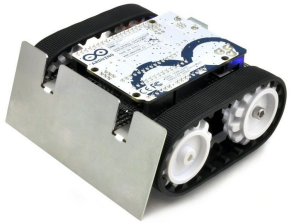
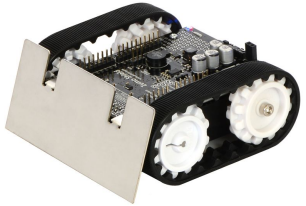
Ant-Swarm BOTS : Ant.S





By Irina DELAMARE - 17/12/2020

Project:

Interest:

- Swarm robotics
- Biomimetism
- Odometry: Exploratory robot
- Passion for ants

ANT BOTS:

➔ Move around randomly and avoid obstacles to search for a food marker

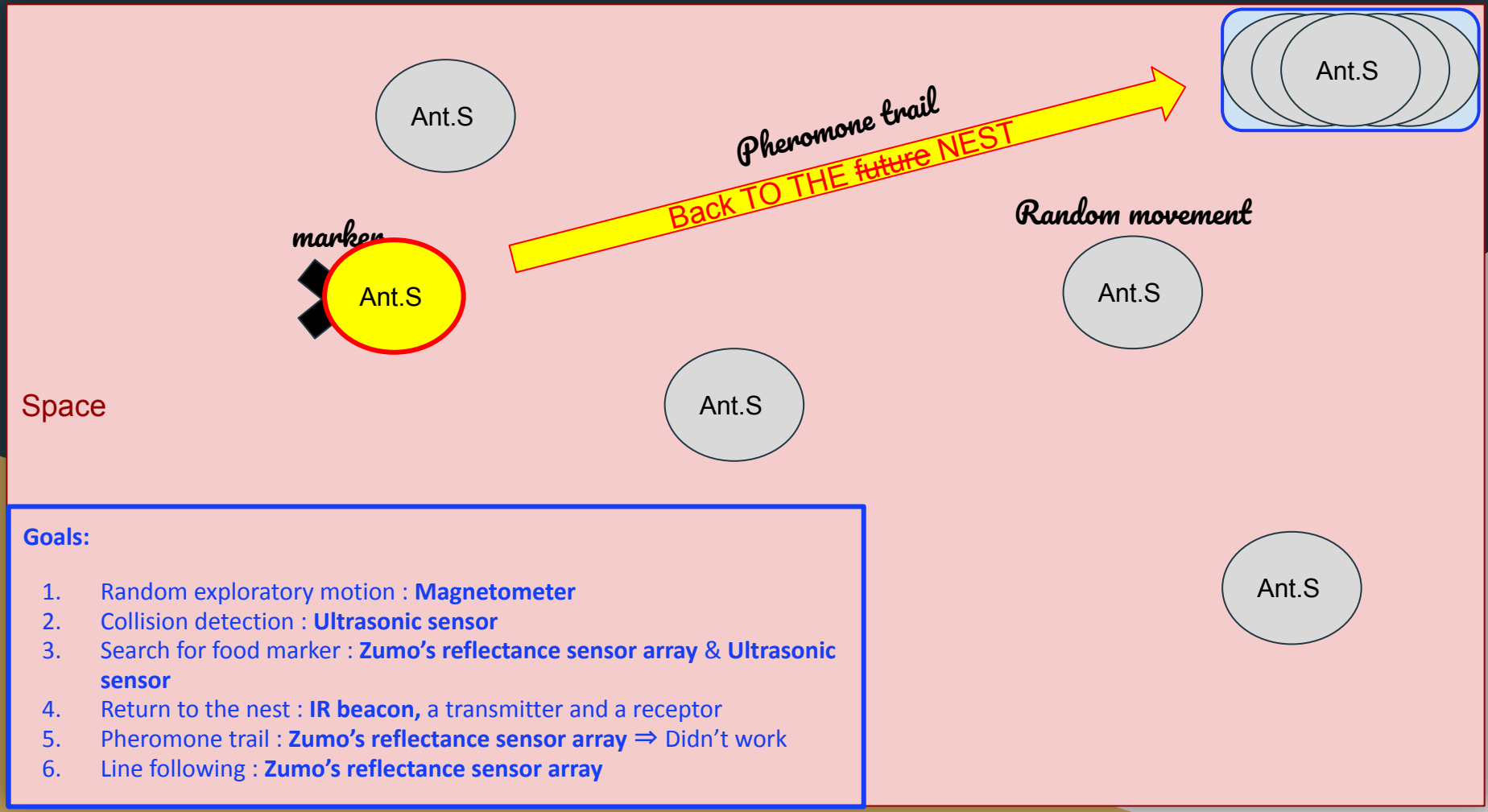
➔ When one Ant.S find the marker, return to the base (ant nest) and leave a trail behind (pheromone) to help other Ant.S find the marker by implementing line following behavior.

Ant facts:

- Old world ants
  - Large ant colonies
  - One or multiple laying queen.s (gynes)
  - Diversity of casts of sterile worker ants:
    - Forager
    - Soldier
    - Nurse
    - Food supply
    - Big-headed…
  - Recrutement behavior & communication with pheromone trail

- New world ants (*Myrmecia*)
  - Small ant colonies
  - Gamergate = fertile worker ants (not the same as gynes)
  - Solitary hunters

- Sight
- Magnetic field



Goals:

1. Random exploratory motion : **Magnetometer**
2. Collision detection : **Ultrasonic sensor**
3. Search for food marker : **Zumo's reflectance sensor array** & **Ultrasonic sensor**
4. Return to the nest : **IR beacon,** a transmitter and a receptor
5. Pheromone trail : **Zumo's reflectance sensor array** ⇒ Didn't work
6. Line following : **Zumo's reflectance sensor array**

Bibliography

- Pololulu Zumo Shield for Arduino User's Guide ⇒ Zumo related libraries & sensors
- It Can See; Giving Your Bot Sight! ⇒ Ultrasonic Sensor
- Compass Calibration and Sampling ⇒ Magnetometer
- Turn with compass ⇒ Magnetometer
- IR receiver
- IR transmitter

Goals:

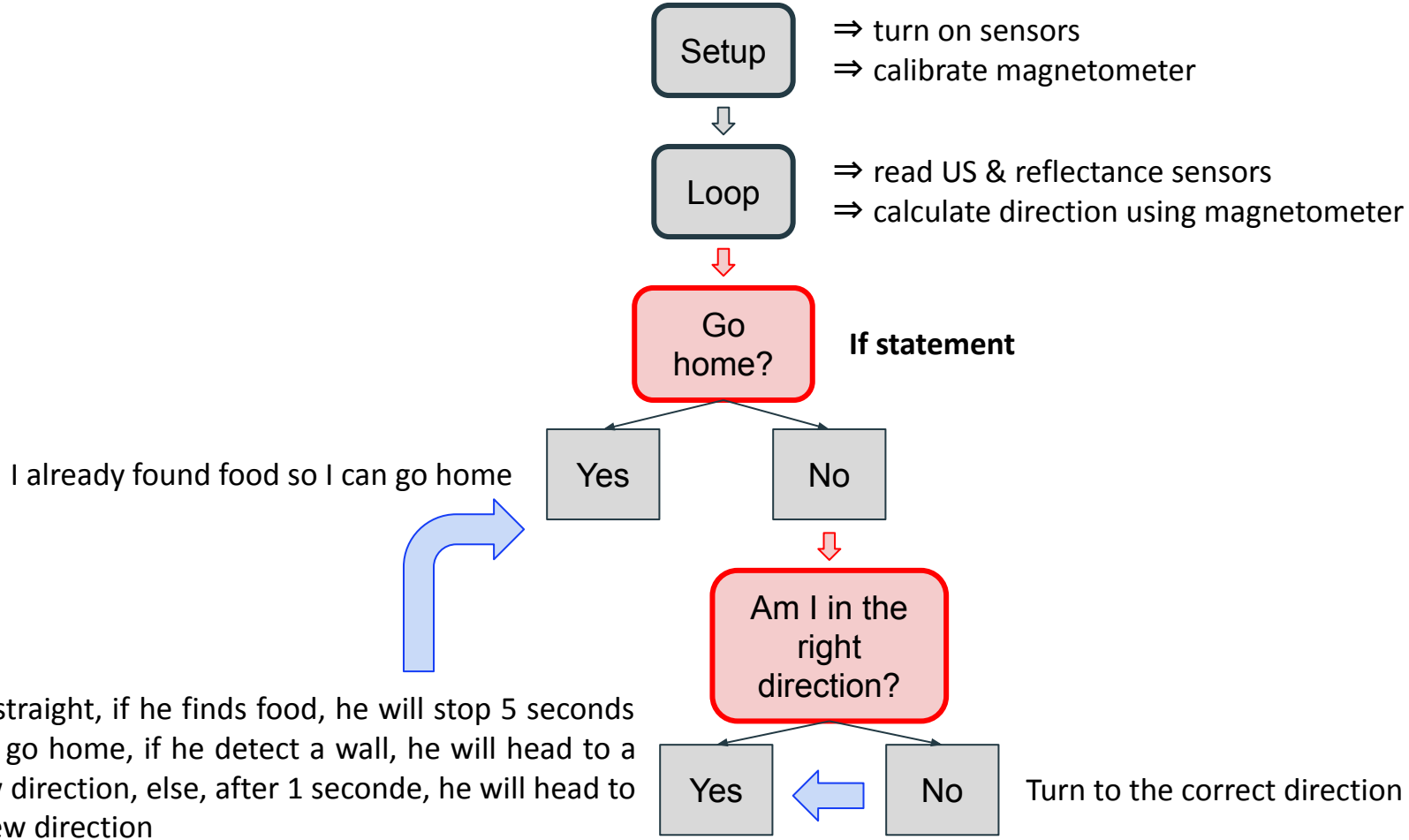
1. Random exploratory motion : **Magnetometer**
2. Collision detection : **Ultrasonic sensor**
3. Search for food marker : **Zumo's reflectance sensor array** & **Ultrasonic sensor**
4. Return to the nest : **IR beacon,** a transmitter and a receptor
5. Pheromone trail : **Zumo's reflectance sensor array** ⇒ Didn't work
6. Line following : **Zumo's reflectance sensor array**

Materials:

- Arduino
- Zumo bots for the Ant.S
  - Use zumo reflectance sensor array to detect the food marker ~~and the “pheromone” trail~~
  - Use zumo magnetometer as a compass for orientation
- IR transmitter & receiver (find the ant nest)
- ~~Thermochromic paint & electronic element producing heat OR Photosensitive paint & laser~~
- Bread board
- 7 male/female cables
- Ultrasonic sensor to detect object in front of the ants

Problem faced & solutions

- Installing Arduino IDE on linux
- Millis() brings magnetic disturbance ⇒ increase threshold
- Line following with reflectance sensor array not working correctly
  ⇒ can only detect black and white
  ⇒ work only on 1 cm lines (I need the trail to be 1 cm)
- Temporary “Pheromone” trail :
  - Late delivery (thursday)
  - Photosensible paint wasn’t picked up by reflectance sensor array
  - Watermark (wetness) wasn’t picked up by reflectance sensor array
  - Thermochromic paint wasn’t picked up by reflectance sensor array
  - Black marker & servo motor ⇒ not temporary
- IR beacon (transmitter & receiver)
  ⇒ doesn’t detect distance, I need my receiver to be unidirectional


Setup
⇒ turn on sensors
⇒ calibrate magnetometer
Loop
⇒ read US & reflectance sensors
⇒ calculate direction using magnetometer
Go home?
If statement
Yes
No
I already found food so I can go home
Am I in the right direction?
Yes
No
Turn to the correct direction
Go straight, if he finds food, he will stop 5 seconds and go home, if he detect a wall, he will head to a new direction, else, after 1 seconde, he will head to a new direction

My Output

Learned:

- Zumo shield IMU libraries (magnetometer)
- IRremote library
- Arduino IDE on Ubuntu
- Millis () vs delay ()
- Have different states using parameters
- Make function in C
- Work on a tight schedule without losing it!

To go further:

- Create a temporary “pheromone” trail
- Build more bots
- Work on improved foraging behavior

Personal:

- I got an arduino to mess around at home

Thanks for your time