2022 CARPA Initiative Project Challenge

HeistBOT - The Fox and the Hound

CAMS - E.D.D.
THE CARPA INITIATIVE
DESIGNED TO INSPIRE

HeistBOT - The Fox and the Hound

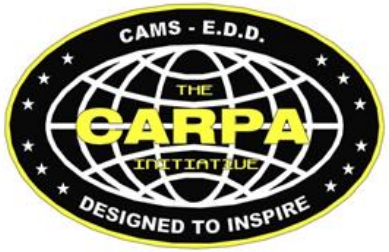
For 2022, The CARPA Initiative is commissioning a project that expands and enhances our current ambulatory technology vein, by introducing a multi-functional, ambulatory, quadrupedal robotic device, capable of walking, running, jumping, reaching and grabbing.

HeistBOT - The Fox and the Hound

Imagine a scenario where a robot is able to negotiate an obstacle course, filled with trenches, berms, and an enclosure, that the robotic device must negotiate successfully.

HeistBOT -The Fox and the Hound

The Set-Up



HeistBOT - The Fox and the Hound

Traditionally, throughout history, foxes have been considered as pest animals because they have: threatened biodiversity by hunting and killing native wildlife, they have contributed to the extinction of several species of small mammals and birds, and they continue to threaten livestock, including poultry, lambs, and goat kids.

HeistBOT - The Fox and the Hound

Foxes are known to be cunning predators. They are often portrayed as being clever, independent, and mischievous. They are nocturnal, and exhibit cat-like behavior, so they are stealth-like. Foxes have been known to kill all of the chickens in a hen house, more than they can possibly eat, due to their predatory nature. Foxes tend to shy away from humans and dogs, and tend to hunt alone.

[Wikipedia]

HeistBOT -The Fox and the Hound

The Mission

HeistBOT - The Fox and the Hound

The CARPA Initiative has been commissioned by the US military, to design, build and demonstrate a suite of semi-autonomous stealth-like robotic devices, hereafter known as a “fox”, and a “hound”, capable of negotiating uneven terrains, running and jumping, in order to complete an obstacle course, within timed parameters.

HeistBOT -The Fox and the Hound

The two teams will be engaged in a mission challenge, where each team builds, and role plays either a Fox, or a Hound during the competition. As the Fox, the device will be used to investigate enemy positions and strongholds, retrieve an artifact of importance from a structure, hereafter known as the “henhouse”, in the mission theater and escape, evading detection from the opposing team.

HeistBOT - The Fox and the Hound

As the Hound, the robot must maintain the security of the encampment, and prevent the fox from completing its mission, or to hunt down the robotic “fox”, terminate it’s function, and retrieve the captured artifact, returning it to it’s original location.

HeistBOT -The Fox and the Hound

Since foxes love chickens, the structure in the mission theater will be known as the “henhouse”, and the artifact to be retrieved will be a raw chicken egg. *Any attempt to purposely damage the egg, to prevent the other team from accomplishing their mission, will result in disqualification.*

The hound may circle the encampment (mission theater), but must start the contest 22’-0” from the henhouse, where the artifact is located.

Both teams must negotiate the obstacle course, in a preliminary round, two days before the mission date, to qualify their device for competition.

HeistBOT -The Fox and the Hound

The robotic system will be comprised of two ambulatory robotic devices, each playing a specific role during the competition. One machine will play the role of the “Fox”, a “heist” robot which must locate, retrieve and escape with an artifact of great value, and other will play the role of the “Hound”, a predatory pursuit robot, designed to secure the mission theater, and to pursue and terminate the function of the Fox HeistBOT, retrieving and returning the stolen artifact to its original location, without damaging it.

HeistBOT -The Fox and the Hound

Both machines must be capable of enhanced ambulatory movement, including running, and jumping, in order to negotiate an obstacle course of varied terrains. Both machines will alternate their role in the competition one time. The winner of the competition will be the device that can accumulate the most points, during the competition.

HeistBOT - The Fox and the Hound

Requirements of the system are hereby defined, but not limited to the following design parameters:

- Each device not to dimensionally exceed 300mm wide, 400mm tall, 600 mm long.
- Each device may not weigh more than 12 Kg.
- The Fox is meant to operate in a covert fashion, and may be camouflaged to robotic vision.
- Each device is required to crouch down to a minimum of 300mm tall, and must be able to walk in that state, to be able to enter a 400mm (w) x 300mm (h) doorway.

HeistBOT -The Fox and the Hound

- Each device must be able to run at a speed of 1m/sec.
- Each device must be able to leap over an obstacle that is 150mm in diameter.
- The device(s) must be water resistant.
- The device(s) must be capable of self-righting, in the event it tips over.
- The device(s) must be able to distinguish specified targets in the mission theater.

HeistBOT - The Fox and the Hound

- Each device must be fitted with end effectors that can pick up, transport, and put down a raw chicken egg, without damaging it (size between medium and jumbo).
- The end effectors must each have a minimum of three phalanges, complete with interphalangeal joints, in order to pick up and cradle the egg.

HeistBOT - The Fox and the Hound

- The end effector must be able to extend the phalanges, so that the end effector can fit through a 100mm diameter hole, to retrieve the egg.
- The artifact of interest will be located inside a “nest”, which itself is inside the henhouse.
- The Fox player must be able to reach inside the box, to retrieve the egg, the Hound player, to return it.

HeistBOT - The Fox and the Hound

- The two devices must be fitted with a magnetic relay switch that will terminate power to the device, should an external magnet come close enough to the switch.
- The magnetic relay needs to be mounted at the rear of the device, accessible to the other device.
- As part of a “shut-down sequence”, the two devices must be able to place the artifact, undamaged, on the ground.

HeistBOT -The Fox and the Hound

- Operating time for each device: 1.5 – 2.5 hr. on one charge.
- Batteries must be easily removed and replaced.
- External interfaces to include, as necessary: a battery charging port, 2x USB, 1x HDMI, 1x Ethernet.

HeistBOT - The Fox and the Hound

Both robotic devices must be able to self-navigate, employ robotic vision, recognize Mission Control, the various items in the mission theater, and the various terrain enhancements, which they must negotiate appropriately.

HeistBOT -The Fox and the Hound

The Hound must be able to prevent the Fox from escaping and use a remote system, to terminate the Fox's functionality. As part of a termination sequence, the fox must lay down the egg, so that the Hound can retrieve it. The Hound must be able to recover the stolen artifact and return the artifact, undamaged, to the henhouse.

HeistBOT -The Fox and the Hound

Vesta Technologies, the winner of the Flash Challenge this year, will choose the order in which the teams will compete, 3 days before the competition.

HeistBOT - The Fox and the Hound

Prohibited technology/weaponry

- Electro Magnetic Pulse (EMP)
- High Voltage Discharge
- Microwave Discharge
- Liquids (oil, water, corrosives)
- Open Combustion (fire, explosives)
- Smokescreens
- Untethered Projectiles
- Smothering/Entrapment
- Signal Jamming
- Lasers above 1mW
- Wheels
- Flight

HeistBOT -The Fox and the Hound

The Fox wins the competition round, if it is able to escape the Hound, and deliver the artifact undamaged to Mission Control before the Hound can terminate it's function, through the use of a magnetic switch and proximity sensor. The Hound wins the contest, if it is able to terminate the Fox device and return the artifact, undamaged, to the cave where it was taken.

HeistBOT - The Fox and the Hound

Should the Hound capture and terminate the functionality of the Fox, the game is over. If the Fox is able to deliver the artifact to Mission Control before the Hound can catch it, the round of competition is over.

HeistBOT -The Fox and the Hound

- The two robots will enter the mission theater, from opposite sides.
- The mission must be completed within a 20 minute time frame.
- You will be awarded percentage points for completed tasks.
- The victor will be declared the contract award winner for this year.

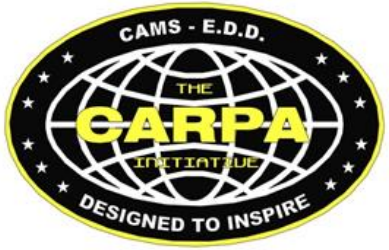
HeistBOT -The Fox and the Hound

Remember to follow our design process. Ask questions! Identify the problems at hand, before deciding on a course of action. This is the most complicated ambulatory robotic system to be developed in the history of this school. You have the opportunity to design and build an extraordinary machine and leave a legacy for your class.

HeistBOT - The Fox and the Hound

I have complete faith in your talents and abilities.
Organize yourselves, and start defining the problems you will face in this challenge.

You have 212 days to complete this mission.



Your time starts now.

HeistBOT -The Fox and the Hound

"Welcome to the Jungle"

CAMS - E.D.D.
THE
CARPA
INITIATIVE
DESIGNED TO INSPIRE