

Summary

Swarm robotics is an approach to designing and creating robotic systems that takes inspiration from natural swarms. Swarm robotics aims to build useful and robust robotics systems by using many small simple robots that using swarm intelligence algorithms work together to complete desired tasks.

Pre-work

To start with read over the following robot categories to see where robots are being used today <https://robots.ieee.org/learn/types-of-robots/>.

Then pick a robot and research it, trying and answer the questions below (20 minutes). You can pick your own robot or select from the following.

- Drive Unit (<https://robots.ieee.org/robots/kiva/>)
- Elios (<https://robots.ieee.org/robots/elios/>)

If you're selecting your own robot to research you can use the following list <https://robots.ieee.org/robots/> or search for examples based on the robot categories you read about.

1. Does the robot move around its environment? Do you think this is a challenging environment to move in for a robot?
2. Sensors allow robots to determine what is going on in the world much like our own senses. What sensors are involved in the robotic system and what do they detect?
3. How does the robot know what to do? To what degree does it make its own decisions and how much are humans involved?
4. How well do you think the robot would cope if it was placed in a new environment? How reliable do you think the system is?

Exercise

Watch the part 2 video (linked on webpage) and make a note of five key components that form a swarm robot.

- 1.
- 2.
- 3.
- 4.
- 5.

Homework

Design a swarm to complete a task of your choosing. Think about what each robot in the swarm would require using the building blocks identified in the video. Also think about what behaviours the swarm would need to display for your chosen task.

To document your idea you can draw a labelled illustration of your swarm robot and then another illustration showing how they would work together. This can be done on paper or using a computer.

Example tasks you could choose include cleaning an oil spill or finding survivors after a disaster. You may also be interested in looking at the resources section (see below) to see the kind of behaviours

swarm robots have been shown to achieve and think about what applications they could be useful in.

Resources

Swarm robotic demonstrations

- Self assembly - <https://youtu.be/-Q14d-c65CY>
- Collective assembly - <https://youtu.be/LFwk303p0zY>
- Decision making - <https://youtu.be/F1JKvzGQBJI>
- Collective Transport - <https://youtu.be/dR4YOSkYjWE>
- Trail formation - <https://youtu.be/E5OnpcQs5x8>
- Other behaviors - <https://youtu.be/GnyDAuqorGo>

Swarm Robotics Overview Open Access Paper (Advanced further reading)

<https://www.frontiersin.org/articles/10.3389/frobt.2020.00036/full>

NOTE: This is an academic paper which if you haven't seen one before can be a little intimidating. These papers often contain technical terms you might not understand so don't worry. Try to read slowly and google any terms you're unfamiliar with. This particular paper is also a *survey paper*, which means it is giving an overview of a subject rather than contributing any new information to it.