Design and Implementation of ESP32-Based IoT Devices: An Educational Framework and Project Showcase

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The Rise of IoT and Educational Need

IoT's Rapid Growth

14.3 billion IoT devices in 2022, with continued growth expected.

Demand for Skills

Growing need for IoT expertise in various industries.

Paper's Purpose

Presents educational IoT tools, technologies, and a course framework.

Key Hardware

Focuses on ESP32 modules like LilyGO TTGO T8.

Essential IoT Device Characteristics & Layers

IoT "Thing" Characteristics

- Data acquisition
- Reaction capabilities
- Network reception
- Communication support

IoT Device Layers

- Physical layer
- Network layer
- Application layer

Integrating IoT into Education

Smart Environments

Improving school building efficiency and smart lecture rooms.

E-Learning & Remote Labs

Enhancing learning experiences with interactive tools.

RFID for Attendance

Automating administrative tasks in educational settings.

Project-Based Learning

Benefits for practical skill development and engagement.

Specific Educational IoT Approaches

Gamification & Virtual Labs

Enhancing engagement and practical learning.

Support for Disabilities

IoT applications aiding students with special needs.

Project-Based Methods

Improving educational quality through hands-on projects.

Educational Platforms

Examples of specialized IoT modules and platforms for learning.

A Pedagogical Framework & Tools

1

Custom Hardware

ESP32 sensor extension boards simplify connections and testing.

2

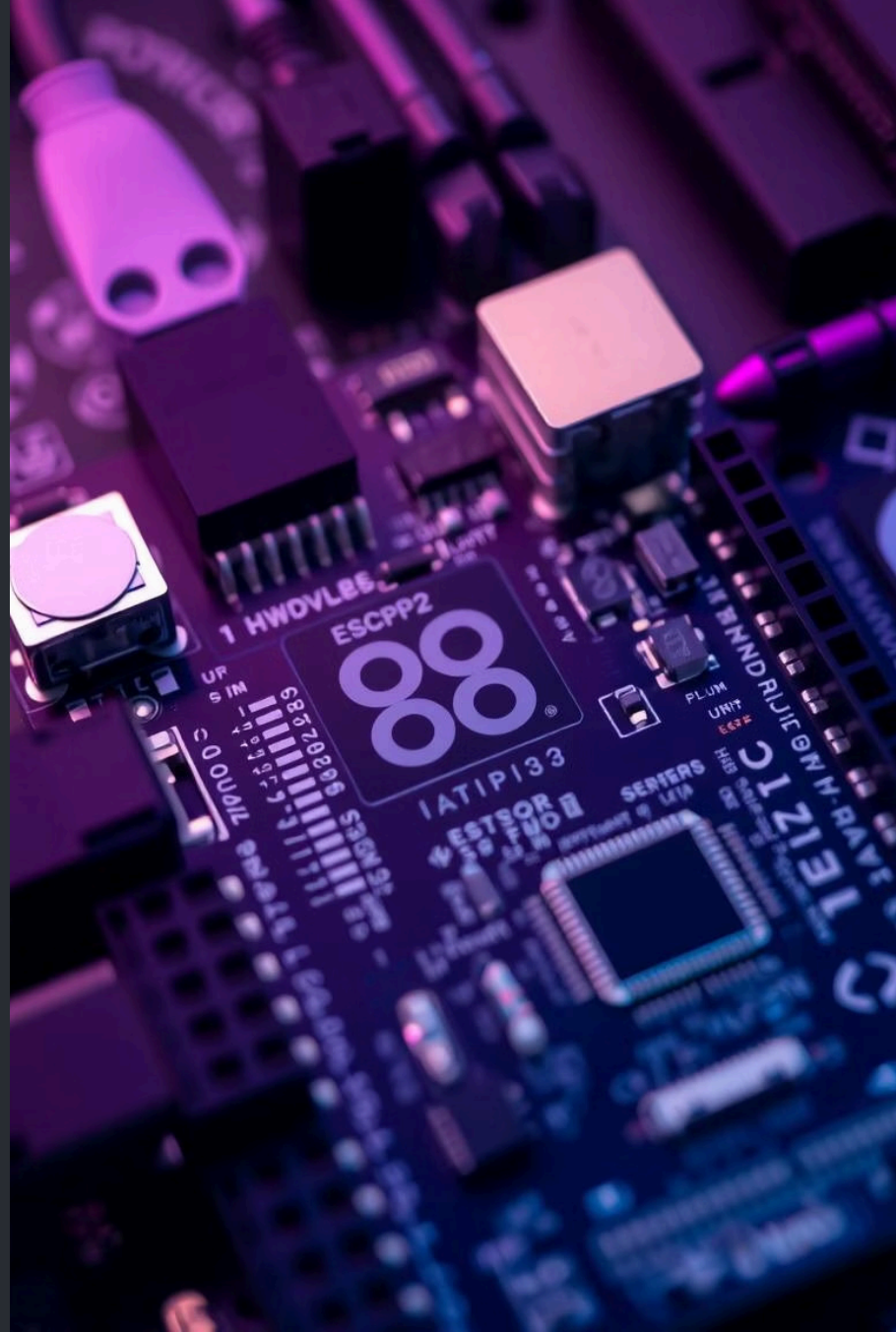
Software Utilized

Arduino IDE with ESP32 libraries and Digilent WaveForms.

3

Structured Course

Introductory ESP32 course flowchart guides learning.



Student-Driven Project Implementation

Practical Application

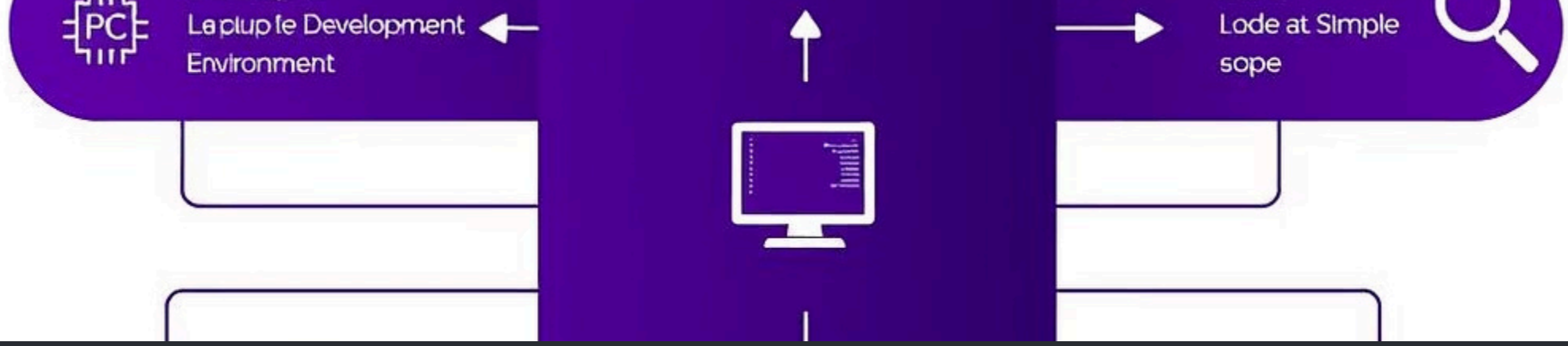
Emphasis on student-developed projects for hands-on learning.

Skill Development

Students learn PCB design, programming, 3D printing, and IoT integration.

Showcase Project

The Beehive Monitoring System serves as a concrete example.



Educational System Overview

ESP32 Introduction

Basics, I/O, and sensor integration.

1

2

Data & Connectivity

Data logging, Wi-Fi, and IoT concepts.

Project Phase

Idea, components, testing, PCB, enclosure, firmware, integration, prototype.

3

Q&A

Thank you for your attention. Any questions?