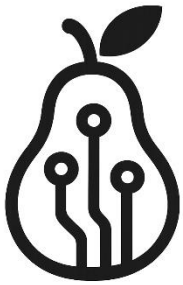

PEAREDGE ROBOTICS AND ELECTRONICS CLUB CURRICULUM FRAMEWORK

Robotics, Electronics, and Edge AI

POWERED BY PEAREDGE TECHNOLOGIES LIMITED

This document outlines the complete structured framework for the PearEdge Robotics and Electronics Club (PREC), designed to prepare learners from foundational electronics to advanced robotics and Edge AI innovation.

Overview

This curriculum equips learners (ages 8–25) with the knowledge and hands-on experience to design, build, and innovate in Robotics, Electronics, and Edge AI. Learners progress from curiosity to advanced AI-driven engineering and entrepreneurship. Sessions are conducted once weekly (Saturdays, 3–4 hours). Each stage runs for 9–12 months, with optional 2-month innovation bootcamps.

Stage 1 – Explorer (Age 8 – 12)

Theme: Introduction to Technology, Electronics and Safe Creativity
Duration: 4 months

Core Focus Areas

Introduction to Technology: Everyday technology, smart machines, innovation and problem-solving.
Lab Safety & Discipline: Safe lab behavior, handling tools, electrical safety, workspace organization.
Basic Electronics: Simple circuits, batteries, LEDs, resistors, switches, and sensors.
Creative Thinking & Teamwork: Story-based design challenges, group collaboration, presentations.
Renewable Energy: Hands-on solar experiments and awareness about sustainable energy.
Introduction to coding: What is programming.
Intro to Coding Logic: Visual coding with Scratch or Tynker to understand computational thinking.
Digital Citizenship: Safe and responsible use of technology and the internet.
Environmental Awareness: Using technology to solve environmental challenges.

Practical Activities

Activity
Make a paper circuit with LED
Build a light sensor lamp
Create a robot face that lights up
Safe tool handling demo
Mini tech quiz/game

Learning Outcomes

Students will be able to:
Explain what technology is and its daily uses.
Identify basic electronic components and functions.
Explain what programming is.
Build and test simple circuits safely.
Demonstrate safe lab behavior.
Work in teams and present ideas confidently.

Assessment Method

Students are assessed through participation, creativity, and hands-on projects. A certificate of completion is awarded upon completing a mini project.

Projects

My First Electric Lamp (LED + battery + switch).
Smart Traffic Light (3 LEDs on breadboard).
Solar-Powered Toy Fan.

Summary: Stage 1 builds curiosity, confidence, and creativity. It prepares learners for deeper robotics and coding by making learning safe, hands-on, and fun.

Stage 2 – Builders Foundation (Age 12 – 16)

Theme: Circuit Design, Logic, Programming with C, and Arduino Projects
Duration: 10 months

Core Focus Areas

Circuit Design & Analysis: Understanding voltage, current, resistance, and Ohm's law; using breadboards and multimeters; identifying electronic components.
Digital Logic & Computational Thinking: Learning binary logic, truth tables, and basic logic gates; understanding how computers "think."
Programming Fundamentals with C: Writing simple programs with variables, loops, and conditions; using the Arduino IDE. Debugging. Documentation.
Arduino Microcontroller Projects: Programming sensors, LEDs, buzzers, motors, and displays for automation and control.
Problem Solving & Debugging: Learning how to fix wiring and code errors systematically.
Project Documentation & Presentation: Drawing circuit diagrams, recording progress, and explaining design ideas clearly.

Practical Activities

Activity
Build a traffic light system using LEDs
Create a buzzer alarm that reacts to light or motion
Design a temperature monitor with a sensor and display
Program Arduino to blink LEDs in patterns
Build a smart night lamp that turns on automatically in the dark

Learning Outcomes

Students will be able to:
Read and assemble basic circuit diagrams.
Write and upload simple programs to Arduino boards.
Use logic and computation to automate small systems.
Work in teams to complete and present practical projects.

Assessment Method

Assessment will be based on:
Class participation and attendance.
Practical project completion and innovation.
Code functionality and documentation.
A final Capstone Project: "Smart Automation Challenge."

Projects

Smart Hand Sanitizer Dispenser.
Sound-Reactive LED Music Lights.
Obstacle Detection Robot.
Automated Plant Watering System.
Temperature-Controlled Fan.

Summary: Stage 2 is the foundation where learners move from curiosity to creation. At this level, participants are introduced to the core building blocks of electronics, programming, and embedded systems. They learn how circuits work, how logic powers machines, and how code brings ideas to life. Through hands-on projects with Arduino and sensors, students begin to understand how hardware and software interact.

Stage 3 – Builders (Age 15 – 20)

Theme: Operating System, Embedded Systems, Internet of Things (IoT), Machine Learning, and Edge AI Applications
Duration: 10 months

Core Focus Areas

Operating System: How Operating System Manages Hardware Resources. OS Layers.
Introduction to Embedded Systems: Understanding microcontrollers vs. microprocessors. Architecture of Arduino, ESP32, Raspberry Pi, etc. How sensors, actuators, and microcontrollers interact.
Internet of Things (IoT) Concepts: Connecting devices to the cloud. Collecting and visualizing data (temperature, motion, etc.). Using WiFi/Bluetooth modules (ESP8266, ESP32). Intro to MQTT and basic cloud dashboards.
Introduction to Machine Learning: What is machine learning. Types of machine learning
Edge AI Fundamentals: What is Edge AI and why it matters for Africa. Using AI on microcontrollers (TensorFlow Lite, Edge Impulse).
Simple models: gesture recognition, sound detection, and image classification.
Data & Sensors: Understanding data types, analog vs. digital signals. Reading data from multiple sensors. Data processing and visualization.
System Integration & Prototyping: Combining hardware, software, and AI models into one system. Using low-power design techniques for edge devices.
Ethics & Real-World Applications: Using AI responsibly. Discussing African problems that can be solved with embedded AI.

Practical Activities

Activity
Build an IoT temperature and humidity monitor
Program an ESP32 to send sensor data to a web dashboard
Train a gesture-recognition model with Edge Impulse
Create a voice-controlled smart device
Design an offline object recognition system using a small AI model

Learning Outcomes

By the end of Stage 3, learners should be able to:
Design and program embedded systems for automation and sensing.
Connect devices to the internet or local edge networks.
Deploy small AI models on microcontrollers.
Collect, process, and interpret sensor data.
Design AI-based projects that solve real problems.

Assessment Method

Continuous practical assessment.
Capstone Project: “Edge AI for Africa Challenge” – Students design a project that solves a local issue using embedded intelligence.

Projects

Smart Irrigation System with Edge AI.
Voice-Controlled Home Automation.
Offline Mask Detection using Edge Impulse.
Intelligent Traffic Management Prototype.
Smart Waste Bin with Motion and AI Detection.

Summary: Stage 3 empowers learners to innovate with purpose. They move from building simple circuits to designing intelligent, connected, and sustainable solutions.

Stage 4 – Innovator (Age 18 – 25)

Theme: Robotics, Edge AI Deployment and Innovation Leadership
Duration: 12 months

Core Focus Areas

Advanced Robotics Systems.
Sensor Fusion.
Mechatronics.
Edge AI Optimization.
AI Lifecycle.
Product Design.
IP.
Entrepreneurship.
Developing business models for hardware + AI products.
Ethical leadership and social impact design.

Practical Activities

Activity
Build an autonomous robot that navigates a maze using Edge AI.
Develop a machine vision system for counting or sorting objects.
Deploy a custom-trained AI model to a Jetson Nano or Coral board.
Design and 3D-print a robotic component.
Present a product pitch and demonstration.

Learning Outcomes

By the end of Stage 4, participants will be able to:
Build and program autonomous robotic systems.
Optimize and deploy AI models to real-world hardware.
Combine engineering, AI, and creativity to design functional products.
Lead a project team or startup.
Communicate complex ideas effectively to technical and non-technical audiences.

Assessment Method

Capstone Project: "AI for Sustainable Development" — students identify a challenge (agriculture, health, education, environment, etc.) and develop a deployable robotic or AI solution.

Demo Day Presentation: project showcase to investors, local partners, and the media.

Summary: Stage 4 transforms learners into Pioneers of African Technology.
They move beyond learning — to leading, innovating, and shaping the future.