Embedded Software Engineer

Candidate Task

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1. Introduction

This project is an application of sensor module. Aim of the project is measuring acceleration and giving an output. An acceleration sensor and microcontroller used in. There are multiple scenarios to use it. One of these scenarios is using it for limiting acceleration of moving devices and the other one is mobile devices. Module reads the acceleration and compares it with threshold value. If acceleration is higher than threshold, module set a digital output high. This can be used as sound output or light output or digital output for other control systems. Hardware of the output is not concerned at the project.

2. Research

A microcontroller and a sensor should be selected for the project. 32-bit microcontroller, which is produced by STMicroelectronics, is selected. STM32F303K8T6 is used to implementation. STM32F303K8T6 has Arm Cortex-M4 32-bit CPU with FPU up to 72 MHz frequency, rich peripherals and HAL support. HAL support is very important. It makes porting software very easy when developing software with STM32 microcontroller family. In addition, I already have a development board with STM32F303K8T6 microcontroller. That was another reason to choose it, development simplicity.

Secondly, I checked an alternative for this microcontroller. STM32F303K8T6 is very fast and powerful but also it is expensive. It can increase BOM cost. So, I checked very popular component supplier's website and find STM32F030K6T6 on stock with very lower price, same package and same peripherals I used. Thanks to STM HAL Library, it is very easy porting the software. Same Timer, I2C and GPIO peripherals can be use in this microcontroller with very low effort.

Finally, I find ADXL345 digital accelerometer from Analog Devices. ADXL345 is popular sensor. I choose ADXL345 because of ultralow power consumption, small and thin package, low BOM cost, and I2C interface. Also, programmable interrupts, additional sensing functions for mobile devices (single tap/double tap detection, activity/inactivity monitoring, free-fall detection) are available for future developments. Also, an enhanced version of ADXL345 is available for defense and aerospace applications (AQEC standard).

MCU Datasheets: https://www.st.com/resource/en/datasheet/stm32f303k8.pdf

https://www.st.com/resource/en/datasheet/stm32f030k6.pdf

Sensor Datasheet: https://www.analog.com/media/en/technical-documentation/data-sheets/ADXL345.pdf

3. Development Spectations

- Timer6 is set to 250ms interval.
- Sleep enabled on exit interrupt routines.
- Sensor used +-4g range.
- Frequency of readings in sleep mode setting is 8 Hz.
- Other sensor settings used as default.

Repository: https://github.com/ccanik/TIM_Task