

# Robotics Track for Teenagers

From zero to a RoboCup Rescue Line competition robot

From absolute beginner to a competition robot you built yourself. Six levels, each ending in a working robot or subsystem: electronics and Arduino, sensors and line following, CAD and 3D printing, your own circuit board, Raspberry Pi vision, and finally a full RoboCup Rescue Line robot — custom PCB, custom chassis, your code. For ages 12–17. No experience needed.



Taught by the team that won 1st place at RoboCup Egypt 2017

6

LEVELS

42

MODULES

203

LESSONS

66–78

WEEKS

PRE-LAUNCH OFFER · TEACHING  
STARTS 15 OCTOBER 2026

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90%

Level 1 opens 15 October 2026; the levels above it are published as each one is finished. A seat is a plan, and the discount shrinks every single day until 25 October 2026, when the plans go back to their full price — so today is always the cheapest day. Card, wallet, or pay later with Tabby. Book at [techmakerz.com](https://techmakerz.com).

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# Six levels, six working robots

Every level ends with a final project that is a real robot or subsystem, reused or rebuilt better in the next level. By Level 6 the student combines everything: their own PCB, their own chassis, their own code, their own vision system.

| LEVEL |                                           | FINAL PROJECT                                         | DURATION    | OPENS           |
|-------|-------------------------------------------|-------------------------------------------------------|-------------|-----------------|
| 1     | Spark — Electronics & Arduino Foundations | Obstacle-avoiding robot on a kit chassis              | 10–12 weeks | 15 October 2026 |
| 2     | Trace — Sensors, Motors & Line Following  | Three-sensor line follower robot                      | 10–12 weeks | Coming soon     |
| 3     | Forge — CAD, 3D Printing & CNC            | Custom-designed, 3D-printed and CNC-cut robot chassis | 10–12 weeks | Coming soon     |
| 4     | Circuit — PCB Design & Custom Electronics | Custom robot mainboard and IR sensor array PCB        | 10–12 weeks | Coming soon     |
| 5     | Vision — Raspberry Pi & Image Processing  | Vision rescue robot: ball detection and pickup        | 12–14 weeks | Coming soon     |
| 6     | Rescue — Competition Engineering          | Full RoboCup Rescue Line competition robot            | 14–16 weeks | Coming soon     |

**Design principle.** The Rescue Line theme is seeded from the first lesson: every final project is a visible step toward the competition robot.

**Control theory**

on/off (L1) → bang-bang (L2) → proportional (L2, L5) → full PID (L6)

**Electronics**

breadboard (L1) → perfboard (L4) → custom PCB (L4) → PCB V2 (L6)

**Fabrication**

kit chassis (L1) → custom chassis (L3) → competition chassis V2 (L6)

**Code architecture**

single loop (L1) → state machines (L2) → dual-computer protocol (L5) → full mission software (L6)

## How the teaching works



Level 1 ends here: a robot that drives itself and dodges what is in front of it.



The kit arrives at home. Every part in it gets used.

## How a session runs (2 hours)

1. **Recap and hook** (10 min): connect to the big goal.
2. **Concept** (20–30 min): short, visual, demo-driven.
3. **Hands-on build and code** (60–70 min): the core.
4. **Show and reflect** (10–15 min): what worked, what broke, why.

```
Python Editable Run Reset Copy
1 # A football robot's first decision.
2 # Change the numbers, press Run.
3 ball_angle = 25 # degrees off centre
4 ball_distance = 40 # centimetres
5
6 if abs(ball_angle) > 10:
7     print(f"Turn {ball_angle} degrees to face the ball")
8 elif ball_distance > 15:
9     print(f"Drive forward {ball_distance - 15} cm")
10 else:
11     print("Close enough - kick!")
12
```

Output Clear

Turn 25 degrees to face the ball

Every lesson has code that runs in the browser — change a number, press Run.

## How students are assessed

- A checkpoint challenge at the end of every module: a small practical task, pass or retry, no grade pressure.
- Final project rubric: functionality 40% · understanding and explanation 30% · design quality 20% · teamwork and documentation 10%.
- Skill badges per module: Solder Master, PID Tamer, CAD Forger and more.

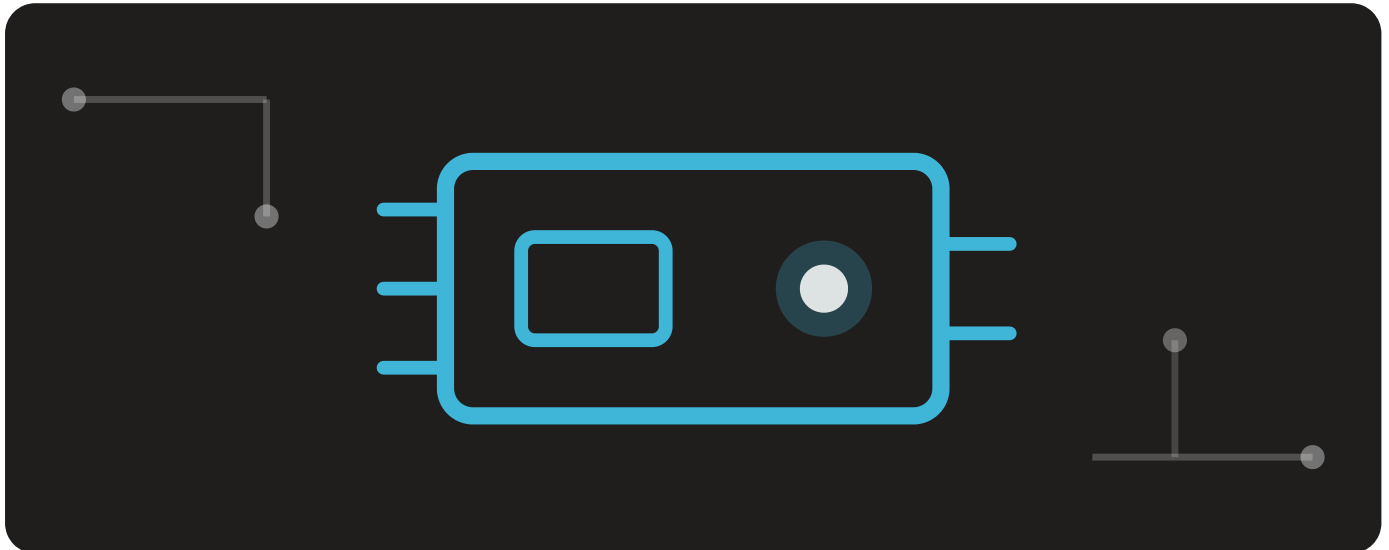
LEVEL 1 OF 6 · 10–12 WEEKS · ABSOLUTE BEGINNERS

# Spark — Electronics & Arduino Foundations

Never touched a wire or written code? Start here. Understand electricity, read circuits, use a breadboard and program an Arduino with confidence — then build a two-wheel robot that drives around and avoids walls on its own.

**Final project:** Obstacle-avoiding robot on a kit chassis

Opens 15 October 2026



## THE 7 MODULES OF THIS LEVEL

**1.1** Welcome to Robotics

**1.2** Electricity Fundamentals

**1.3** Hello Arduino

**1.4** Inputs & Decisions

**1.5** Making Things Move

**1.6** Seeing with Sound

**1.7** Final Project: Obstacle-Avoiding Robot

# Trace — Sensors, Motors & Line Following

The programming heart of Rescue Line. Master several sensors at once, precise motor control and real control logic — state machines, calibration, proportional steering — and build a three-sensor line follower that handles curves, intersections and obstacles.

**Final project:** Three-sensor line follower robot

Written next — published as it is finished



## THE 7 MODULES OF THIS LEVEL

**2.1** Thinking Like a Programmer

**2.2** The IR Sensor: Eyes for Lines

**2.3** Line Following Logic

**2.4** More Senses

**2.5** Precise Motion

**2.6** Rescue Line Rules 101

**2.7** Final Project: Line Follower Robot

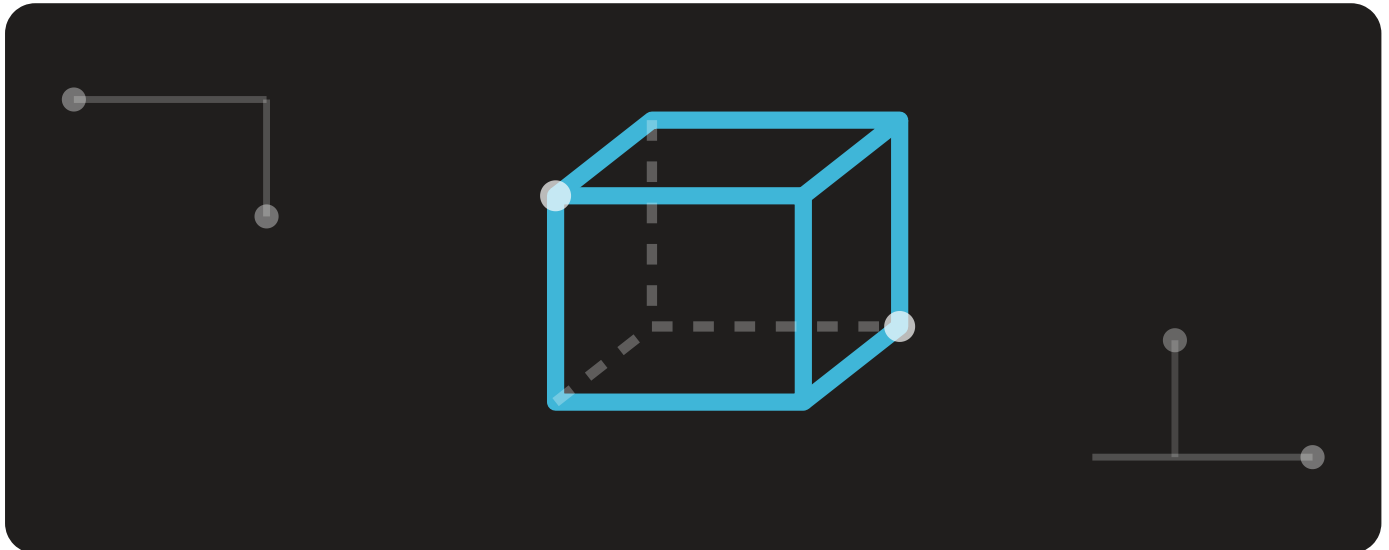
LEVEL 3 OF 6 · 10–12 WEEKS · AFTER LEVEL 2

## Forge — CAD, 3D Printing & CNC

Stop using kit chassis. Measure real parts with calipers, design in Fusion 360 or Onshape, print and CNC-cut your own robot body around the electronics you already built — then move the line follower onto it and feel the difference.

**Final project:** Custom-designed, 3D-printed and CNC-cut robot chassis

Written next — published as it is finished



### THE 7 MODULES OF THIS LEVEL

**3.1** Design Thinking & Measurement

**3.2** CAD Fundamentals

**3.3** Advanced CAD & Assemblies

**3.4** 3D Printing Mastery

**3.5** CNC & 2D Fabrication

**3.6** Robot Architecture Design

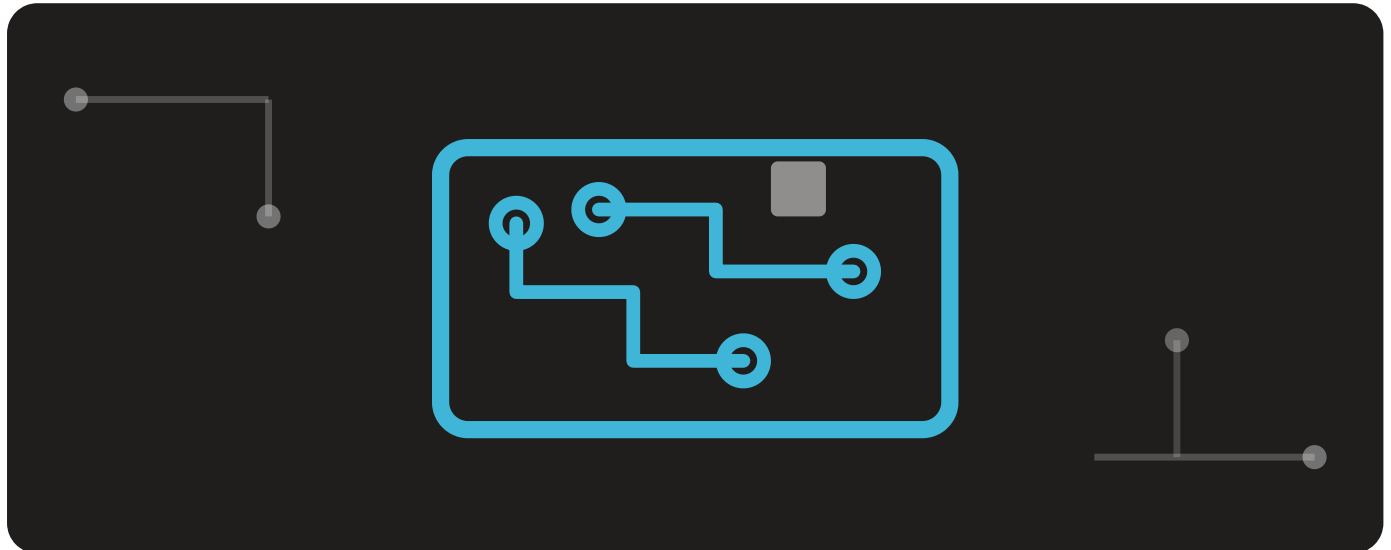
**3.7** Final Project: Custom Chassis Build

# Circuit — PCB Design & Custom Electronics

Replace the jumper-wire spaghetti with boards you designed. Read datasheets, draw schematics and lay out two-layer PCBs in KiCad, order them from a fab, solder through-hole and basic SMD, and bring up your own robot mainboard and IR sensor array.

**Final project:** Custom robot mainboard and IR sensor array PCB

Written next — published as it is finished



## THE 7 MODULES OF THIS LEVEL

**4.1** Electronics, Deeper

**4.2** Soldering School

**4.3** KiCad: Schematic Capture

**4.4** KiCad: PCB Layout

**4.5** Manufacturing & Assembly

**4.6** The Sensor Array Board

**4.7** Final Project: Custom Robot Electronics

# Vision — Raspberry Pi & Image Processing

Give the robot a real eye and a second brain. Linux and Python on a Raspberry Pi, live video with OpenCV, colour and shape detection, and a serial link to the Arduino — the key to the Rescue Line evacuation zone. Ends with a robot that finds balls, drives to them and picks them up.

**Final project:** Vision rescue robot: ball detection and pickup

Written next — published as it is finished



## THE 7 MODULES OF THIS LEVEL

**5.1** Hello Raspberry Pi & Linux

**5.2** Python Crash Course

**5.3** Camera & Image Basics

**5.4** Seeing Objects

**5.5** Two Brains, One Robot

**5.6** Grippers & Manipulation

**5.7** Final Project: Vision Rescue Robot

# Rescue — Competition Engineering

The summit. Integrate everything into one reliable, rule-compliant, competition-ready machine: chassis V2, mainboard V2, full PID line navigation, evacuation-zone mastery, reliability engineering and the documentation real RoboCup teams present. Ends in a scored tournament.

**Final project:** Full RoboCup Rescue Line competition robot

Written next — published as it is finished



## THE 7 MODULES OF THIS LEVEL

**6.1** Mission Analysis & System Design

**6.2** Robot V2: Design & Build

**6.3** Advanced Line Navigation

**6.4** Evacuation Zone Mastery

**6.5** Reliability Engineering

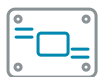
**6.6** Documentation & Team Skills

**6.7** Final Project: Competition Run

## EQUIPMENT

# What each level uses

## IN THE LEVEL 1 KIT



Arduino UNO



Breadboard



Jumper wires



LEDs & resistors



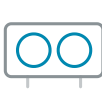
Motor driver



Gear motors



Wheels



Ultrasonic sensor



Battery holder



USB cable



Screwdriver



Colour sensor

|                |                                                                                                                                                    |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Level 1</b> | Arduino UNO, breadboard, LEDs, resistors, buttons, L298N or TB6612 motor driver, 2WD kit chassis, HC-SR04 ultrasonic sensor, batteries, multimeter |
| <b>Level 2</b> | Analog IR sensor array, TCS34725 colour sensor, MPU6050 IMU, wheel encoders, practice line track tiles                                             |
| <b>Level 3</b> | Calipers, Fusion 360 or Onshape (free for education), 3D printer with PLA and PETG, CNC router or laser cutter, fasteners and inserts              |
| <b>Level 4</b> | KiCad (free), soldering stations, fume extractors, component stock, PCB fabrication budget of roughly \$2–10 per board                             |
| <b>Level 5</b> | Raspberry Pi 4 or 5, Pi Camera v2 or v3, 5V/3A UBEC, SD cards, servo gripper hardware, ball set (silver and black)                                 |
| <b>Level 6</b> | Regulation Rescue Line tiles and evacuation zone, spares of everything, a GitHub organisation, competition consumables                             |

## Duration

About 66–78 weeks of lessons: two school years at one session a week, or one year at two sessions a week, with natural pause points after Levels 2 and 4 for holiday camps and mini-competitions.

## What every graduate leaves with

A robot they built from raw materials, boards they designed, code they wrote, a portfolio of CAD files, PCBs and a GitHub repository — and the ability to compete in RoboCup Junior Rescue Line.



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