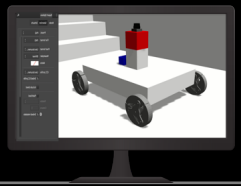
ROS nodes with executable algorithms and packages

Control inputs

Simulated output data

High-fidelity Robot Simulator

for locomotion & task-level control




UGV field testing


Low-fidelity swarm simulator


Locomotion Simulator


Spraying drone

multidisciplinary
RESEARCH

Kiju Lee

Overall project lead and management

- Swarm robotics
- Human-robot interaction
- Mobile robotics
- Decision-making and task allocation in robotic swarms

Juan Landivar

Project co-lead; AgriLife/ TAMU-CC management

- Precision agriculture
- Digital twin farms
- Agriculture data collection and management

Muthu Bagavathi-annan

Project co-lead

- Weed science and agronomy
- Weed ecology and management
- Robot-assisted weed monitoring and treatment

Mahendra Bhandari

Topic area lead – Digital twin

- Precision agriculture
- UAS enabled data collection and management
- Digital twin of agriculture environments

John Cason

Topic area lead – Peanut

- Soil and crop science
- Peanut breeding and genetics
- Field research protocols and methodology

Robert Hardin

Topic area lead - Cotton

- Cotton engineering
- Precision agriculture
- Automation and control in agriculture applications

Louis Tedeschi

Topic area lead – Livestock animals

- Animal science
- Beef cattle
- Cattle management
- Animal behavior, health, and diet

Dugan Um

Topic area lead – wireless networking

- Embedded sensor network systems
- Field robotics
- Wireless networking for agriculture applications

TEES

TEXAS A&M AGRILIFE RESEARCH

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TEXAS A&M AGRILIFE EXTENSION

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THANK YOU.

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