PATHAHEAD · FREE ROADMAP

Become an IoT & Robotics Engineer from Scratch

Make your code move things in the real world. Go from zero electronics to connected devices and a working robot in about five months — the hands-on path into Industry 4.0.

22	5	4	~₹2K
weeks · ~10–12 hrs/wk	hardware projects	phases · code to robot	one starter kit (or free sims)

A free PathAhead learning resource · adjust the pace to your life — the order matters more than the dates.

THE ONE RULE

Wire it → code it → make it move

Hardware punishes theory-only learning instantly. Build every circuit, flash every sketch, and let things fail — a burnt LED teaches more than a perfect lecture. Free simulators count when parts aren't handy.

> **Legal & ethical use only.** A basic Arduino/ESP32 starter kit costs about ₹1,500–2,500 and covers the first three months. Until you have one, Wokwi and Tinkercad simulate almost everything free — never let missing parts stop the learning.

THE ROADMAP

Four phases, step by step

0 Foundations

Weeks 1–5

Electronics and the first microcontroller.

WEEK 1
Electricity basics
Voltage, current, resistance, breadboards — safely.

WEEK 2
Arduino first steps
Digital/analog pins, blink, buttons (Wokwi works too).

WEEK 3
C/C++ for embedded
Just enough to write clean sketches.

WEEK 4
Sensors
Temperature, distance, light, motion — read them all.

WEEK 5
Actuators
LEDs, buzzers, servos, relays — make things happen.

1 IoT

Weeks 6–11

Put your devices on the internet.

WEEK 6
ESP32 & WiFi
The ₹300 chip that connects anything to the internet.

WEEK 7
MQTT
The messaging protocol of IoT, hands-on.

WEEK 8
Cloud dashboards
Stream sensor data to live charts (free tiers).

WEEK 9
Control from anywhere
Switch devices from your phone, safely.

WEEK 10
Power & reliability
Batteries, sleep modes, surviving reboots.

WEEK 11 · PROJECT ▶
Smart-home node
A WiFi sensor + relay node with a live dashboard.

2 Robotics

Weeks 12–17

Motors, vision, and a robot that decides.

WEEK 12

Motors & drivers

DC motors, H-bridges, PWM speed control.

WEEK 13

Robot chassis

Build a two-wheel-drive robot base.

WEEK 14

Raspberry Pi + Python

A Linux brain for bigger robots.

WEEK 15

Computer vision

OpenCV basics — follow a line or a colored ball.

WEEK 16

Control loops

Sense → decide → act; simple PID intuition.

WEEK 17 · PROJECT ▶

Autonomous robot

An obstacle-avoiding or line-following robot.

3 Integration

Weeks 18–22

Robots + cloud + polish = Industry 4.0 portfolio.

WEEK 18

Robot telemetry

Stream your robot's sensors to your IoT dashboard.

WEEK 19

ROS 2 taste

The framework real robotics companies use.

WEEK 20

Mechanics & mounting

3D-printed or hand-built parts that don't fall off.

WEEK 21

Testing & safety

Fail-safes, e-stops, and honest documentation.

WEEK 22 · CAPSTONE ▶

Connected robot system

A robot you can monitor and command over the internet.

BUILD A PORTFOLIO

Five projects that get you hired

Projects beat certificates. Do them in order — each builds on the last. Put every one on GitHub with a clear README: problem → approach → result.

Start here

1 · Sensor Station

Read three sensors and display live values (Wokwi or real board).

IoT

2 · WiFi Weather Node

An ESP32 that streams temperature to a live cloud dashboard.

Automation

3 · Smart-Home Controller

Control lights/appliances from your phone via MQTT.

In demand

4 · Vision Line-Follower

A robot that follows a track using a camera and OpenCV.

Capstone

5 · Internet-Connected Robot

Drive and monitor your robot from a web dashboard.

ROLES YOU CAN APPLY FOR

IoT Engineer · Embedded Systems Engineer · Robotics Engineer · Firmware Developer

TYPICAL STARTING SALARY · INDIA

₹4–10 LPA

LEARN IT

Learning resources

Every item links to the real source (clickable in this PDF).

BOOKS

- Making Embedded Systems by Elecia White
- The C Programming Language by Brian Kernighan and Dennis Ritchie
- Programming Embedded Systems by Michael Barr and Anthony Massa

COURSES

- Introduction to Embedded Systems by NPTEL (free)
- Internet of Things by NPTEL (free)
- Introduction to the Internet of Things by Coursera
- Embedded Systems by Coursera

YOUTUBE

- Andreas Spiess
- GreatScott
- Ben Eater

PRACTICE

- Arduino Project Hub
- Wokwi
- GitHub

DO THIS TODAY

Your first step (takes 30 minutes)

1

Open Wokwi

wokwi.com — a free online Arduino/ESP32 simulator. No hardware needed.

2

Blink an LED

The 'hello world' of hardware — in the simulator or on a real board.

3

Read one sensor

Wire (or simulate) a temperature sensor and print its values. Started.

> **Job-ready checklist:** 3–5 solid projects on GitHub (≥1 deployed or documented) · can explain your work in an interview · comfortable with the core tools of the field · a portfolio or profile recruiters can find.

PathAhead — India's premium career guidance platform. This roadmap is a free educational resource; timelines are a guide and everyone learns at a different pace. Referenced third-party resources (Arduino docs, Wokwi simulator, Random Nerd Tutorials, Paul McWhorter (YouTube), ROS 2 docs) are for learning only and are not affiliated with PathAhead.