OSS Development for the ESP8266 & Azure

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Pamela Cortez

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@ritazzhang
@hello_techie
Introduction
<table>
<thead>
<tr>
<th>Microcontroller</th>
<th>ESP8266</th>
<th>Arduino Uno</th>
<th>Particle Photon</th>
<th>Intel Edison</th>
<th>Raspberry Pi 2</th>
<th>MBM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microprocessor</td>
<td>32-bit RISC, 80MHz</td>
<td>ATmega328</td>
<td>ARM Cortex-M3 (120 MHz)</td>
<td>Intel Atom</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>GPU</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Intel Quark</td>
<td>ARM Cortex A7 (Quad core, 900 MHz)</td>
<td>Intel Atom E38x (Dual Core, 1.33 GHz)</td>
</tr>
<tr>
<td>ADC</td>
<td>10-bit, 1-ch</td>
<td>10-bit, 6-ch</td>
<td>12-bit, 8-ch</td>
<td>-</td>
<td>Y</td>
<td>Integrated</td>
</tr>
<tr>
<td>Memory</td>
<td>512k - 4Mb Flash</td>
<td>32k Flash</td>
<td>1Mb Flash</td>
<td>1GB RAM + 4GB eMMC</td>
<td>1 GB RAM</td>
<td>2GB RAM</td>
</tr>
<tr>
<td>Wi-Fi SoC</td>
<td>Y</td>
<td>-</td>
<td>Y</td>
<td>Y + BT4</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Linux</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Android</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Y</td>
</tr>
<tr>
<td>Windows 10 IoT</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Cost</td>
<td>$2 - $15</td>
<td>$30</td>
<td>$19</td>
<td>$80</td>
<td>$42</td>
<td>$140</td>
</tr>
</tbody>
</table>
IoT @ Microsoft
Client

- Windows IoT Core
- Open & Closed Tools
- Open & Closed Libraries

Cloud

- IoT Platform
  - On Azure Foundation
  - PaaS Components
- Solution Templates
  - Remote Monitoring
  - "SaaS" - like
IoT Device & Cloud Patterns

Device Connectivity & Management

Analytics & Operationalized Insights

Presentation & Business Connectivity

- Hot Path Business Logic
  - Service Fabric & Actor Framework

- Hot Path Analytics
  - Azure Stream Analytics, Azure Storm

- Batch Analytics & Visualizations
  - Azure HDInsight, AzureML, Power BI, Azure Data Factory

Microsoft Azure

Presentation & Business Connections

- Websites, Mobile Services
  - Dynamics, BizTalk Services, Notification Hubs

- Dynamic, BizTalk Server

- Presentation & Business Connectivity

Protocol Adaptation

Cloud Gateway

Event Hub

RTOS, Linux, Android, iOS, Windows

Field Gateway
Azure IoT Reference Architecture

- Devices and Data Sources
- Data Transport
- Device and Event Processing
  - Cloud Gateway
    - Provisioning API
    - Solution Portal
    - Identity & Registry Stores
    - Device State Store
    - Stream Event Processor
    - Storage
    - Analytics/Machine Learning
    - Control System Worker Role

- Presentation
  - Data Visualization & Presentation
Azure IoT: Software

We've found 28 repository results

**Azure/azure-iot-sdk**
SDks for a variety of languages and platforms that help connect devices to Microsoft Azure IoT services
Updated 4 hours ago

**Azure/azure-iot-remote-monitoring**
Azure IoT Remote Monitoring preconfigured solution
Updated 2 hours ago

**Azure/azure-iot-protocol-gateway**
Azure IoT protocol gateway enables protocol translation for Azure IoT Hub
Updated 5 days ago

**Azure/azure-iot-gateway-sdk**
Azure IoT Gateway SDK
Updated 10 hours ago
Developer Experience
...but we also support C#
Open Source Toolchain
A Complete Solution
## Workshop Goals

<table>
<thead>
<tr>
<th>EVENT DRIVEN PRODUCER</th>
<th>COLLECTION</th>
<th>TRANSFORMATION</th>
<th>STORAGE</th>
<th>PRESENTATION &amp; ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Devices</td>
<td>IoT Hub</td>
<td>Stream Analytics</td>
<td></td>
<td>Power BI</td>
</tr>
<tr>
<td>Applications</td>
<td>Event Hub</td>
<td></td>
<td></td>
<td>Web App</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Machine Learning</td>
<td>Storage</td>
<td>Productivity</td>
</tr>
</tbody>
</table>
Demo
ESP8266
ESP32

Figure 1-1. ESP32-DevKitC Layout
Partnerships
Adafruit is ranked #11 in the top 20 USA manufacturing companies and #1 in New York City by Inc. 5000 “fastest growing private companies.”
ESP8266 Starter Kit

- Easy to get started
- Open Source Hardware
- Example Code and Libraries all on GitHub
- Great to prototyping for both Makers and R&D
From Idea to Product

SAM Labs was incubated in Microsoft's London Accelerator.
Outreach
ConstructAR - The Holographic Tool Belt

Made by TEAM ConstructAR (Ron Dagdag) - Published in Hackster Dallas - Fort Worth, Hackster Live, Johnny-Five, littleBits, Microsoft, Oculus, Unity, and Virtual Reality

ABOUT THIS PROJECT

In Hololens, overlay as-built BIM model over Real World. Turn on/off content. IoT Integration for temperature, light switch and fan switch.

› mixed reality  › augmented reality
› home automation

PROJECT INFO

Type  Full instructions provided
Difficulty  Advanced
Published  June 30, 2016
License  GPL3+
Open Source HW/SW + EDU

GET CREATIVE, GET CONNECTED, GET CODING.

https://www.microbit.co.uk/
pxt.io (programming experiences toolkit)
Go Hack!

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Resources

- Azure IoT SDKs
  - https://github.com/Azure/azure-iot-sdks

- ESP8266
  - https://github.com/espressif/ESP8266_RTOS_SDK

- ESP32
  - https://github.com/espressif/esp-idf
  - https://ritazh.com/get-started-with-esp32-785a111476f2

- ThingLabs ESP8266 workshop
  - http://thinglabs.io/workshop/esp8266/

- VSCode
  - https://code.visualstudio.com

- Docker Image for ESP
  - https://hub.docker.com/r/vowstar/esp8266/