

Project Title:

Building a Semi-Autonomous Robot to Track and Follow People

Can we design a robot that can detect and follow a person automatically while keeping a safe distance?

Group Members:

- Farah Omar
- Hamidah Shittu

Teacher:

Mrs.Khalil

Date Started:

November 24 2025

Science Fair Logbook – Human-Following Robot

Day 1 – Monday, Nov 24th, 2025 (Science Class)

Time spent: ~10 minutes

- Science fair was announced.
- We were introduced to the project requirements and expectations.
- We both talked about some project ideas
- Decided we wanted to try to build a robot again because last year our other one didn't work

Problem: None

What we learned: Nothing

Day 2 – Tuesday, Nov 25th, 2025 (Science Class)

Time spent: ~10 minutes

- Continued talking about robot ideas.
- Decided to build a human-following robot.

- We talked about what went wrong with last year's line-following robot.
- Agreed this year's robot needed better planning.

Problem: None

What we learned: Choosing the right project early is important.

Day 3 – Wednesday, Nov 26th, 2025 (After school Call)

Time spent: ~1 hour

- Decided budget is \$100 each
- Made a basic list of materials we might need:
 - Arduino
 - Motor driver shield
 - Motors and wheels
 - Sensors
 - Batteries

Problem: None

What we learned: We need to research a lot before we buy anything.

Didn't do anything on Thursday, Nov 27th, 2025

Day 4 – Friday, Nov 28th, 2025 (At Farah's house)

Time spent: ~2 hours

- Researched how human-following robots work.
- Learned about ultrasonic and infrared sensors.
- Decided to use an Arduino Uno to control the robot.
- Planned how the robot would detect a person and move.
- Planned where sensors would be placed on the robot.

Problem: None

What we learned: All about the robots parts

Research

The human-following robot relies on the interaction of sensors, microcontroller, motor control, and power systems. In the middle of the robot is an Arduino Uno, a microcontroller that's like its brain. It reads data from ultrasonic and infrared (IR) sensors, processes it, and sends commands to the motors. The ultrasonic sensor works by sending sound waves at a frequency above human hearing. These waves bounce off objects and return as echoes. The Arduino calculates distance using the formula:

Distance=Time for Echo×Speed of Sound /2

This allows the robot to know how far away a person is and maintain a safe following distance. The IR sensors detect reflected infrared light to determine lateral movement, letting the robot know if it needs to turn left or right. Multiple IR sensors allow the robot to detect the direction and relative position of the person in real time.

The motor driver shield is useful because the Arduino cannot give enough power to drive the DC motors directly. The shield receives low-power control signals from the Arduino and converts them into higher current output to drive the motors safely. The DC motors provide movement for the wheels, converting electrical energy into mechanical motion. Speed and direction are controlled by Pulse Width Modulation (PWM) signals from the Arduino, allowing fine adjustments to prevent jerky movements. Servo motors are used to adjust the orientation of sensors, like sweeping the ultrasonic sensor side to side for better scanning coverage.

Power management is critical for stable performance. The robot uses 18650 Li-ion batteries in a holder, which deliver enough current for all motors while maintaining a consistent voltage. Batteries are connected to the motor driver shield, and a DC power switch allows safe powering on and off. Voltage fluctuations or weak connections can cause motors to stall or sensors to return incorrect readings. Loose soldering, noisy wiring, or reflective surfaces can make ultrasonic sensors return “0 cm” or erratic measurements, which the code must handle.

The Arduino code uses information from all the hardware parts. It constantly reads data from the sensors and uses logic to decide what the robot should do next. The code sends PWM signals to the motors so they can move.

The program uses conditional statements to handle different situations. The robot moves forward when it detects a person. It turns when the IR sensors show that the person is off to one side. It stops if the person is too far away. Some advanced parts of the code help deal with sensor noise, reduce sudden spikes in ultrasonic readings, and make sure the motors speed up smoothly instead of all at once.

All of these parts working together—sensors, computing, motor control, and power management—allow the robot to work on its own. Human-following robots like this show how automation, robotics, and real-time processing work. They also show engineering challenges, such as making sensors reliable, keeping power stable, and making sure the hardware and software work well together.

Day 5 – Saturday, Nov 29th, 2025 (Video Call)

Time spent: ~1 hour

- We planned who would buy which parts on Amazon.
- Split responsibilities so we wouldn't order duplicates.
- Hamidah's Parts
 - Motor Driver Shield
 - TT Gear Motors (×4)
 - Wheels (×4)
 - 18650 Battery Holder
 - Servo Motor
 - Ultrasonic Sensor
 - Infrared Sensors (×2)
 - Extra Male Header Pins, Flux
 - Female to Female Jumper Wires
 - Ultrasonic sensor bracket
 - Foam
- Farah's Parts
 - 18650 Li-ion Batteries (×2)
 - Arduino Uno
 - Cardboard (robot base)
 - Laptop for coding
 - USB Cable for uploading code
 - Screwdriver

Problem: Could not build while waiting for materials.

What we learned: Ordering parts early saves time later.

Waited about one week for all parts to arrive.

Day 6 – Monday, Dec 1st, 2025 (CTF)

Time spent: ~20 minutes

- Opened and checked all delivered parts.
- Made sure nothing was broken or missing.
- Cut cardboard into base
- Attached motors to the base using hot glue.
- Put wheels onto motors.

Problem: None

What we learned: Nothing

Day 7 – Tuesday, Dec 2nd, 2025 (Hamidah's house)

Time spent: ~1 hour

- Installed motor driver shield onto Arduino.

- Connected motors to ports M1–M4.
- Had to unscrew all motors because we forgot to solder the motor driver shield
- Farah bought soldering kit

Problem: Forgot to solder, and we didn't buy a soldering iron.

Fix: Going to buy soldering iron on amazon and research how to use it.

What we learned: Mechanical assembly needs patience, and research a bit more before you start

Day 8 – Friday, Dec 5th, 2025 (Genesis Library)

Time spent: ~4 hours total

- Soldering iron came and we tried to solder but it turned out really bad
- Arduino powered on, but motors did not spin.
- Tested motors directly with battery.
- Connected ultrasonic sensor and infrared sensors.
- Initial sensor readings were unstable.
- Fixed wiring and retested sensors.
- Mounted ultrasonic sensor into bracket.
- Hot-glued bracket to foam and added screws.
- Hot-glued IR sensors to each side of the bracket.
- Used circuit to connect all wires
- Put code in arduino.
- The robot didn't work.
- Tested if sensors work with another code and it didn't.
- Tested if motors work with another code and it did.

Problem: Sensors still wasn't working, so it was making the whole robot not work and we were getting mad

Fix: Decided we need to solder it another day again for it to work, we were taking out the wires in the motor driver shield to give to the high school science teacher, if it's not working we still accomplished a lot today

What we learned: To always double check your work and ask for help.

Took a break for a week

Day 9 – Friday, Dec 12th, 2025 (Video call)

Time spent: ~30 minutes total

- Started planning our slides
- Tried soldering another motor driver shield, and it turned out bad again
- We're going to ask the high school science teacher to help next week

Problem: Robot still didn't work because not soldered proper
Fix: High school science teacher helped
What we learned: Always ask for help

Day 10 – Monday, Dec 15th, 2025 (CTF)

Time spent: ~20 minutes total

- Robot started to move a little
- Our friend tried to help but cut the wrong wire and then smoke started to appear, then it stopped moving
- Then we waited all winter break to start again

Problem: The robot stopped moving

What we learned: Nothing

We never did anything until the winter break

Day 11- Tuesday, Jan 6th, 2026 (Science class)

Time spent: ~1 hour total

- We took out all the wires and then put them back in
- We tested the code to see if everything was connected and it was, then it started to move
- Then we called it a day

Day 12- Wednesday, Jan 7th, 2026 (CTF)

Time spent: ~20 minutes total

- Did the code one last time and it moved
- We moved the desks and it started to follow are hands

Problem: None

What we learned: You could do anything you put your mind to

Overall Time Summary

- Calendar time: ~5 weeks (Nov 24 – Jan6)

- Work schedule:
 - Some Science and CTF classes
 - Some weekends and after-school sessions
 - Many days with no work done
- Early classes: Only ~10 minutes per class during the first 2–3 science periods
- Later sessions: Longer build and test periods
- Actual hands-on work time: ~7–9 hours total

Final Reflection

This project was challenging and took longer than expected because we did not work on it every class and had to wait for materials. We learned how to plan, order parts, assemble a robot, wire electronics, and troubleshoot problems. Even though progress was slow at times, we learned that patience, testing, and teamwork are important in engineering projects.