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Curtin University – Department of Computing

Assignment Cover Sheet / Declaration of Originality

Complete this form if/as directed by your unit coordinator, lecturer or the assignment specification.

Last name:	Chitete	Student ID:	20169321
Other name(s):	Tanaka		
Unit name:	Intelligent Agents	Unit ID:	COMP2009
Lecturer / unit coordinator:	Dr Johannes Herrmann	Tutor:	Dr Johannes Herrmann
Date of submission:	14/05/2021	Which assignment?	(Leave blank if the unit has only one assignment.)

I declare that:

- The above information is complete and accurate.
- The work I am submitting is *entirely my own*, except where clearly indicated otherwise and correctly referenced.
- I have taken (and will continue to take) all reasonable steps to ensure my work is *not accessible* to any other students who may gain unfair advantage from it.
- I have *not previously submitted* this work for any other unit, whether at Curtin University or elsewhere, or for prior attempts at this unit, except where clearly indicated otherwise.

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- It is my responsibility to ensure that my submission is complete, correct and not corrupted.

Signature: TANAKA CHITETE Date of signature: 14/05/2021

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Alternative to Boeing Airpower Teaming System

Overview and Purpose of Boeing Airpower Teaming System

Boeing Airpower Teaming System (ATS) is a stealth, multirole, unmanned aerial vehicle designed to act as a force multiplier aircraft capable of flying alongside manned aircraft for support and performing autonomous missions independently using artificial intelligence.

Source

Overview and Purpose of Alternative

The proposed alternative, named Airpower Teaming System (Helico) (ATSH) serves, overall, the same purpose as ATS. However, ATSH seeks to be more effective in lower speed, low altitute environments involving building-to-building surveillance and CQC (close-quarters combat)–environments for which winged-aircrafts are typically not well-suited.

Design of Alternative

PEAS Description

Performance Measure

- Minimises time spent tracking/surveilling adversaries before engaging in combat
- Minimises ammunition usage in taking down adversaries
- Minimises fuel consumption, both in tracking/surveillance and combat-engagement
- Doesn't endanger manned flying vehicles
- Doesn't impede upon other unmanned vehicles
- Doesn't endanger soldiers
- Doesn't endanger civilians

Environment

- Mission location, containing:
  - Living obstacles (soldiers, civilians and animals)
  - Inanimate obstacles (other vehicles, trees, buildings, fences, walls etc)

Actuators

- Roll
- Pitch
- Yaw
- Lift

- Thrust
- Shoot

Sensors

- GPS
- Gyroscope
- Cameras
- Fuel sensors
- Speedometer
- Accelerometer
- Odometer

Environment

Fully Observable, Partially Observable or Unobservable? Virtually all environments ATSH will be operating are going to be partially observable. This is because ATSH cannot at any given time know, for example, the location of every adversary with which it is engaged in combat.

Deterministic or Stochastic? Stochastic, as the agent cannot reliably predict the actions of its adversaries.

Episodic or Sequential? Sequential, as the agent choosing to engage with a particular adversary might hinder its ability to engage with another adversary as it may have sustained potentially terminal damage from previous engagements.

Static or Dynamic Dynamic, as the adversaries of ATSH can relocate while ATSH is deliberating its next action, for example.

Discrete or Continuous? Both, since the discrete/continous distinction applies to: 1. The *state* of the environment 2. The manner in which *time* is handled 3. The *percepts* and *actions* of ATSH

Surveilling and, in turn, engaging with adversaries is a continuous-state and continous-time problem as velocity and location of ATSH and its adversaries sweep through a range of continous states and do so smoothly with the passage of time. On the other hand, input from digital cameras is discrete, but is typically treated as representing continuously varying aspects of the environment that ATSH is currently operating within.

Alternative to Rio Tinto Autonomous Haulage System

Overview and Purpose of Rio Tinto Autonomous Haulage System

Rio Tinto runs more than 130 autonomous trucks, part of their Autonomous Haulage System (AHS), across their Iron Ore operations. The trucks are operated by a supervisory system and a central controller, rather than a driver. The system uses pre-defined GPS courses to automatically navigate haul roads and intersections and knows actual locations, speeds and directions of all vehicles at all times.

Source

Overview and Purpose of Alternative

The proposed alternative, named Autonomous Haulage System (Light) (AHSL) serves, overall, the same purpose as AHS. However, AHSL seeks to provide a less resource-intensive alternative for lighter loads travelling shorter distances–substituting road-trains for tip trucks, with the ultimate goals of reducing the allocation of fixed costs for smaller-scale hauls.

Design of Alternative

The alternative agent discussed is an instance of an autonomous tip-truck (for convenience, an ATT) which operates within AHSL, *not* the entirety of AHSL, itself.

PEAS Description

Performance Measure

- Minimises time spent hauling iron ore
- Minimises distance travelled in hauling iron ore
- Minimises fuel consumption
- Doesn't endanger drivers of manned haulage vehicles
- Doesn't impede upon manned haulage vehicles
- Doesn't impede upon other unmanned vehicles
- Doesn't endanger mine site workers
- Doesn't endanger loading operators
- Doesn't endanger off-loading operators
- Doesn't endanger civilians

Environment

- Path between mine site and destination, containing:

  - Living obstacles (mine site workers, loading operators, off-loading operators and civilians)
  - Inanimate obstacles (other vehicles, trees, buildings, fences, walls etc)

Actuators

- Accelerate
- Brake
- Steer
- Indicate
- Sound horn
- Off-load (i.e. tip bed)

Sensors

- GPS
- Gyroscope (to determine whether load is in danger of spilling)
- Cameras
- Fuel sensors
- Speedometer
- Accelerometer
- Odometer

Environment

Fully Observable, Partially Observable or Unobservable? Virtually all environments the ATT will be operating are going to be partially observable. This is because the ATT cannot at any given time know, for example, the location of every vehicle along the path between its start and destination sites.

Deterministic or Stochastic? Stochastic, as the ATT agent cannot reliably predict the actions of, for example, motorists.

Episodic or Sequential? Sequential, as the ATT choosing to change into and stay in a particular lane (for a prolonged period of time) might result in the increase in overall travel time as the lane it selected may have a higher percentage of slower-moving vehicles than alternative lanes.

Static or Dynamic Dynamic, as, for example, motorists can continue driving while the ATT is deliberating its next action–like when the ATT is at a stop while the motorists are able to continue driving.

Discrete or Continuous? Both, since the discrete/continous distinction applies to: 1. The *state* of the environment 2. The manner in which *time* is handled 3. The *percepts* and *actions* of the ATT

Hauling a load from one site to another is a continuous-state and continous-time problem as velocity and location of the ATT sweeps through a range of continous states and do so smoothly with the passage of time. On the other hand, input from digital cameras is discrete, but is typically treated as representing continuously varying aspects of the environment that the ATT is currently operating within.