Sensortile.box介绍

Jie Yu Jan. 2020







SensorTile.box 2

准备就绪的物联网节点

- 外壳防护等级: IP54
- 与智能手机的应用程序配合





www.st.com/content/st_com/en/products/evaluation-tools/product-evaluation-tools/mems-motion-sensor-eval-boards/steval-mksbox1v1.html

SensorTile.box 开发套件 3



SensorTile.box 板 ___



SensorTile.box 感知、处理和连接



SensorTile.box 框图

SensorTile.box 操作模式 ___

SensorTile.box直连手机,即开即用 用户可以直接访问app预定义的应用功能

专家模式 可

开发人员可以使用智能手机上的图形应用程序 定义额外的应用程序,如同搭乐高积木 无需编程,直接构建自己的应用程序

完全兼容支持STM32开放式开发环境

- 完全兼容Cube.MX工具
- ALLMEMS2和AI功能包可用
- 兼容ST-LINK V3编程/调试 (电平转换到1.8V)

SensorTile.box 不同用户的选择 11

SensorTile.box 如何开始?

3) 通过micro USB线连接 SensorTile.box到PC上

4) 运行【ST BLE Sensor】 点击【开始扫描】

手机连接SensorTile.box 1

5) 选择你自己的 SensorTile.box

> 与移动设备蓝牙连接成功后蓝 色LED灯开始闪烁 (2s)

修改设备节点名(1) 17

• 当网络中有多个设备时建议修改设备节点名以避免混淆

修改设备节点名(2) 18

• 当网络中有多个设备时建议修改设备节点名以避免混淆

app会自动检测SensorTile.box里的固件是否最新

7) 点击 上传固作	古按键 牛更新
▶ ← 固件升级	≵ 🔃 - ≝⊿ 🛿 11:00
Board Name: SENSOI Version: 3.0.8 MCU Type: L4R9	Info RTILE.BOX
Selected firmware: SELECT FILE	SEN\$ORTILE.B OX_v822.bin
	9

更新最新固件 19 8) 等待固件

上传完成

	Decend lafe
Name: Version: MCU Type	SENSORTILE.BOX 3.0.8 e: L4R9
Selected SELECT F	firmware: SENSORTILE.B OX_v322.bin FILE
Uploade	d 587360 bytes

固件更新后再连接

9) 一旦固件更新完成,点击【确定】,重新插拔电池让SensorTile.box 复位,再连接到ST BLE Sensor App

10) 打开【Options】,点击【固件升级】,可以查看当前 SensoTile.box的固件版本信息

预定义功能示例 23

预定义的app 24

1) 点击主界面下的 [Create a new app]

* № : * 12:41 Example Apps	Baby Crying Detector
	Barometer
8 Baby Crying Detector ↑	Compass and Level
Barometer	Data recorder
★ Compass And Level	Human Activity recognition
■ Data recorder	Pedometer
∦ Human Activity recognition ↑	Sensor Fusion - Quaternion
≱ Pedometer	Vibration monitor - Compare
t∰ → = SENSORS START MORE	Vibration monitor - Training

2) 预定义的应用实例

3) 点:	击【	Se	nsor
Fusion]	后	的	【↑】

Example Apps Turnan Accurry recognition Pedometer Pedometer Sensor Fusion - Quaternion Vibration monitor - Vibration monitor - Training Vibration monitor - Training EXPERT VIEW		* № ÷4	12:41 🗌 🗌
 Pedometer Ŷ Pedometer Ŷ Sensor Fusion - Quaternion Ŷ Vibration monitor - Compare Ŷ Vibration monitor - Training Ŷ Vibration monitor - Training Ŷ Vibration 	Example App	S	
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* Vibration monitor - Compare T Vibration monitor - Training T EXPERT VIEW	Sensor Fusion	on - Quaterni	
■ Vibration monitor - Training ↑ EXPERT VIEW	Xibration mo Compare	onitor -	Ť
EXPERT VIEW	Vibration mo	onitor - Traini	ing ↑
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SENSORS START MORE	SENSORS S	→← FART	MORE

点击【Play】	
* № ** ⊿ ■ 12:42	← Board
Available boards	Available boar
Scanning for nearby boards. Choose your board to run the apps.	Scanning for nearby b your board to run the a
C) TILEBOX @3207FD T PLAY	Overwrite boar Any Apps currently on board will be re Continue?
	с

加载Sensor Fusion示例 25 4)选择您的设备 5)点击【OK】

* 🔊 🖆 📋 12:42 rd y loaded eplaced. ОК CANCEL

进入Sensor Fusion app I 26 7) 重新连接设备 6) 等待app加载完成 进入Sensor Fusion界面 * 🔃 🖆 📋 12:43 ⊁ 🔃 :⁴⁵⊿ 📋 12:42 * 🔊 🧉 📋 12:42 * 1 Mems Sensor... ST BLE Sensor App loaded successfully Uploading your App It may take few seconds. Please wait... 确定 Co 重置

Sensor Fusion 操作 ____

9) 向左滑动屏幕进入 【Plot Data】 绘图界面

8) 点击 四图标开始 做绕 四字校 准

29

- 专家模式允许用户在ST BLE Sensor app中使用专家界面创建自己的 应用程序/算法。
- 用户可以使用各种输入和函数:
 可用输入和表达式

Temperature Sensor	Battery low
Humidity Sensor	Bluetooth connected
Pressure Sensor	Logic False
Accelerometer (low power)	Logic True
Accelerometer (vibrometer)	USB Connected
Gyroscope	
Accelerometer (inclinometer)	
Magnetometer	
Microphone	
RTC (time)	
RTC (data)	

输出
通过蓝牙输出到手机
存储到SD卡
通过USB输出到PC
通过指示灯显示逻辑结果

温湿度传感器: HTS221

气压传感器: LPS22HH

▲低功耗加速度计: LIS2DW12

2 振动计: LSM6DSOX

陀螺仪: LSM6DSOX

倾角加速度计: LIS3DHH

磁力计: LIS2MDL

麦克风: MP23ABS1

实时时钟: STM32L4R9ZI

专家模式示例:实现自由落体检测

• 如何用SensorTile.box的专家模式来实现自由落体的检测?

[Create a new app]

1) 点击主界面下的 2) 【Example apps】列 表拉到最下方,点击 [Expert View]

	本 🛽	2 12.41
Example /	Apps	
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* Pedome	ter	Ŧ
Sensor I	Fusion - Quaterni	on ↑
Xibratio Compare	n monitor - e	Ŧ
Vibratio	n monitor - Train	ing ↑
	EXPERT	VIEW
章 SENSORS	→ ← START	MORE

3) 点击【+New App】

4) 点击 [Select input source]

	∦ 🔃 ீ⊿ 🖡 13:48
← New App	
INPUT	
Select input source	
× TERMINATE	✓ SAVE APP
ented	,

5)	选择用到的传感器 (这里选择的是
	LIS2DW12) ∗ เ≦ਾ ≅ I 13:48 ← Input sources
	SENSORS
	Temperature sensor
	Humidity sensor
	Pressure sensor
	Acceleration sensor (Low power)
	Vibrometer
	Gyroscope sensor
	✓ SET INPUT

选择传感器 33

6) 设置选中的传感器

≱ 🔃 ։ ≝⊿ 13:48
← New App
🔅 Acceleration sensor (Low power) 🔹
FUNCTIONS
Choose a function
OUTPUT
Choose output
X TERMINATE

	≱ 🔃 ։ "⊿ 💈 13:49	
	← Input options	
	High performance mode	
	OUTPUT DATA RATE (ODR)	
	50.0 Hz 👻	
	LOWPASS FILTER	
	No filter 👻	
	HIGHPASS FILTER	
	No filter 🔹	
	FULL-SCALE (FS)	
	2 g 🔹	
5	✓ SAVE CONFIG	
ife.augme	nted	

8) 选择函数 【Choose a function】

* 🔊 🗳 13:48
← New App
Ø INPUT
Acceleration sensor (Low power)
FUNCTIONS
Choose a function
OUTPUT
Choose output
X TERMINATE

9) 选择"阈值比较"

设置判断阈值 35

11) 再添加一个函数

10) 设置阈值参数

设置判断标准 36

13) 选择"逻辑非"

14) 选择输出为"True"或是"False"

		* 🔃 🖆 🛿 13:51
	 ← Functions 	
	AVAILABLE FUNCTIONS	5
	O Logic AND	
	O Logic OR	
	O Logic XOR	
	Logic NOT	
ife.augmented		

← New App	
0	
亞 Acceleration sensor (Low power)	۵
Σ Threshold Comparison	۵
Σ Logic NOT	
+ ADD FUNCTION	
OUTPUT	
Choose output	
X TERMINATE V SAVE AF	pp

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		* 🔃 🛀 💈 13:51
← (Dutput	
AVAILA	BLE OUTPUT I	METHODS
🗌 Sa	ave as Input	
Sa Sa	ave as EXP	

16)使能LED显示

17) 保存APP

× № * 🗹 🕴	13:52
← ST BLE Sensor	
APP DETAILS	
Add a name and notes to your App	
NAME	
Free-fall	
DESCRIPTION	
✓ FINI	SH

		* 🛚	4 🛿 13:52
÷	Custo	m Apps	
Cu Up YC	Istom A load and run DUR APPS	pps the app on yo + NEW APP	ur board. F TPLAY
E	• Free-fall		T
SI		→ ← START	MORE

19) 设置【IF condition】

20) 为App选择蓝牙输出

加载新的App到SensorTile.box 40

21) 点击【PLAY】, 等待加载App到SensorTile.box

A 🖸 🔼 13.34	∦ (N ⊭ ⁴ 6⊿ (2) 13:54	* 🕅 🖆 13:5
 ← Board Available boards Scanning for nearby boards. Choose your board to run the apps. 	 ← Board Available boards Scanning for nearby boards. Choose your board to run the apps. 	춛 ★ № - '∡ № 13:
TILEBOX @3207FD	Overwrite board Any Apps currently loaded on board will be replaced. Continue? OK	Uploading your App It may take few seconds. Please wait

自由落体检测 41

22) App加载成功后,再次连接 SensorTile.box

23) 界面中绘制事件计数图形

- 开发人员可以根据需要在SensorTile.box上编写/调试自己的代码
- SensorTile.box提供两种编程/调试的方法:
 - 1. 通过板上的JTAG接口连接ST-Link V2或是ST-LINK V3编程器
 - 2. 通过Micro USB连接PC使用STM32的DFU功能

- 1. 把JTAG适配器插到ST-LINK上
- 2. 用扁平线缆连接ST-LINK和SensorTile.box (注意两块板子的pin1位置)
- 3. 通过Micro USB线为SensorTile.box上供电
- 4. 用Mini USB线将ST-LINK连接到PC上

通过ST-LINK用ST-LINK Utility更新固件 45

- 用STM32 ST-LINK Utility更新固件
 - 1. 选择【Connect to the target】连接目标板,读取 MCU内当前的二讲制文件
 - 2. 选择【Target】→【Erase Chip】擦除STM32 FLASH
 - 3. 选择【File】→【Open File】,将.bin文件下载到目 标板上
 - 4. 选择【Target】→【Program】
 - 5. 点击【Start】开始下载
- Sensortile.box固件下载: •

https://www.st.com/content/st_com/en/products/embedded-software/mcu-mpu-embe software/stm32-ode-function-pack-sw/fp-sns-stbox1.html

• ST-LINK Utility 工具下载:

https://www.st.com/content/st_com/en/products/development-tools/software-developr development-tools/stm32-programmers/stsw-link004.html

Memory display Address: 0x08 Device Memory @	3000000 Si:	ze: 0x3F14 Binary File	4 Data W	idth: 32 bits	~	Device Device ID Revision ID Flash size	STM32L4Rx/L4Sx 0x470 Rev Y 2MBytes	□Live	Jodat
rget memory, Ad	dress range: [0x	08000000 0x080	003F14]					18-19- 1	
Address	0	4	8	С	ASCII				_
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x08000030	08001765	00000000	08001767	08001769	e	gi			
x08000040	080017B1	080017B5	080017B9	080017BD	??.	? ?			
x08000050	080017C1	080017C5	080017C9	080017CD	??.	? ?			
x08000060	080017D1	080017D5	080017D9	080017DD	??.	?			
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xx09000080	<pre>CSN: 52FF71065 77 ted via SWD. requency = 4,0 M in Low Power mot D10:0x470 flash Size: 2MBy family :STM32.4# er mode enabled.</pre>	11855253273903 Hiz. al. le enabled. tes tx/L45x e/stm3	⁸⁷ pevice ID:0x 82-eml	470 bedde	d-	← De	vice List .BOOT .3:95:9F.E5:19:8F		

其他工具的使用

Unicleo GUI 47

- 支持Unicleo-GUI:
 - Data logging, MLC, FSM
 - 可通过ST BLE SNESOR App实现MLC编程

Unicleo-GUI

https://www.st.com/content/st_com/en/products/embedded-software/evaluation-tool-software/unicleo-gui.html

• FP-SNS-STBOX1固件

https://www.st.com/content/st_com/en/products/embedded-software/mcu-mpu-embedded-software/stm32-embedded-software/stm32-ode-function-pack-sw/fp-sns-stbox1.html

AlgoBuilder 48

• 支持AlgoBuilder

- 提供图形化算法设计的操作界面帮助用户实现软件编程以及调试
- 支持DFU模式下编程

🛃 AlgoBuilder GUI		🗐 SensorTile.box Programmi	ng In DFU Mode	>
File Edit View Firmware Tools Help	🏙 🊔 👗 = = ‡ 피 🗽 ++ 🔍 오, ①, @, 📪 👼 😿 🔂 🔂 😫 🛤 Not	SensorTile.box: Enter DFU Option 1	Mode Option 2	Option 3
Filter: X > Buffers ^ > Comparison ^ > Constants > > Display > > FFT > > Graphics	Firmware Settings × Firmware Location Tookhain / IDE	- Disconnect Battery - Disconnect USB Cable - Hold BOOT Button - Connect USB Cable	- Hold BOOT Button - Press RESET Button	COM4 Enter DFU Mode
Logic Operators Logic Operators Math Operations MotionAC MotionAC MotionFC MotionFX MotionFC MotionFC MotionFD	Target SensorTile.box NUCLEO.41768G + X-NUCLEO-IKS01A2 NUCLEO.41768G + X-NUCLEO-IKS01A2 NUCLEO.41768G + X-NUCLEO-IKS01A2 NUCLEO.41768G + X-NUCLEO-IKS01A2	SensorTile.box: Firmware D Erasing Programing	ownload	0%
> MatianMC > MatianPM > MatianPW > MatianTL	NOCLEO THORE A TROCEO INSTITUS Sensor Tile Sensor Tile box	Option 1 - Disconnect USB Cable	Option 2 - Press RESET Button	Option 3 - Automatic
Subdesigns 6 × Filter: X IForLoopTemplate		- Connect USB Cable		
ISubdesignTemplate IWhileLoopTemplate				Close

AlgoBuilder安装包:

life.augmented

https://www.st.com/content/st_com/en/products/embedded-software/mems-and-sensors-software/inemo-engine-softwarelibraries/algobuilder.html

