STMicroelectronics IOT Tutorials

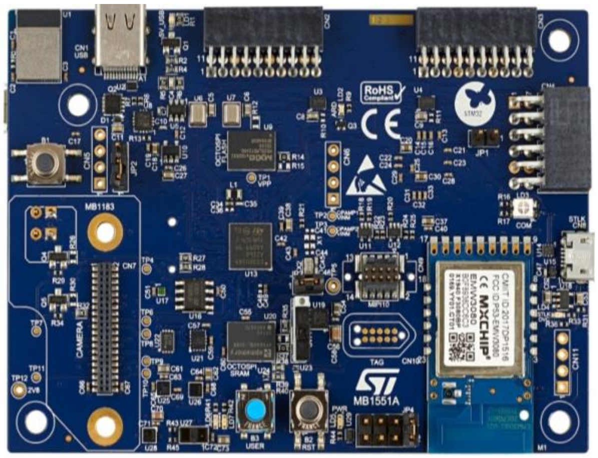

Figure 1. The STMicroelectronics IoT Platform - B-U585I-IOT02A

The IoT Platform shown in Figure 1 includes these components:

1) The IoT Platform Processor System is an STM32L4 microprocessor based on the ARM Cortex M33 system. This provides introduction to the ARM processor architecture that is deployed on nearly every smartphone on earth.

2) The IoT Platform Sensors includes:
   a) The ISM330DHCX combining microaccelerometer and microgyroscope.
   b) The IIS2MDCTR magnetometer for compass heading
   a) The LPS22HH barometric pressure sensor for determination of altitude and atmospheric pressure.
   b) Two MP23DB01HPTR microphones

3) The IoT Platform also includes non-volatile flash storage that stores the executable code that enables IoT system operation.

1) Tutorial 1: Introduction to the IoT Platform and Integrated Development Environment (IDE)
   - a) There are two versions of this tutorial. One for Apple Mac Platforms, and one for Microsoft Windows Platforms.
     - i) Tutorial 1: Introduction to the STM32CubeIDE Integrated Development Environment (IDE) for the Apple Mac Platform
     - ii) Tutorial 1: Introduction to the STM32CubeIDE Integrated Development Environment (IDE) for the Microsoft Windows Platform
   - b) This Tutorial provides an introduction to IoT platform also and its development tools.
   - c) The Tutorial steps include:
     - (1) Installing the STM32CubeIDE on a personal computer.
     - (2) Obtaining reference design example project software. This will specifically include a sensor Data Logging system.
     - (3) Usage of the IDE to Import, Build, Run, Debug and write the compiled (binary) code to the IoT Platform to run the example Data Logging project.

2) Tutorial 2: Sensor System Signal Acquisition, Event Detection and Configuration

   - a) This Tutorial provides experience in the development of applications that acquire IoT system sensor signals, detect events in the sensor system data stream, and also configure sensor systems.
   - b) The Tutorial steps provide:
     - i) An introduction to control of sensor signal acquisition and sensor system configuration. These topics are fundamental to IoT system development.
     - ii) An experience in software system development for the IOT Platform system demonstrating important capabilities of the STM32CubeIDE in accelerating system development.

3) Tutorial 3: Accelerometer Sensor Systems with Orientation and Motion Pattern Recognition

   - a) This Tutorial provides additional experience in sensor system data processing including recognition of gesture motion.
   - b) Experience from this Tutorial provides guidance for the development of capable IoT systems that recognize and may even guide specific motion. The Tutorial steps provide:
     - i) An introduction to accelerometer sensor systems and methods for detection of sensor orientation by exploiting gravitational acceleration signals.
     - ii) An introduction to gesture recognition through the use of sensor information and state machine systems for characterizing specific behavior.

4) Tutorial 4: Introduction to Machine Learning for IoT

    a) This Tutorial introduces a new Machine Learning platform entirely hosted and supported on the IOT microsystem. This provides the background required to develop new applications that enable the IOT Platform to autonomously learn from sensor signals and then process sensor signals and predict environmental events.

    b) This Tutorial and those that follow are enabled by the EmbeddedML system It is a technology advance allowing compact microsystems to train, learn and execute a machine learning system without reliance on external computing resources.

        i) The EmbeddedML system is demonstrated with a classic training and execution application.

5) Tutorial 5: Motion Recognition by Machine Learning

    a) This Tutorial provides the first introduction to a fully integrated system that acquires sensor data, learns to recognize events, and then executes on new sensor data to predict the occurrence of events. The events are motions.

        i) Critical experience is provided in the development of methods for designing and computing the characteristic "features" that can be applied to train a Neural Network Machine Learning System.

        ii) This system will take advantage of the insights from Tutorial 3 for sensing.

        iii) This also applies the concept of state machines from Tutorial 3 for development of sensor data acquisition, learning, and execution.

6) Tutorial 6: Motion Pattern by Machine Learning

    a) This Tutorial extends the concepts of Tutorial 6 to develop systems that recognize not only motions, but motion patterns consisting of two orientation changes of the IoT Platform.

7) Tutorial 7: Motion Pattern Recognition with Rotation Angle Sensing and Machine Learning

    a) This Tutorial introduces self-learning systems based on motion sensing. This introduces the microgyroscope sensor.

8) Tutorial 8: Motion Pattern Recognition by Inertial Sensing and Machine Learning for IoT

    a) This Tutorial is the capstone for E96i.

    b) This Tutorial introduces powerful systems for learning and then recognizing complex motion patterns.

    c) This include multiple final assignment options that students may select for their final course project submission.