IoT Based Health Care Monitoring System

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ARM MBED OS and Sensing Devices

ARM MBED OS

MBed is a platform and operating system for internet-connected devices based on 32-bit ARM Cortex-M microcontrollers. MBed OS provides the Mbed C/C++ software platform and tools for creating microcontroller firmware that runs on IoT devices. It consists of the core libraries that provide the microcontroller peripheral drivers, networking, RTOS and runtime environment, build tools and test and debug scripts. These connections can be secured by compatible SSL/TLS libraries such as Mbed TLS or wolfSSL, which supports mbed-rtos.

CCS811 / BME280

The CCS811 Air Quality Breakout is a digital gas sensor solution that senses a wide range of Total Volatile Organic Compounds (TVOC). It has Total Volatile Organic Compound (TVOC) sensing from 0 to 32,768 parts per billion and eCO2 sensing from 400 parts per million to 29,206 ppm. The sensor has 5 operating modes and an integrated MCU along with onboard processing. It uses a standard I2C digital interface.

The BME280 is a humidity sensor especially developed for mobile applications. It has an operating range of 300 – 1100 hPa and -40 to 85°C. BME280 supports both SPI and I2C interfaces. Its response time is 1s and it has an accuracy tolerance of ±3%. Further this board comes in an 8 pin LGA with metal contact.

MAX30102

The MAX30102 is an integrated pulse oximetry and heart-rate monitor module. It includes internal LEDs, photodetectors, optical elements, and low-noise electronics with ambient light rejection. The MAX30102 operates on a single 1.8V power supply and a separate 3.3V power supply for the internal LEDs. Communication is through a standard I2C-compatible interface.

The MAX30102 is fully adjustable through software registers, and the digital output data can be stored in a 32-deep FIFO within the IC. The Spi02 ADC has programmable full-scale ranges from 2μA to 16μA.

AWS IoT Integration

AWS IoT offers IoT services for industrial, consumer, and commercial solutions. In IoT, the thing is a device. In this project, the STM32L4 board B-L4SST-IOT01A is a thing. For AWS to connect to this device, there are a set of CA certificate and private key required. Once the AWS recognizes these certificates, it approves of the connection between the Device and the AWS IoT Core.

Policies help to grant access to the device, there are many services present in the AWS, so using these policies we will give read, write, and execute access to the thing. Later, once the policy is created, activate this policy, and attach it to the Thing. It also important to define the end rest point in the program. These end rest points are a gateway or endpoints of a channel. In this project, the rest point is based in us-east-2 (Ohio) region.

Root CA certificates help to authenticate client (Thing). Once created, this certificate is then registered with AWS IoT. Along with the certificate, public and private keys are also created. These assets are important for a successfully communication between the AWS IoT and the device thing. MQTT is a publish and subscribe protocol, meaning that instead of communicating with a server, client devices can publish data over a network to a server and a broker can access the data published. It generally publishes over IP.

AWS offers a variety of services to its clients. As a result, the display monitor will be designed using AWS resources that are already available. If data needs to be monitored in real-time then Sitewise is the right service to go forward with as it provides data for every minute whenever the telemetry data comes in.

Summary/Conclusions

This project taught us how to integrate various sensors with the STM32 series of Microcontrollers. This project also enabled us to understand the working of a real time operating system which can be used to give efficient and urgent response. We also understood how AWS can be integrated to form a complete system which can be used to monitor data for real time purposes. Last but not the least we also understood how Artificial Intelligence works which can help us make the system smarter.

Key References

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