PROJECT NUMBER: 2023-1-PL01-KA220-SCH-000154043

Bringing the Internet of Things in school education as a tool to address 21st century challenges

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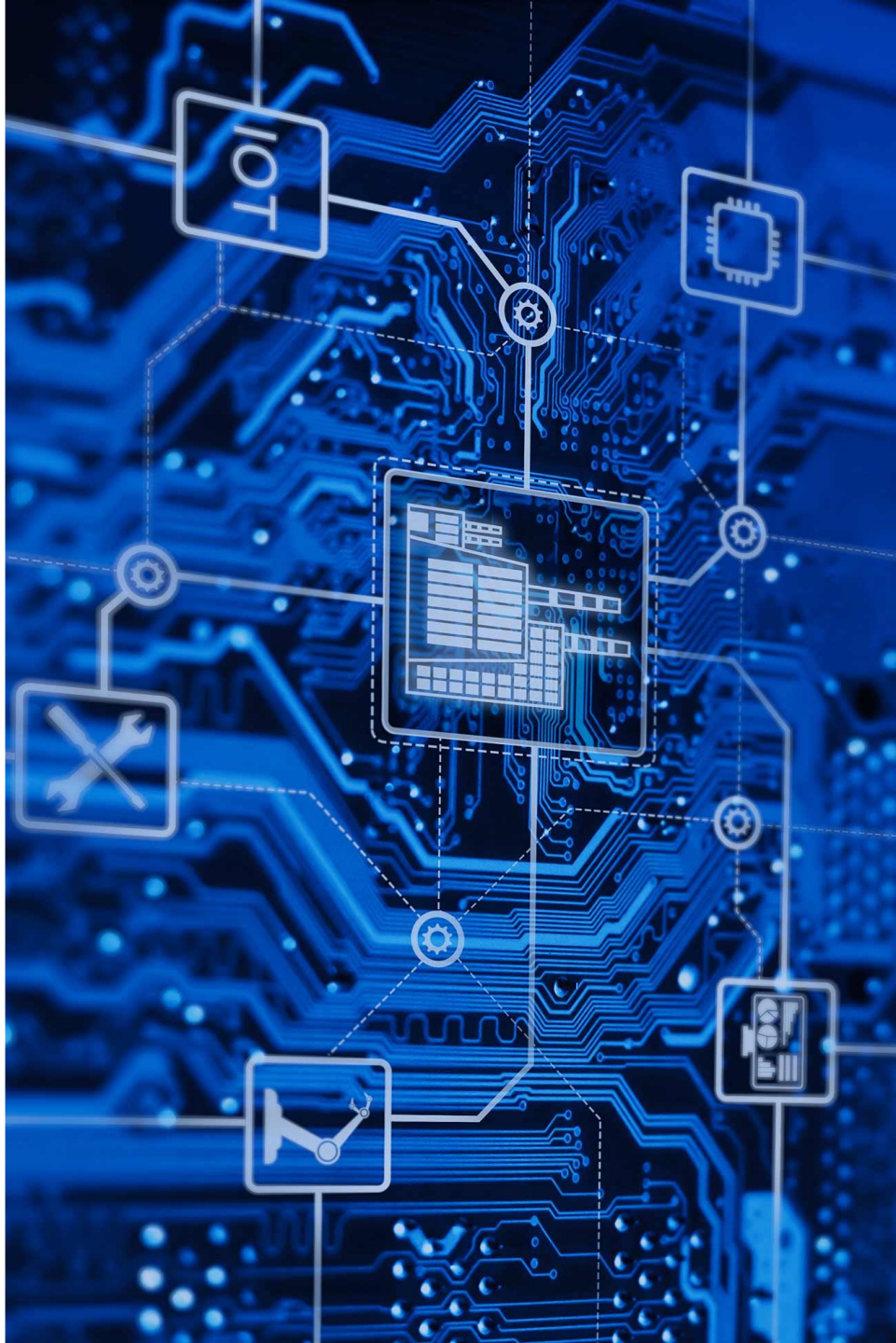
Overview of the SmartHome project: Building a SmartHome ecosystem using IoT devices



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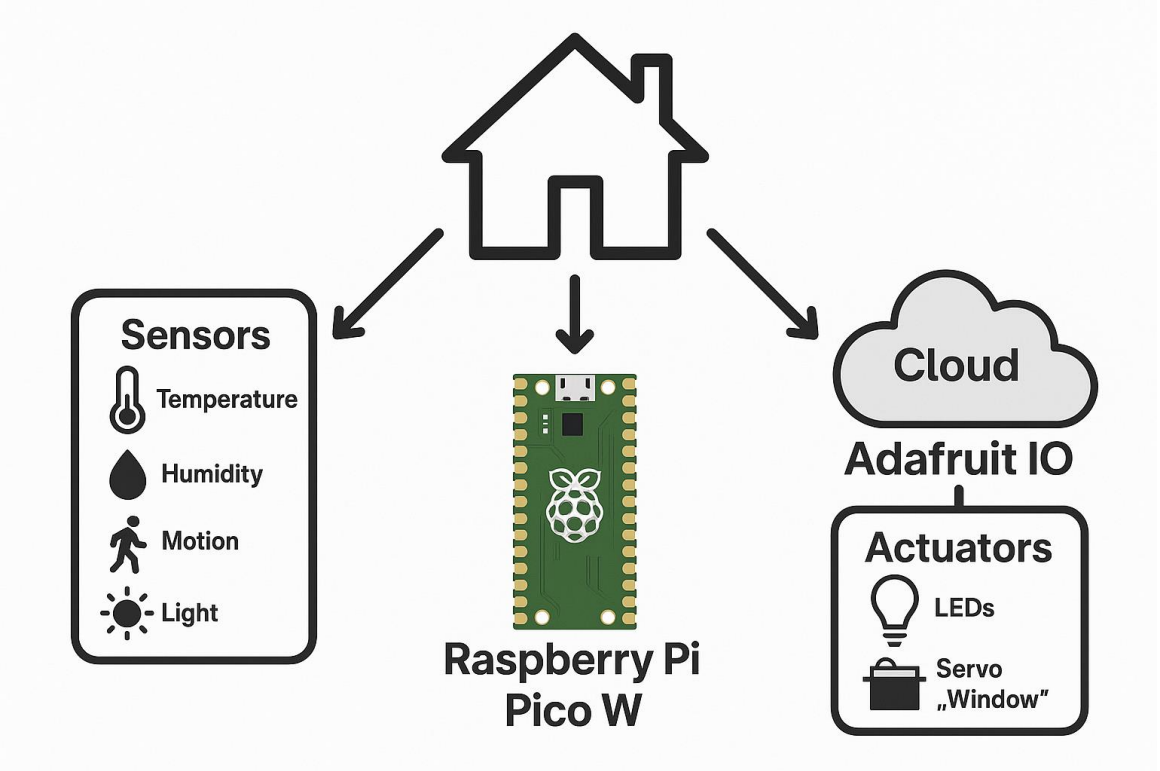
What is the SmartHome project?

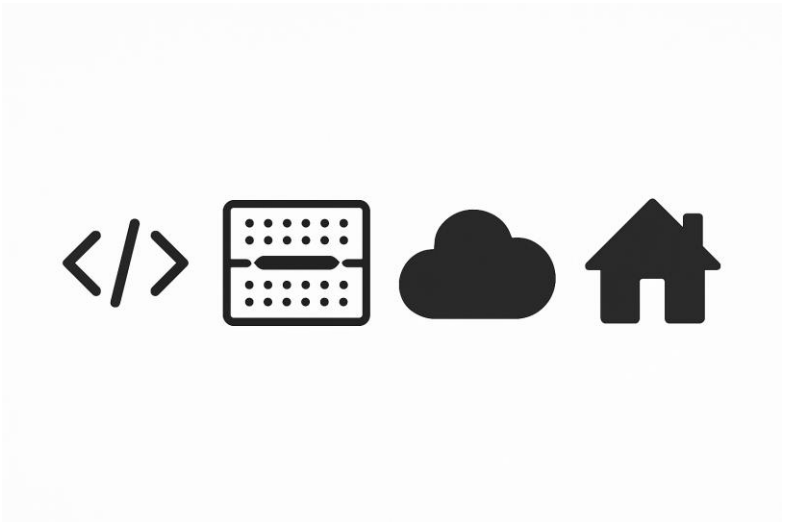
1. Students build a mini Smart Home system
2. Use Raspberry Pi Pico W as the main microcontroller
3. Integrate sensors (DHT11, PIR, LDR) and actuators (LEDs, servo motor)
4. Program everything with MicroPython in Thonny
5. Connect to the Adafruit IO cloud platform to monitor & control the system online.



Key Learning Objectives

By the end of the project, students will be able to:

1. Program in MicroPython for a microcontroller
2. Connect and use sensors & actuators on a breadboard
3. Build a Smart Home IoT application with cloud connectivity
4. Understand Smart Home and IoT concepts (sensors, cloud, actuators)
5. Interpret basic sensor data (temperature, humidity, light, motion)



Learning Pathway & Time Plan

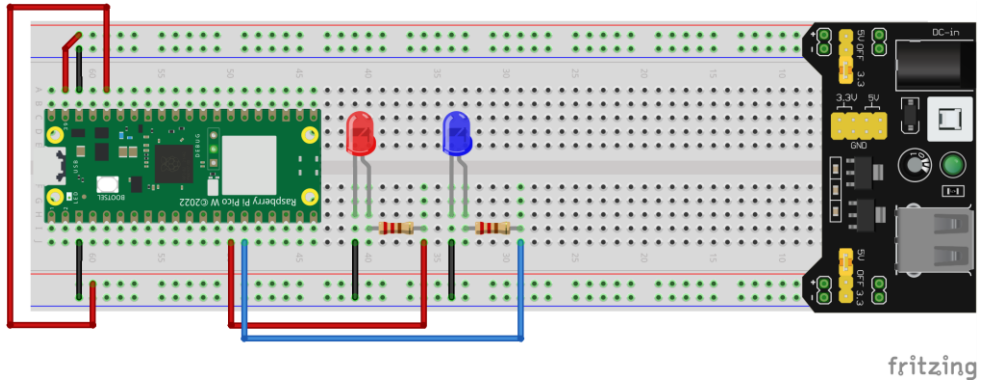
- Total duration: 7–8 class periods (≈6.5–7.5 hours)
- Implemented in 2 levels and 8 sessions
- Recommended pacing: 2–3 sessions per week over 3–4 weeks
- Mix of mini-lectures, hands-on building, coding, and presentations

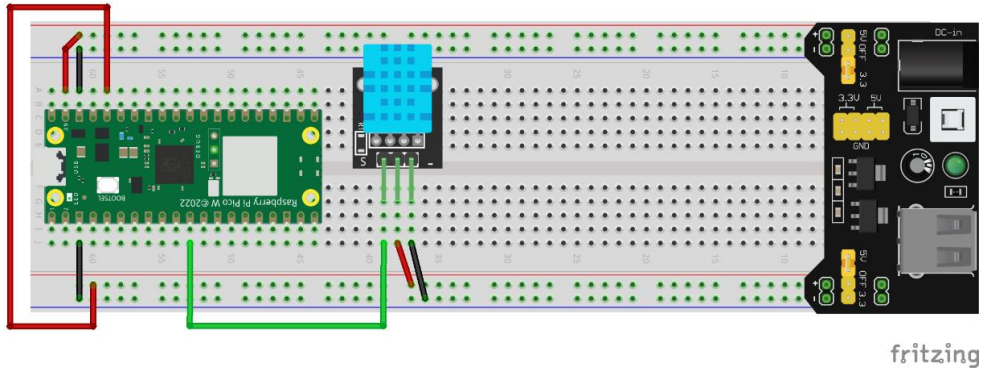
Level 1	Level 2
Session 1: IoT In smart homes	Session 6: Integrate system & Adafruit IO
Session 2: RPi Pico W setup & First LED blink	Session 7: Test, debug & document
Session 3: MicroPython basics and Components explanation	Session 8: Students' presentations
Session 4: Read sensors (DHT11, PIR, LDR)	
Session 5: Actuators (LEDs, servo motor)	

Level 1: Foundations

Sessions 1–5 focus on:

- Introducing **IoT & Smart Home concepts**
- Setting up **Raspberry Pi Pico W** & running the first blink.py
- Learning **MicroPython basics** and core syntax
- Understanding key components: **breadboard, resistors, jumper wires, sensors, LEDs, servo**
- Reading data from **DHT11, PIR, LDR** and controlling **LEDs & servo**

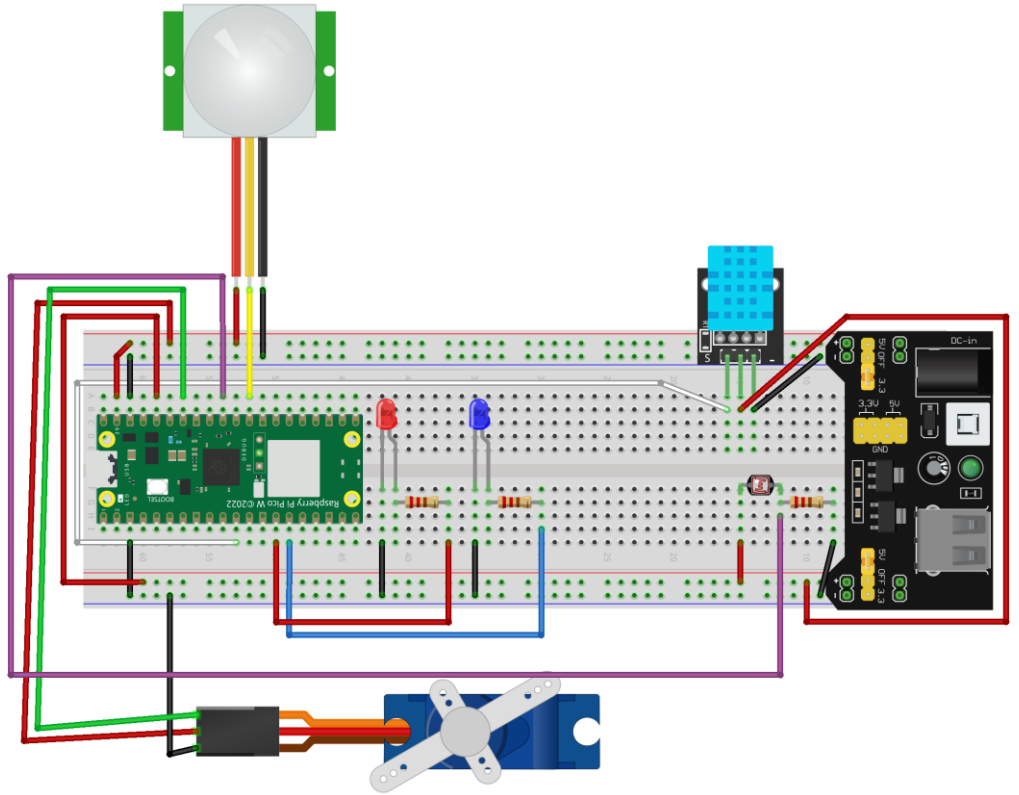




Level 2: Integration & Cloud Application

Sessions 6–8 focus on:

- Building the **complete Smart Home circuit** with all sensors & actuators
- Connecting Pico W to **Wi-Fi** and **Adafruit IO**
- Sending sensor data (temperature, humidity, motion) to the cloud
- Controlling **LEDs & servo** from an online dashboard
- Testing, debugging, documenting, and **presenting student projects**



Hardware & Software

Hardware

- 1 × Raspberry Pi Pico W
- 1 × Breadboard
- 1 × MB-102 power supply
- 6 × AA batteries
- Sensors: DHT11, PIR (HC-SR501), LDR photoresistor
- Actuators: 2 × LEDs, SG-90 servo motor
- Resistors, jumper cables

Software & Platforms

- Thonny IDE & MicroPython firmware
- MicroPython libraries (e.g., dht.py, servo.py, iot4schools.py software
- Adafruit IO for dashboard & data feeds

Pedagogical Approach

- Designed for **group work** (3–4 students per team)
- Roles can rotate: Coder, Builder, Tester, Documenter
- Combines **theory, guided practice, and open-ended problem-solving**
- Fosters **computational thinking**, **collaboration**, and **communication**
- Discussion prompts:
  - IoT benefits & risks
  - Energy efficiency & sustainability
  - Data privacy & security in smart homes

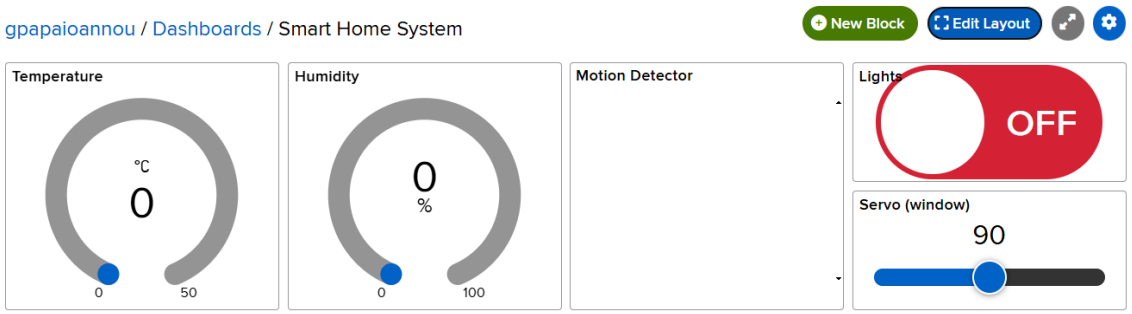
What Can Students' Smart Homes Do?

Smart temperature system:
- Opens "window" (servo) when temperature > threshold
- Closes "window" when humidity > threshold

Smart lights system:
- Uses LDR to turn LEDs on when it gets dark

Smart security system:
- Uses PIR sensor to detect motion
- Turns on LEDs & closes "window" when motion is detected

Smart Home App (Adafruit IO):
- Dashboard to monitor temperature, humidity & motion
- Toggle LEDs and control servo angle from the cloud



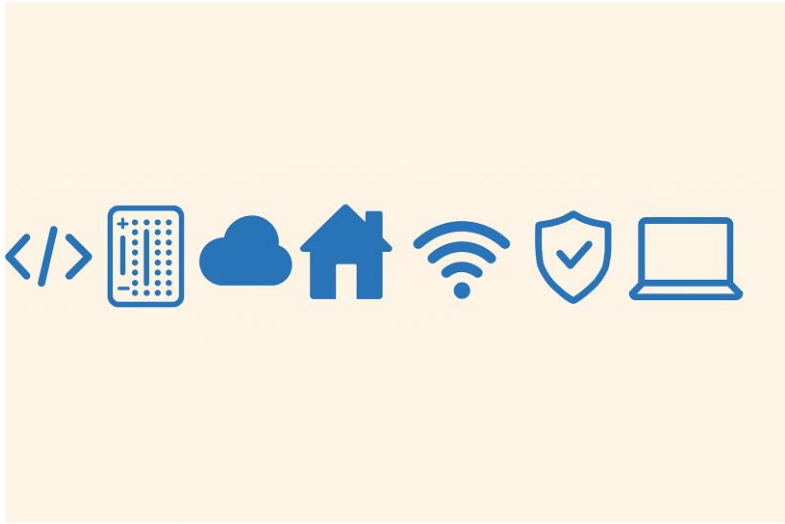
Requirements & Getting Started

Student prerequisites:

- Basic programming concepts (variables, loops, conditionals, functions)
- Familiarity with IDE/editor, terminal/shell
- Basic understanding of circuits and safe breadboard use

Teacher & classroom prerequisites:

- Thonny installed on lab PCs/laptops
- MicroPython firmware flashed to Pico W
- School Wi-Fi that allows Pico W connection (2.4 GHz, WPA2)
- Classroom strategy for an Adafruit IO account & feeds
- Short safety briefing (voltages, current limits)



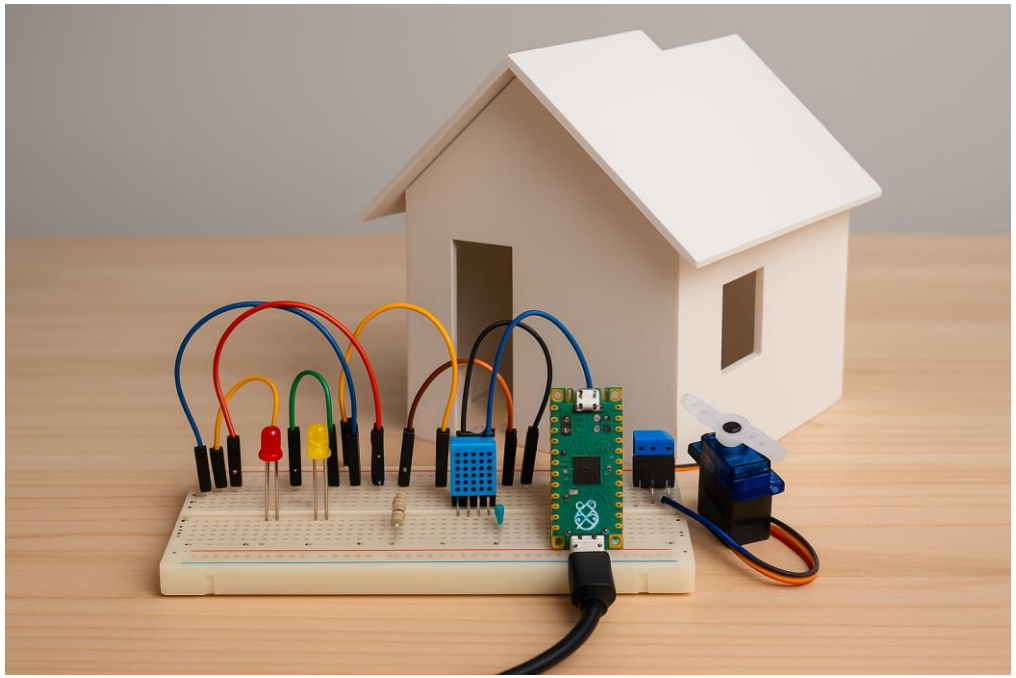
Outcomes

By completing the project, students will:

- Build and demonstrate a working Smart Home prototype
- Document and present their design decisions
- Reflect on sustainability, privacy and security in IoT

Possible extensions:

- Add more sensors/actuators (buzzer, OLED display, etc.)
- Extend Adafruit IO dashboard with charts and data logging
- Connect with other IoT4Schools activities or school projects



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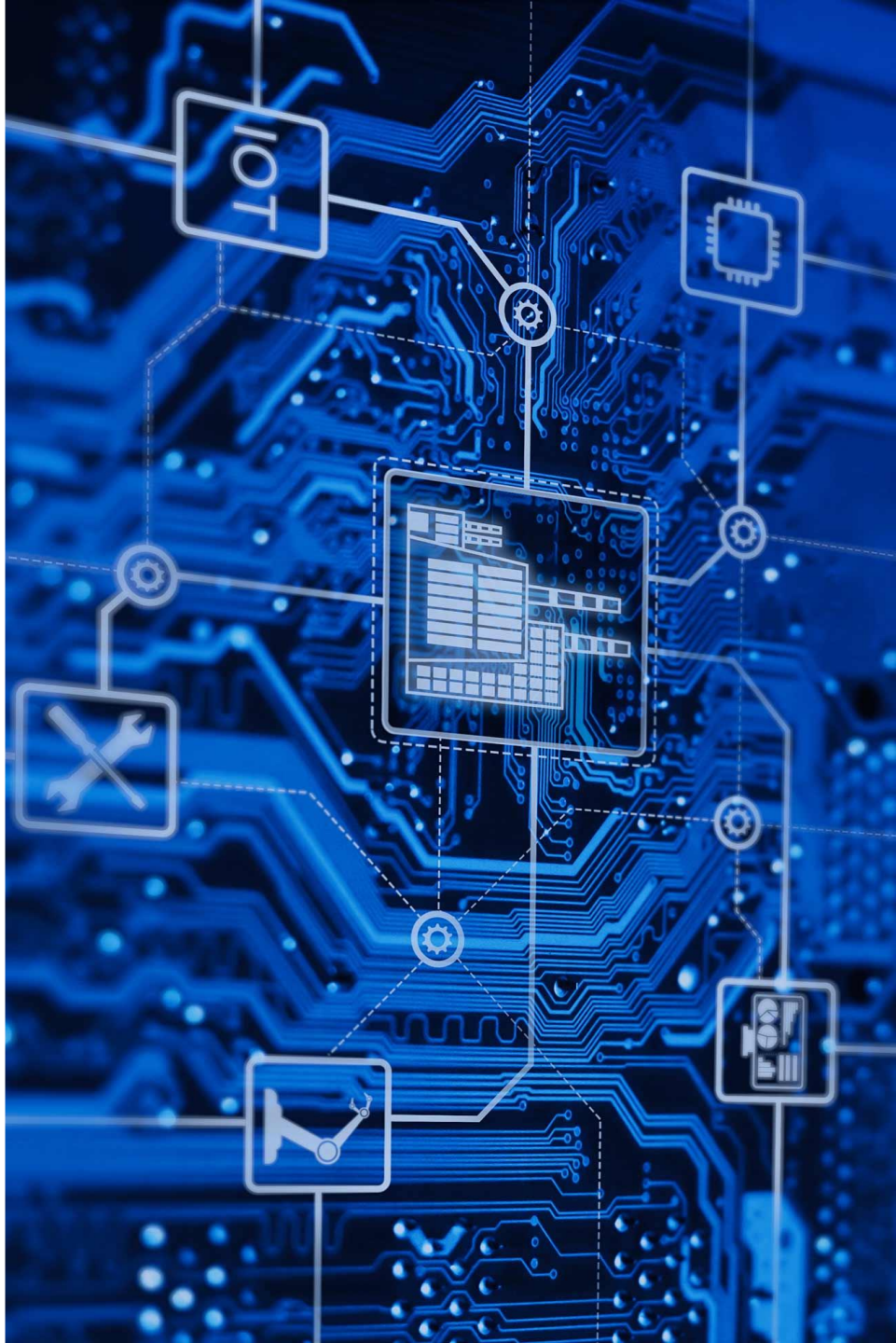
Thank you & Good luck!



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