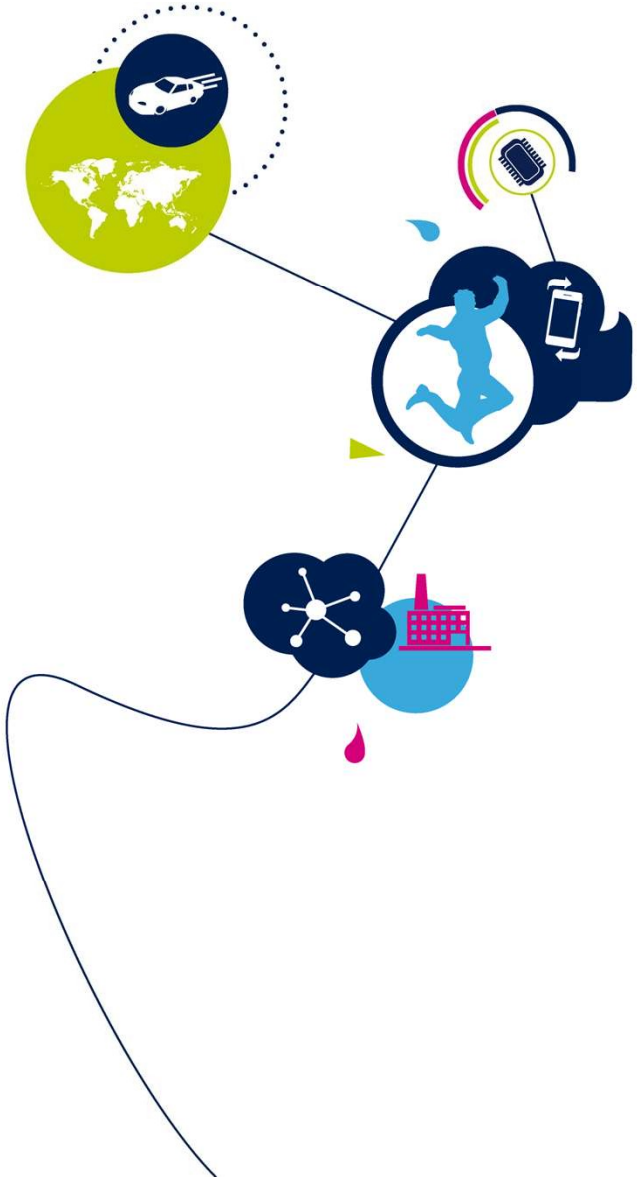
Sensortile.box介绍

Jie Yu

Jan. 2020



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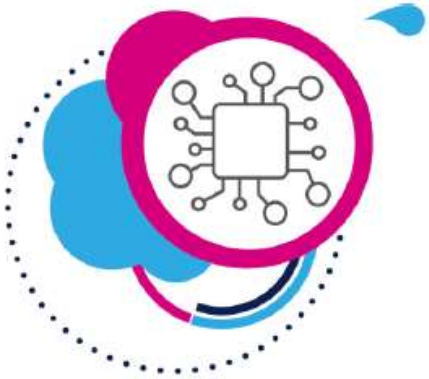
SensorTile.box

准备就绪的物联网节点

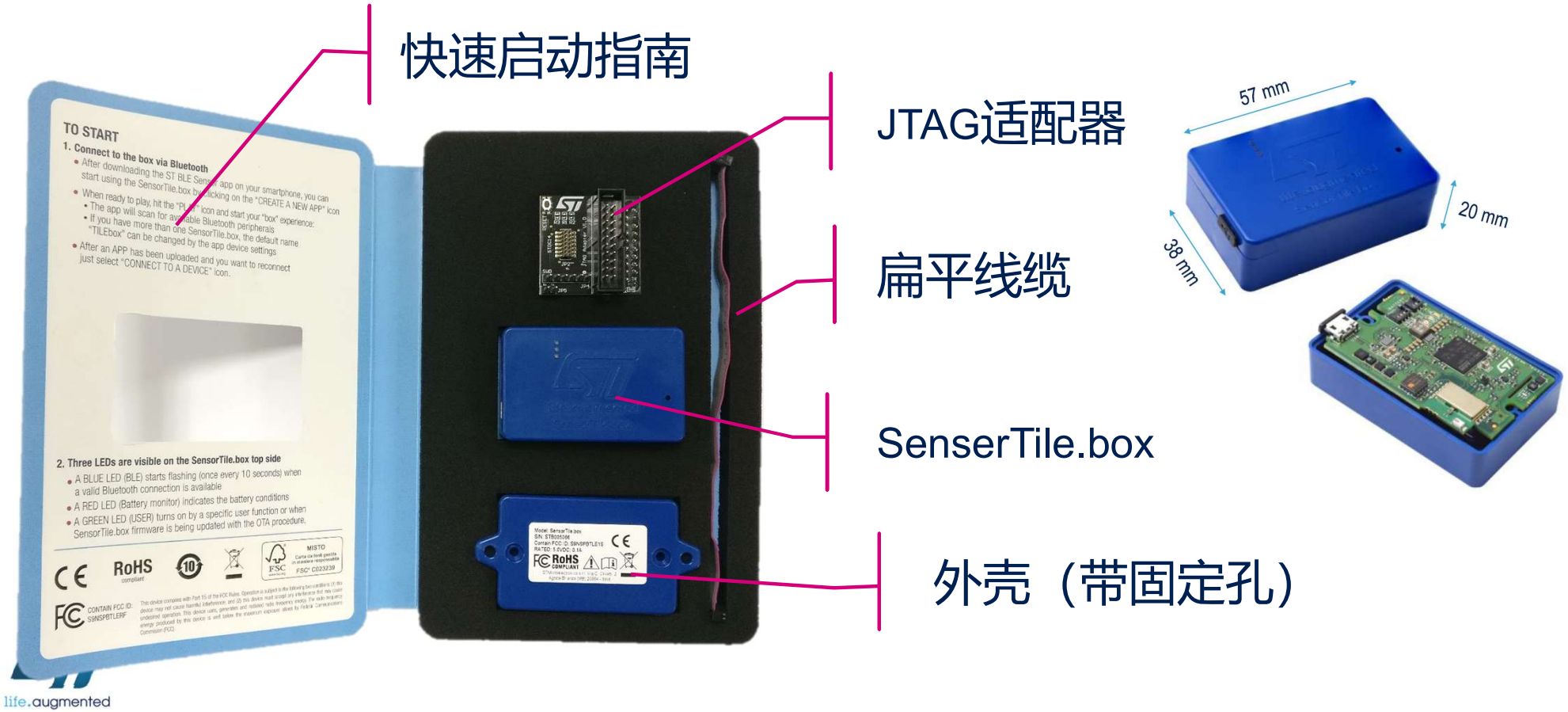
- 外壳防护等级：IP54
- 与智能手机的应用程序配合



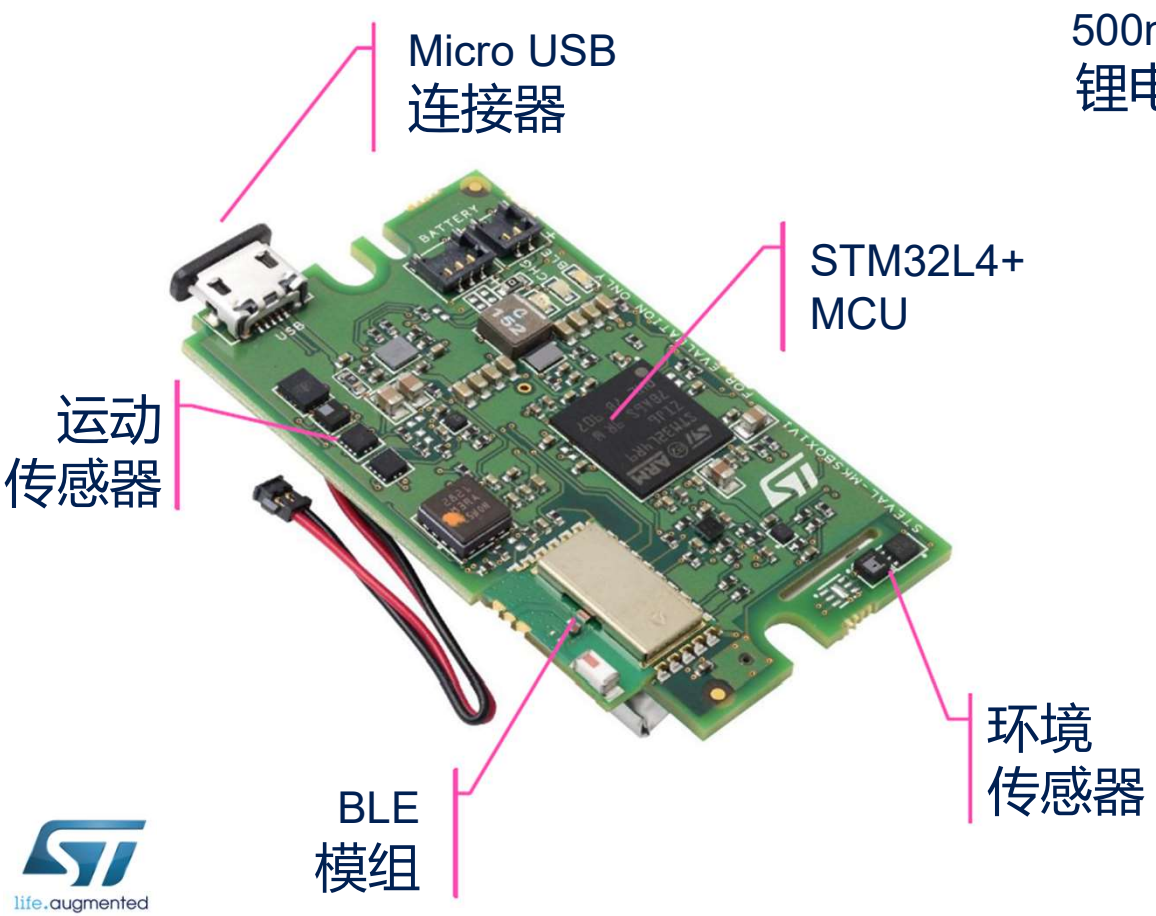
型号：STEVAL-MKSBOX1V1

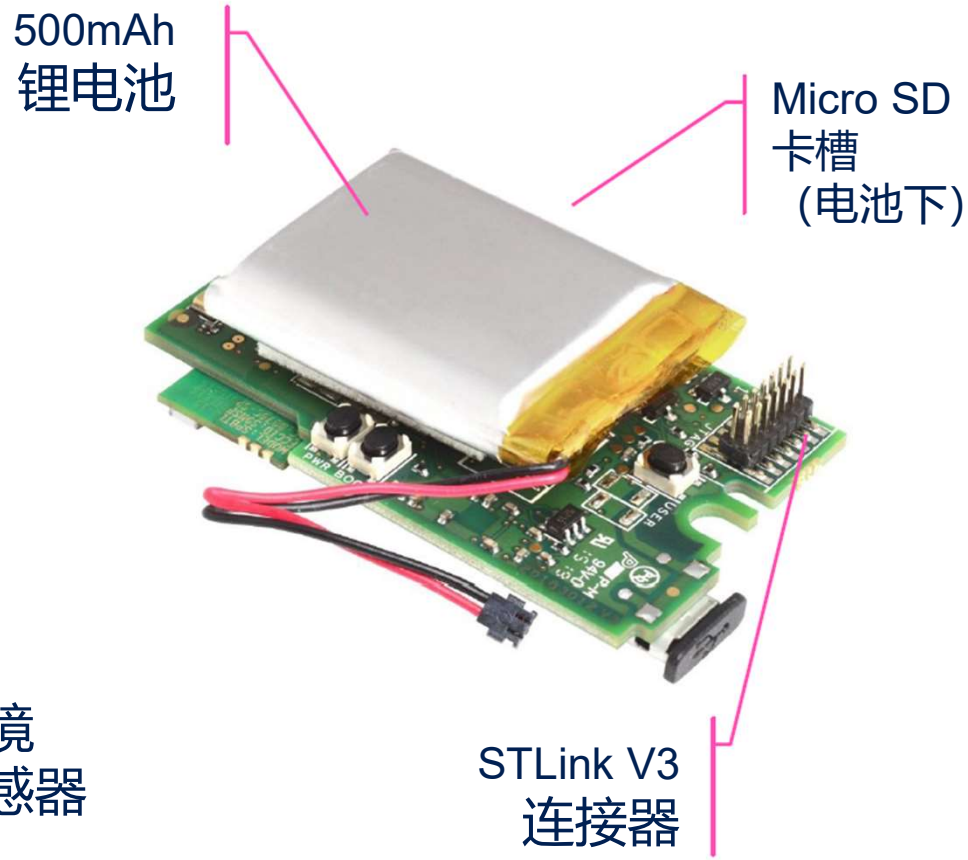
https://www.st.com/content/st_com/en/products/evaluation-tools/product-evaluation-tools/mems-motion-sensor-eval-boards/steval-mksbox1v1.html

SensorTile.box 开发套件



SensorTile.box 板





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SensorTile.box 感知、处理和连接

运动传感器

低功耗6轴IMU
内嵌FSM和MLC
LSM6DSOX

高性能和低功耗加速度计
LIS3DHH & LIS2DW12

磁力计
LIS2MDL

环境传感器

高度计/气压计
LPS22HH

高精度温度传感器
STTS751

温湿度传感器
HTS221

模拟麦克风
MP23ABS1

处理器

STM32L4低功耗MCU
STM32L4R9ZIJ6

连接

低功耗蓝牙模组
SPBTLE-1S

电源管理

电池充电
STBC02

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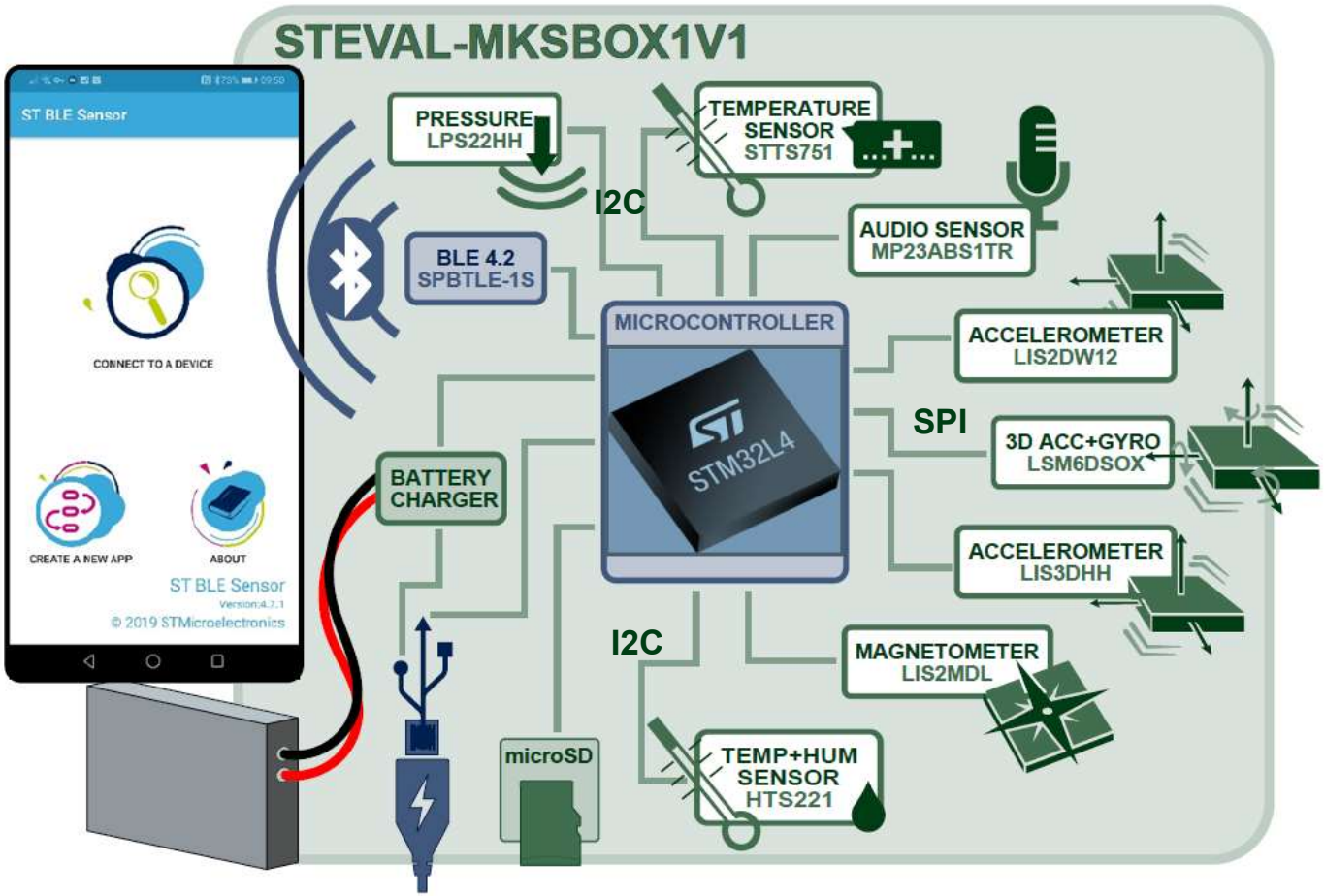
SensorTile.box 框图



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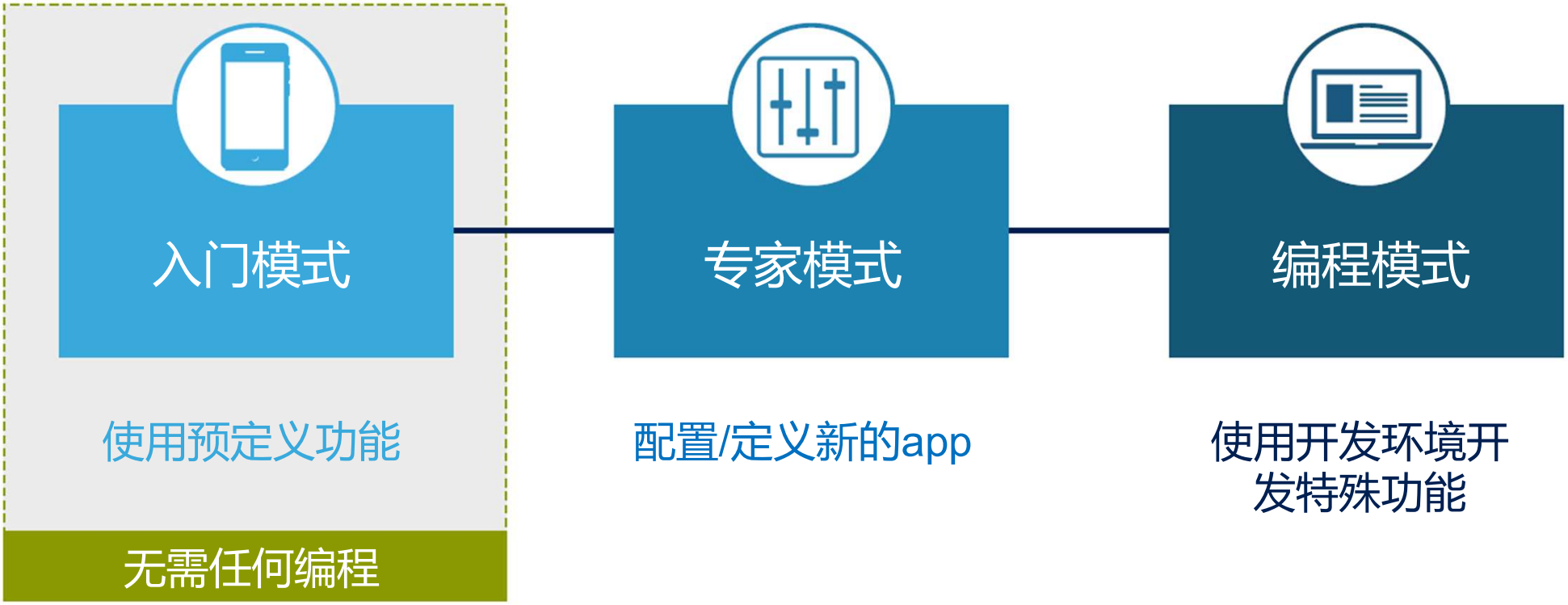
SensorTile.box 操作模式



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入门模式

- 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

计步器

数据计录器

振动检测

婴儿哭声监测

气压计

指南针和水平仪

车辆/货物追踪

AI based

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专家模式

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

专家模式下的一些配置示例

功耗优化	硬铁零偏补偿	模式识别、精度
可以单独激活或关闭单个传感器，仅启用所需的传感器	组装固定后，可以单独校准	可以激活神经网络和专用传感器融合

编程模式

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）

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SensorTile.box 不同用户的选择

没有编程经验的用户

让没有编程能力的潜在客户拥有开箱即用的传感器试验平台
例如，非工程公司愿意开发与Iot相关的用例

系统集成

高效紧凑的集成平台，嵌入高性能的传感和处理能力

云开发人员

通过传感器和应用程序来试验功能的实现

教育

易于获取传感器技术
提供各种操作模式——从简单操作到复杂编程

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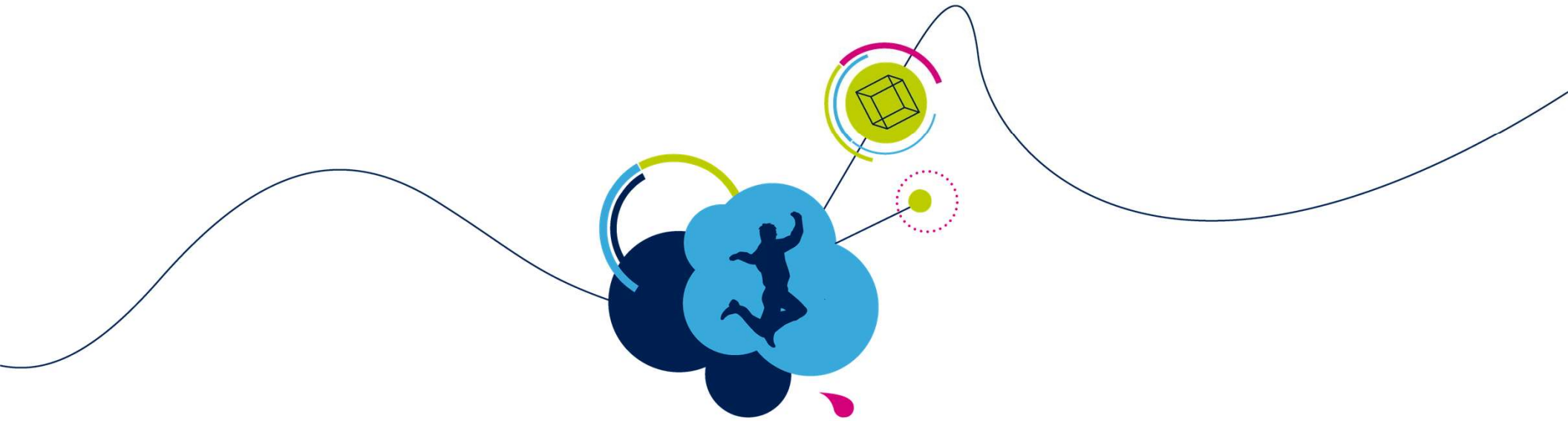

SensorTile.box 如何开始?

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手机App

- ST BLE Sensor app下载：

GET IT ON Google Play

Download on the App Store

安卓系统最新的apk可以从eeworld下载：http://bbs.eeworld.com.cn/thread-1105280-1-1.html

安装电池

1）旋开两边螺丝

2）插上电池线

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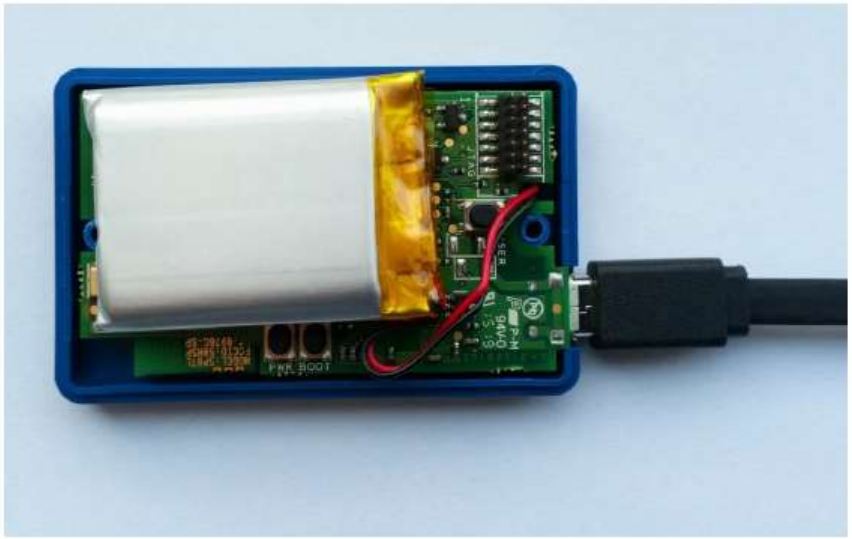
电池充电

3）通过micro USB线连接SensorTile.box到PC上

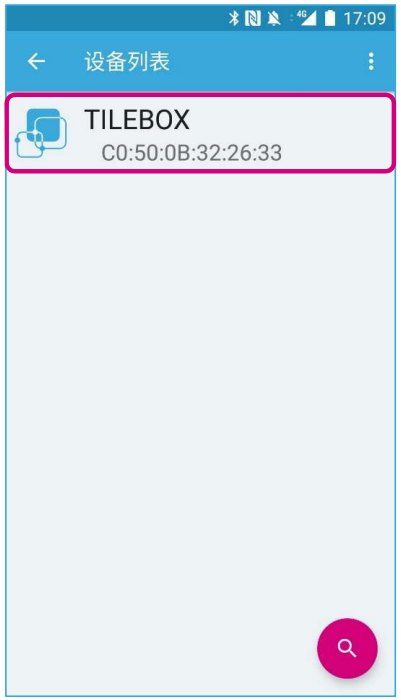


红色LED灯开始闪烁
（充满电后红灯不再闪烁）

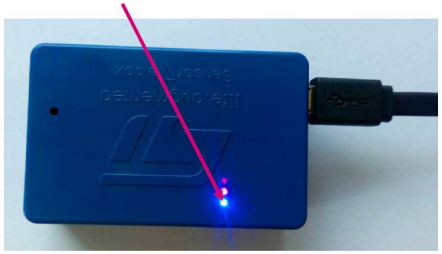
手机连接SensorTile.box

4）运行【ST BLE Sensor】
点击【开始扫描】

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）



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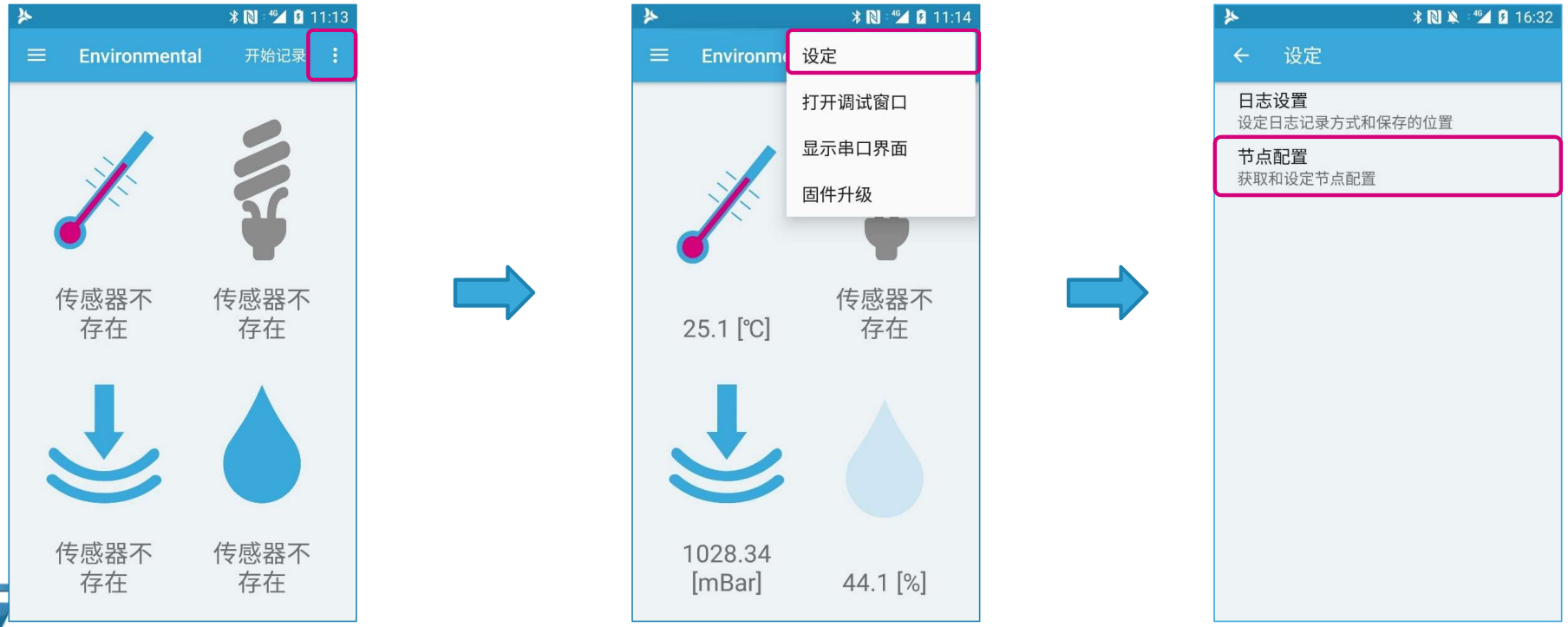
修改设备节点名(1)

- 当网络中有多个设备时建议修改设备节点名以避免混淆



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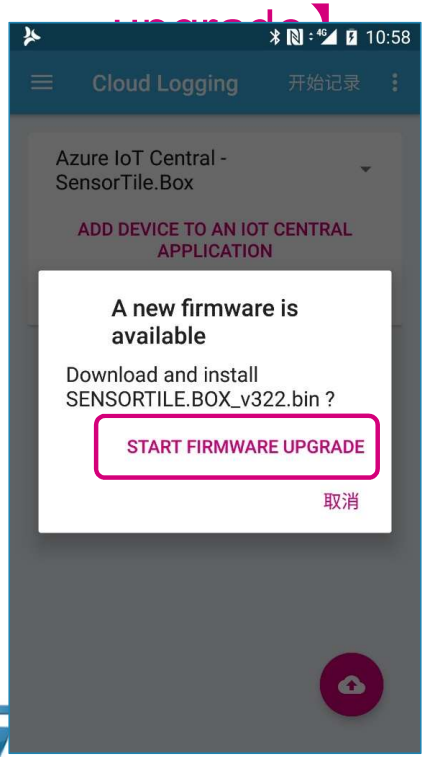
修改设备节点名(2)

- 当网络中有多个设备时建议修改设备节点名以避免混淆

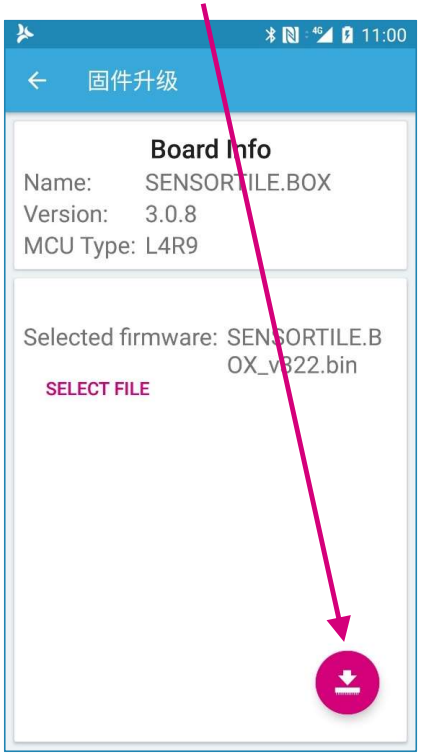
app会自动检测SensorTile.box里的固件是否最新

更新最新固件

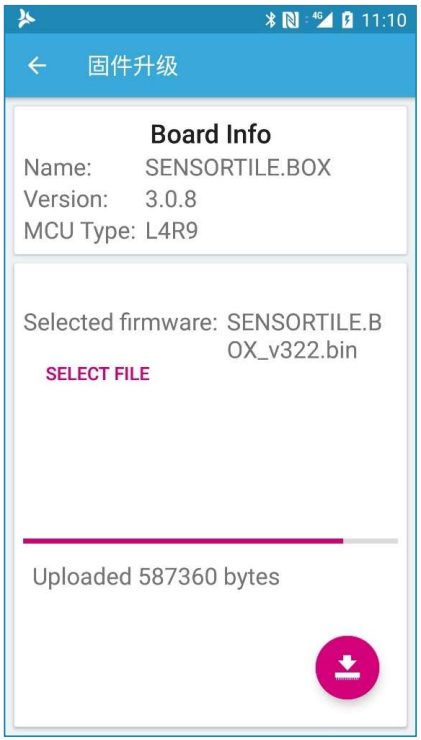
6）点击【Start firmware upgrade】



7）点击按键上传固件更新



8）等待固件上传完成



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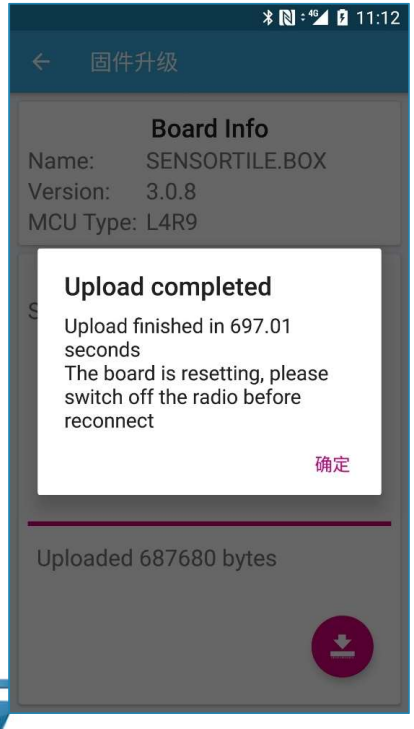
固件更新后再连接

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



固件更新后MAC地址会有所变化

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检查固件版本

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

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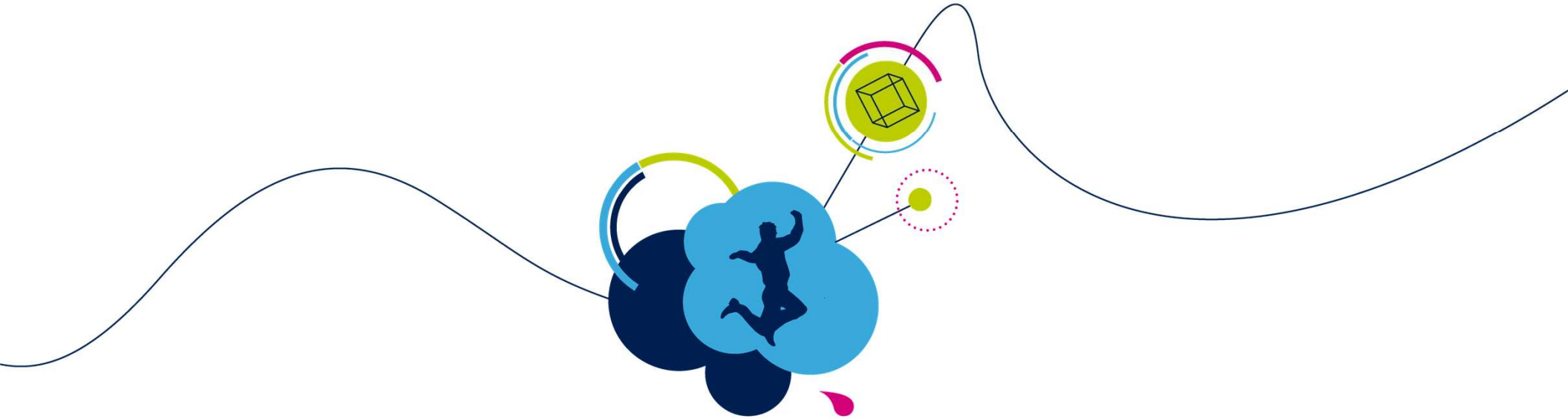

入门模式

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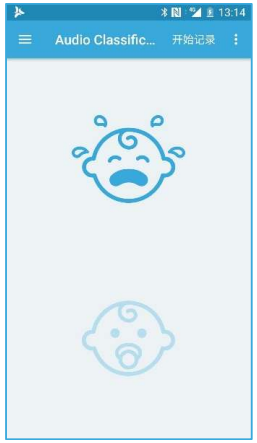
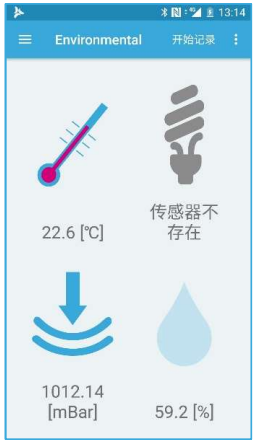
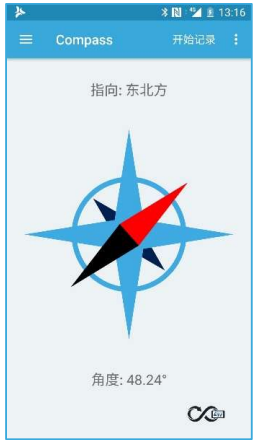
预定义功能示例

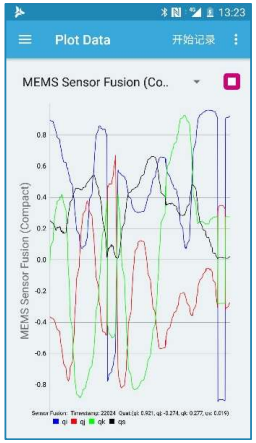
- Baby Crying Detector
- Barometer
- Compass and Level
- Data recorder
- Human Activity recognition
- Pedometer
- Sensor Fusion - Quaternion
- Vibration monitor - Compare
- Vibration monitor - Training

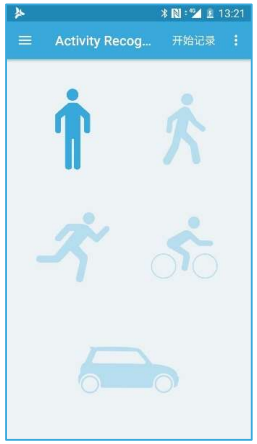
*将继续增加新的应用

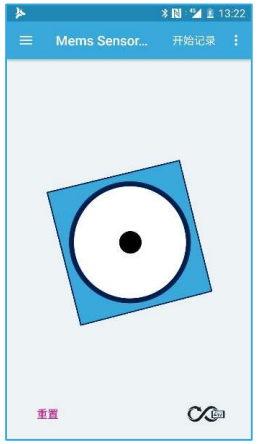


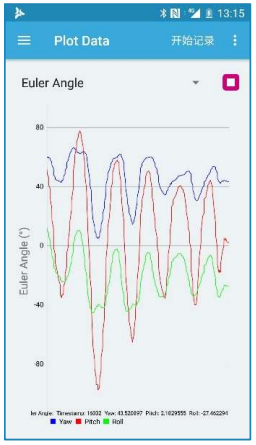








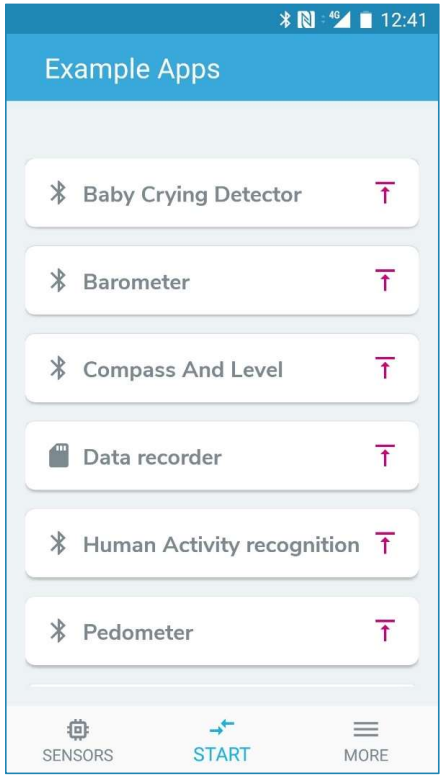




预定义的app

1）点击主界面下的
【Create a new app】

2）预定义的应用实例



- Baby Crying Detector
- Barometer
- Compass and Level
- Data recorder
- Human Activity recognition
- Pedometer
- Sensor Fusion - Quaternion
- Vibration monitor - Compare
- Vibration monitor - Training

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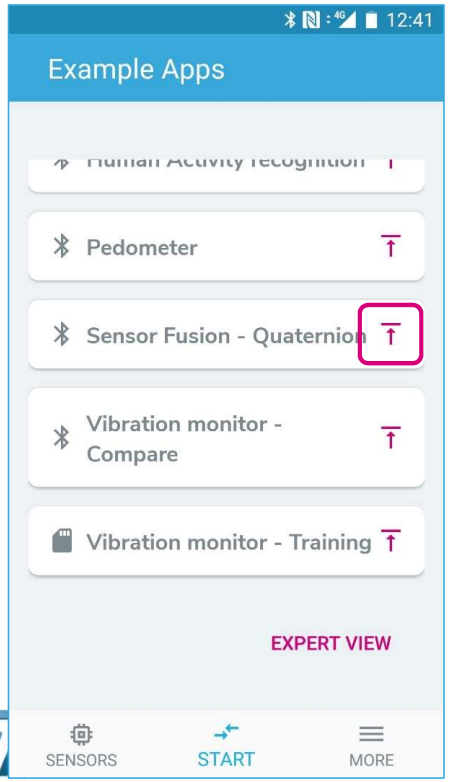
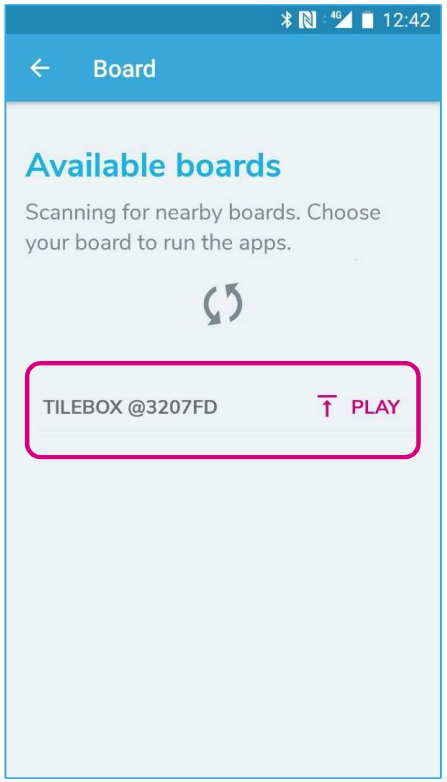
加载Sensor Fusion示例

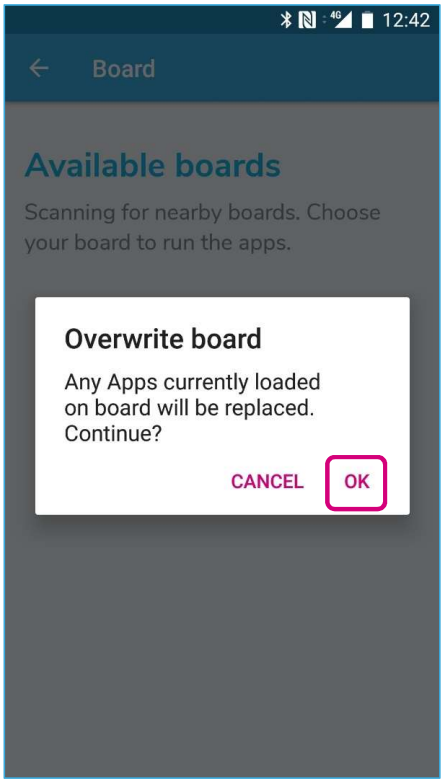
3）点击【Sensor Fusion】后的【↑】



4）选择您的设备
点击【Play】



5）点击【OK】



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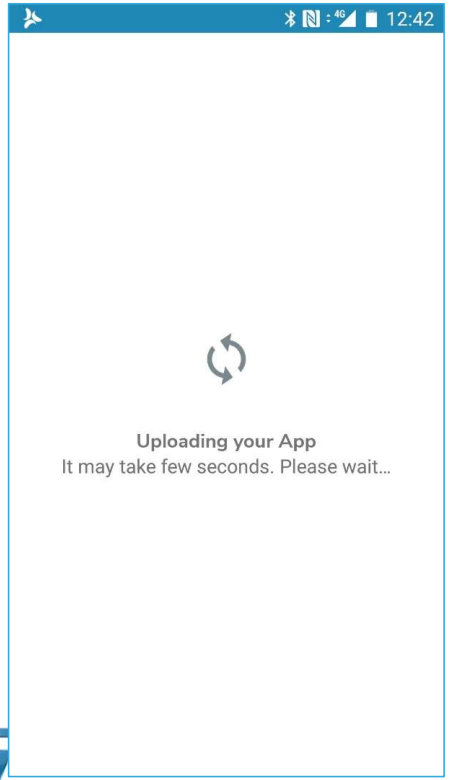
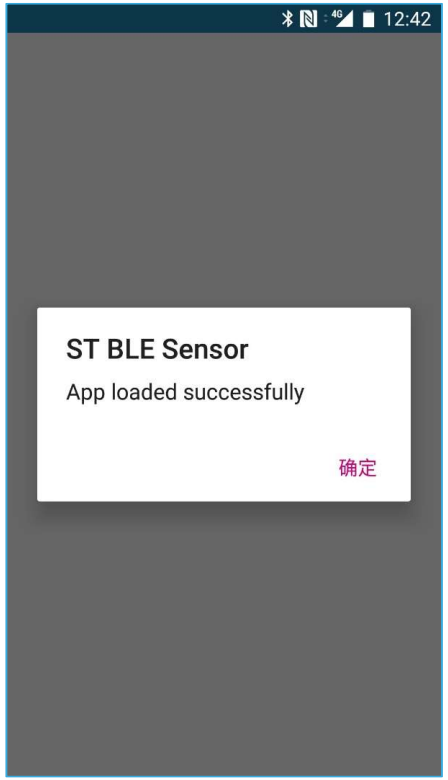
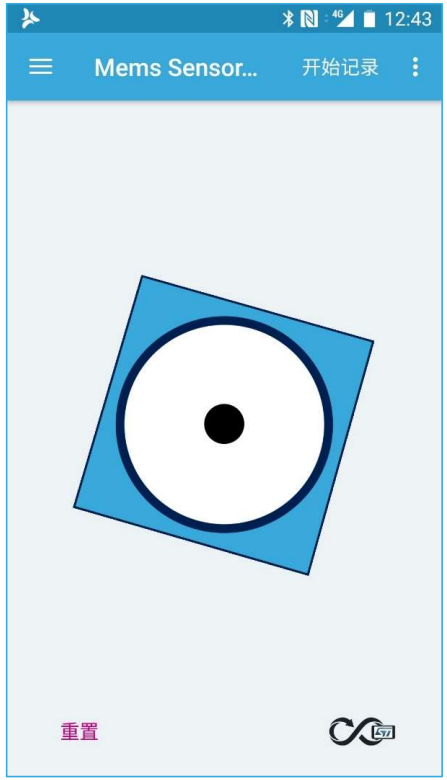
进入Sensor Fusion app

6）等待app加载完成





7）重新连接设备
进入Sensor Fusion界面



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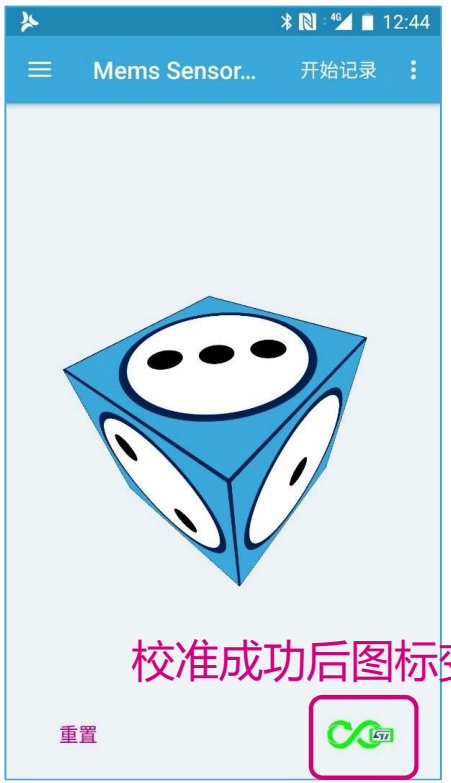
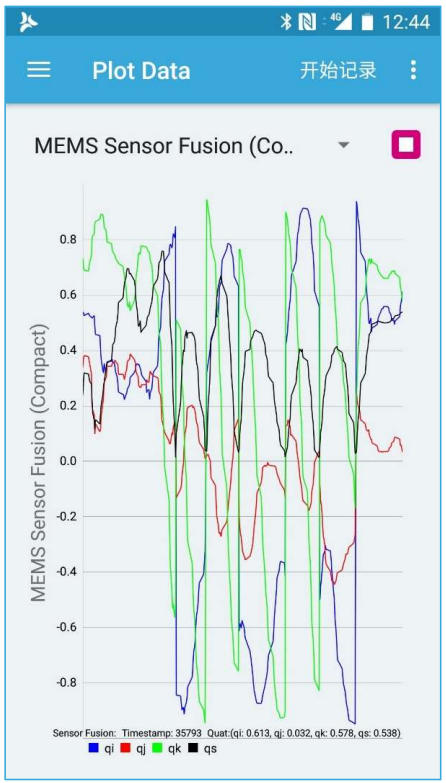
Sensor Fusion 操作

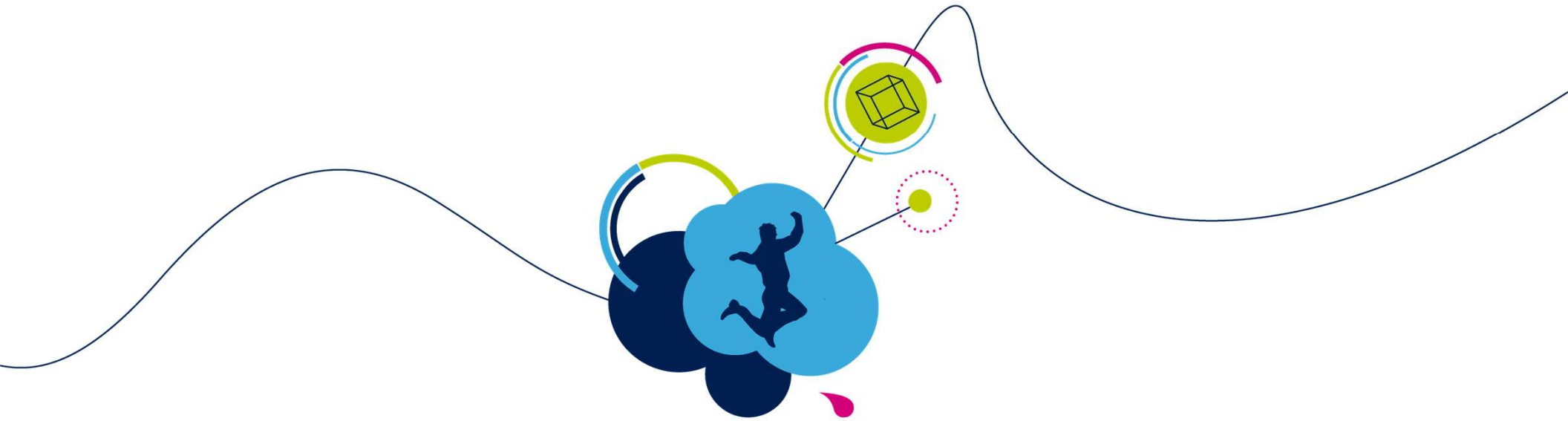
8）点击∞图标开始做绕∞字校准



校准成功后图标变绿色

9）向左滑动屏幕进入【Plot Data】绘图界面





专家模式

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专家模式

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

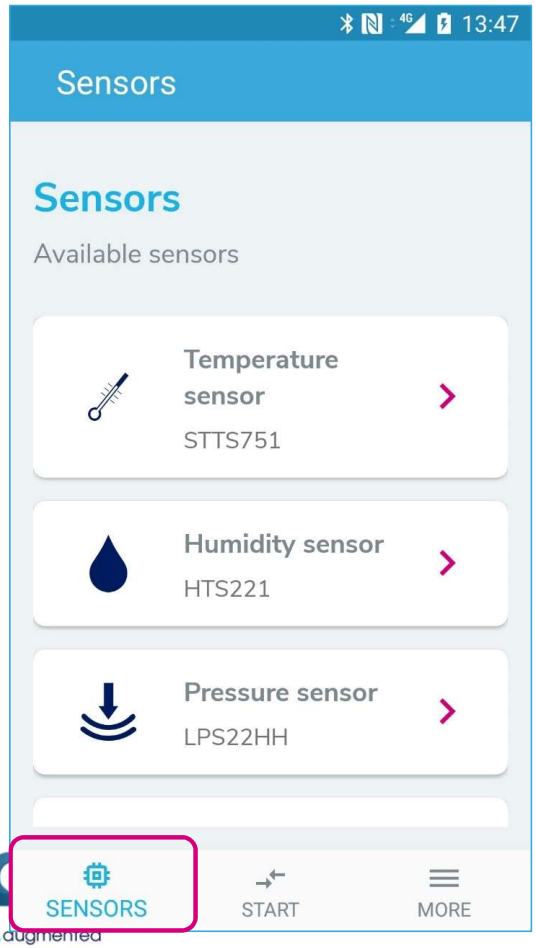
可用函数

- ARMA (自回归取平均)
- FFT
- Pedometer
- RMS
- MAX
- MIN
- NORM
- AVG
- Standard Deviation
- Threshold Comparison

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

传感器输入



温度传感器: STTS751

温湿度传感器: HTS221

气压传感器: LPS22HH

低功耗加速度计: LIS2DW12

振动计: LSM6DSOX

陀螺仪: LSM6DSOX

倾角加速度计: LIS3DHH

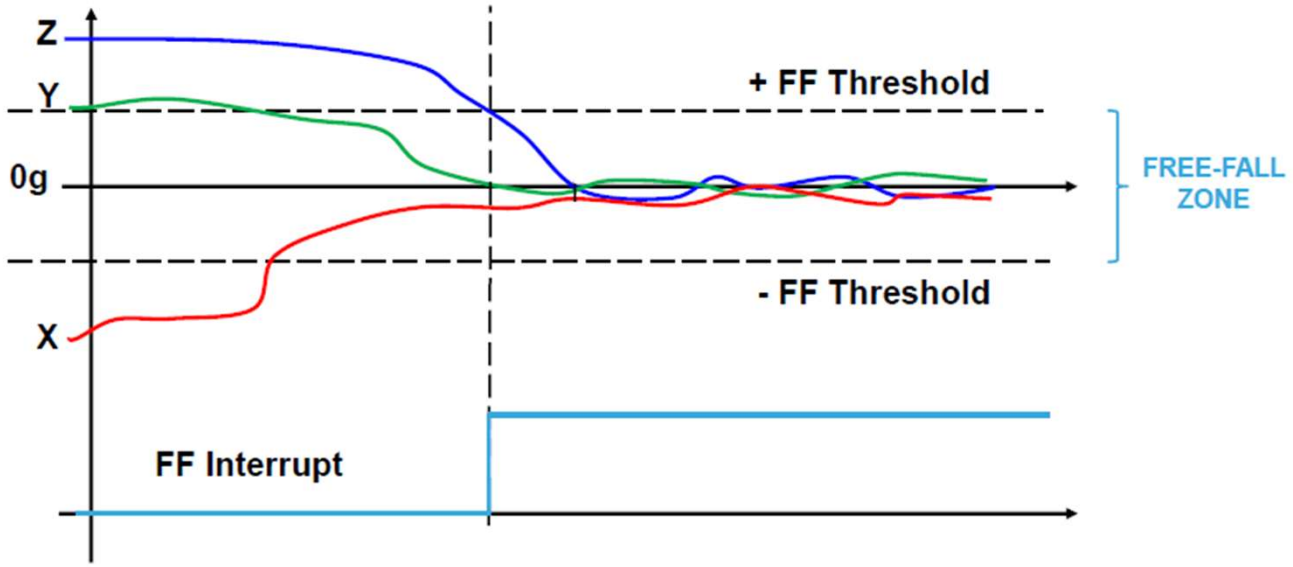
磁力计: LIS2MDL

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?



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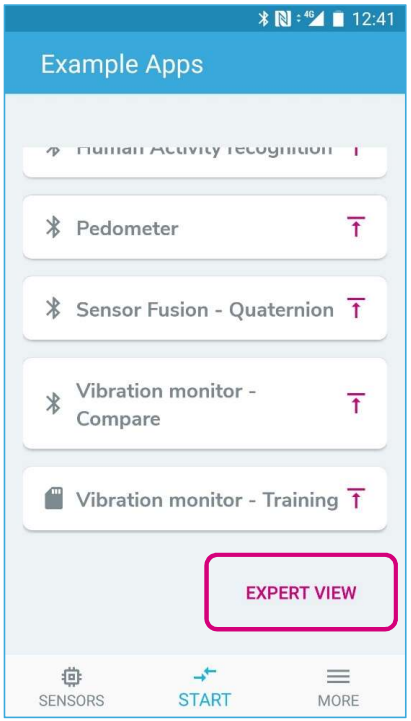
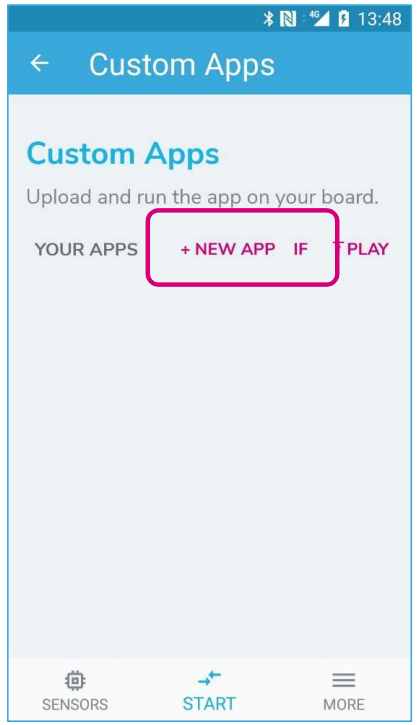
创建新的App

1）点击主界面下的【Create a new app】

2）【Example apps】列表拉到最下方，点击【Expert View】



3）点击【+New App】



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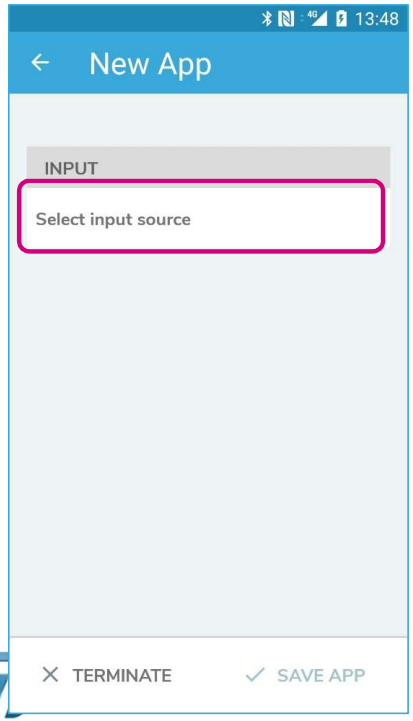
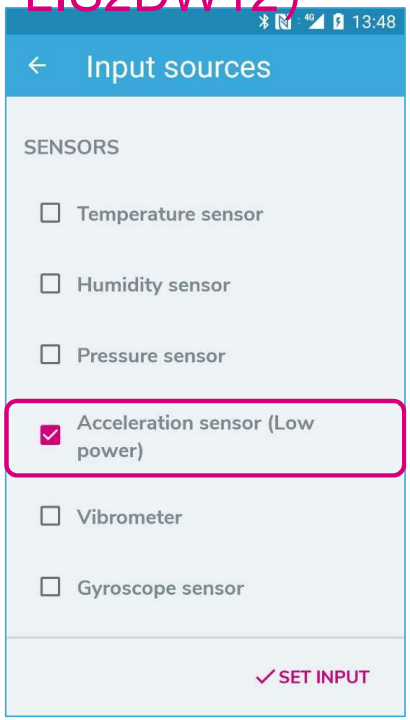
选择传感器

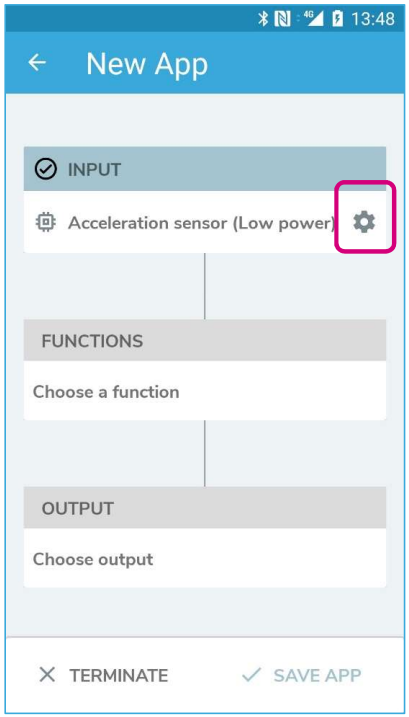
4）点击
【Select input source】



5）选择用到的传感器
（这里选择的是
LIS2DW12）



6）设置选中的传感器



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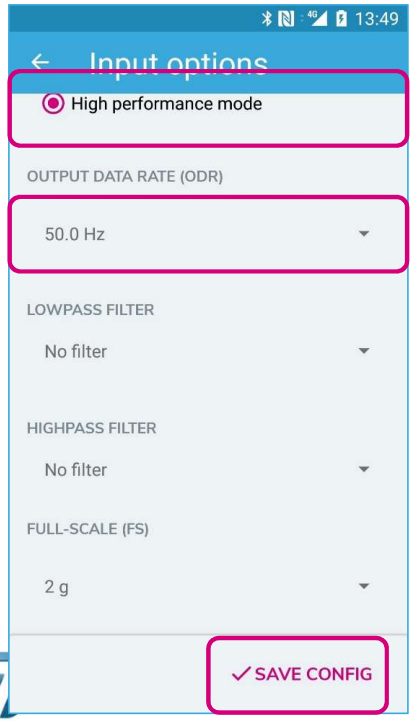
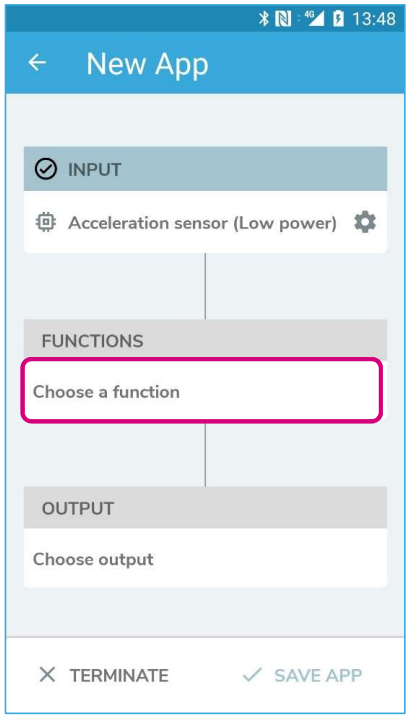
设置参数

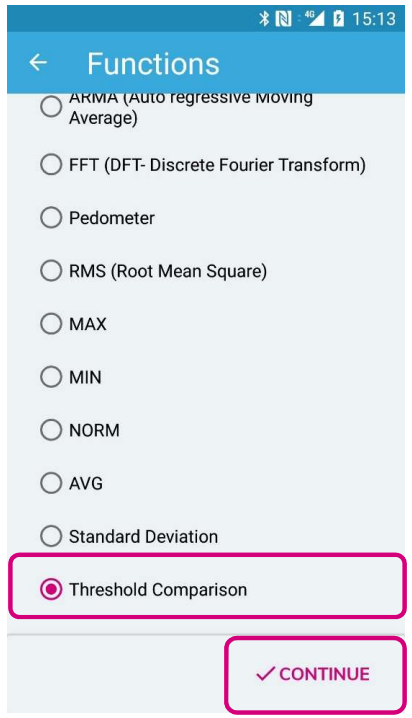
7）选择传感器参数配置并保存



8）选择函数【Choose a function】



9）选择“阈值比较”



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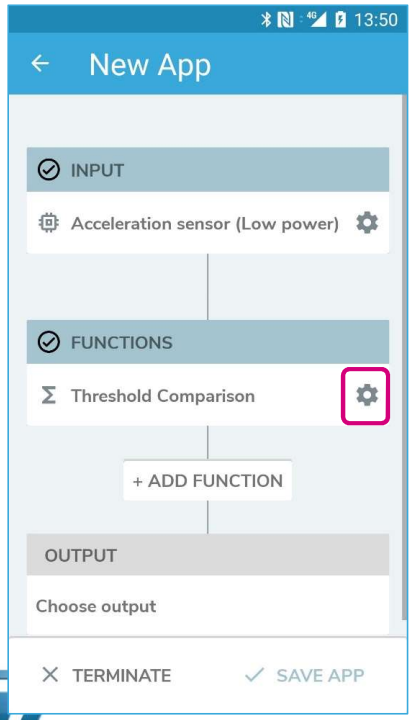
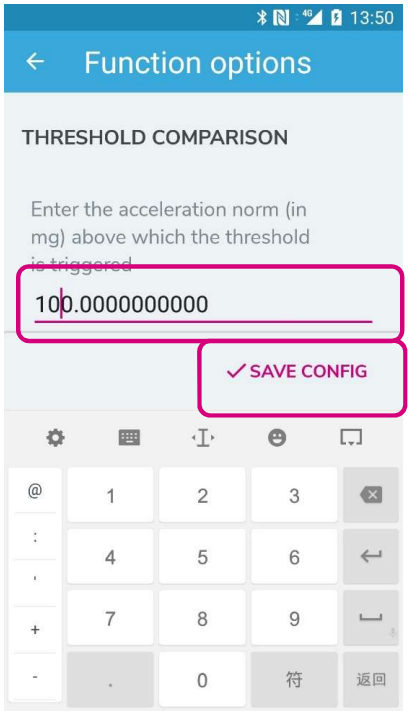
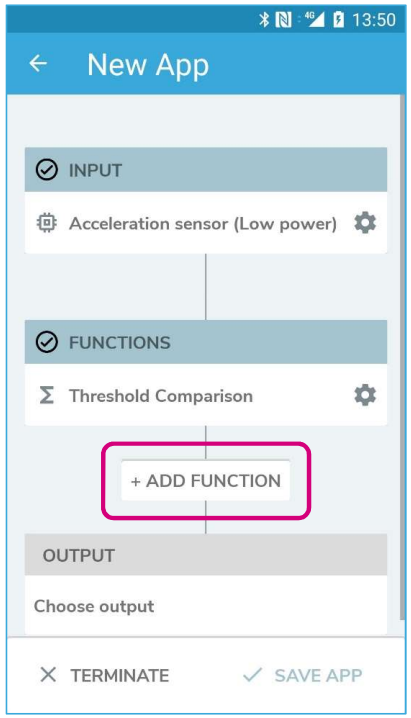
设置判断阈值

10）设置阈值参数





11）再添加一个函数



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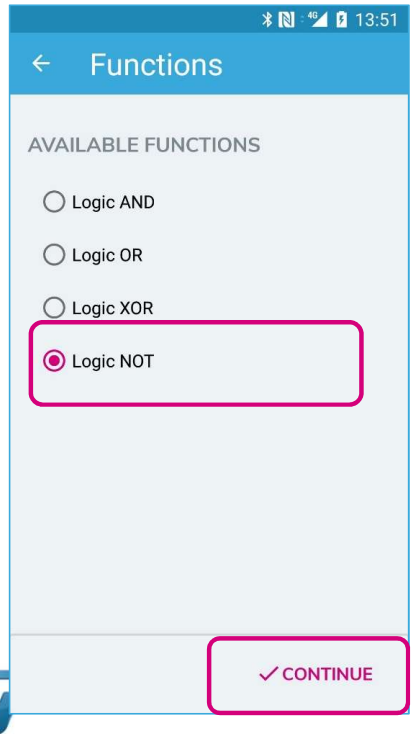
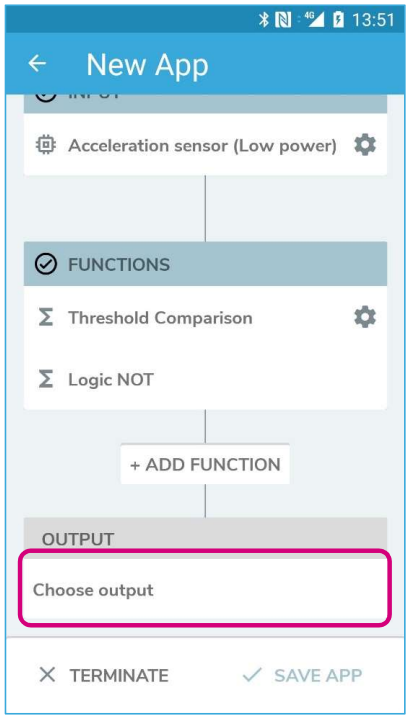
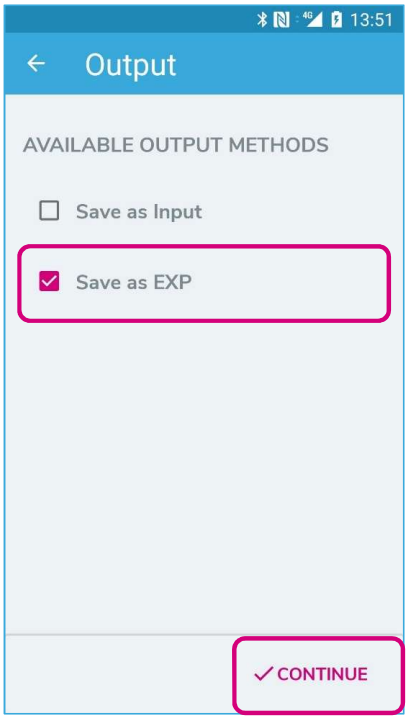
设置判断标准

13）选择“逻辑非”

14）选择输出为“True”或是“False”







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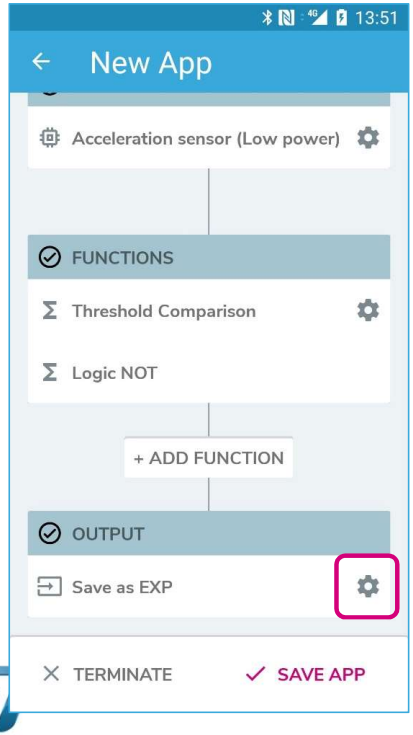
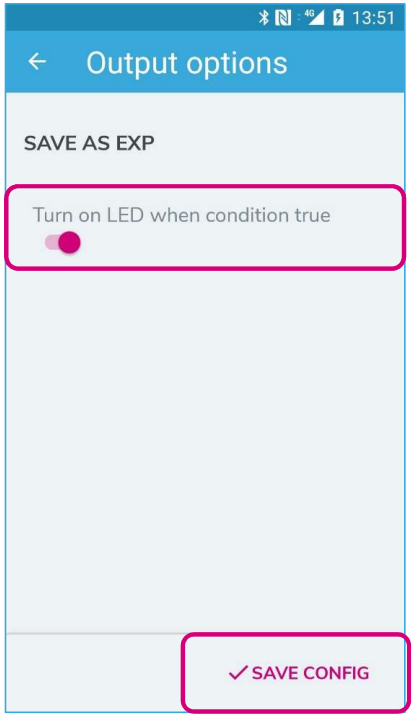
设置LED显示

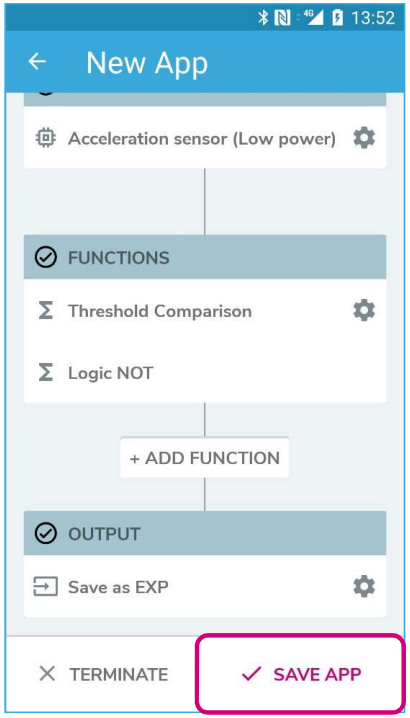
15）设置所选中的输出



16）使能LED显示



17）保存APP



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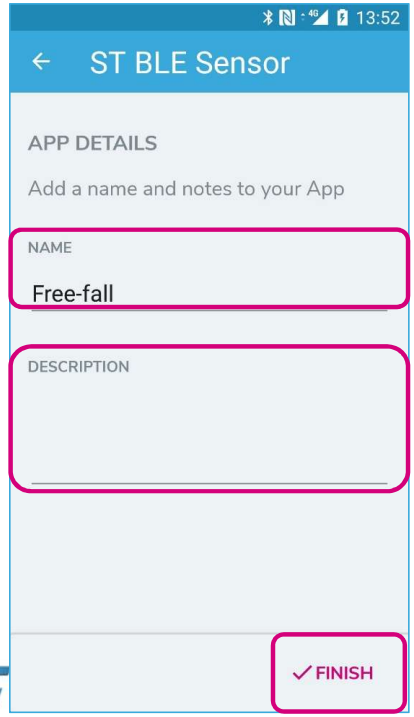
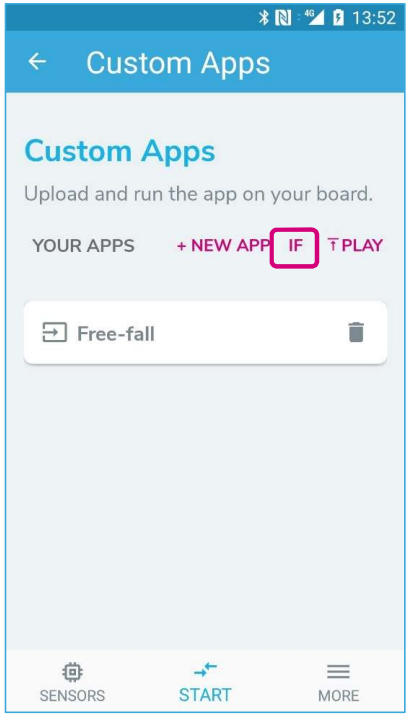
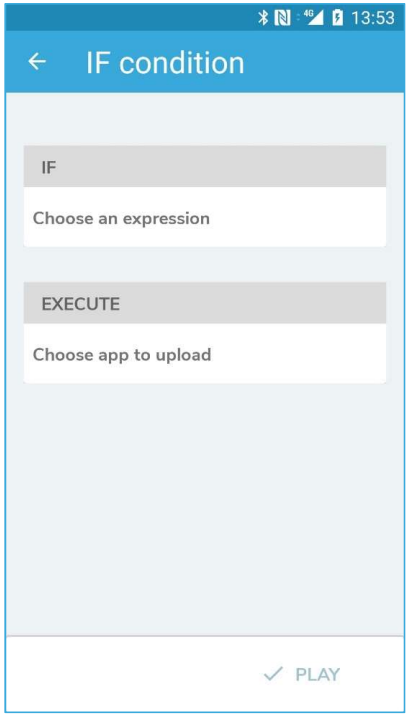
保存App

18）填写app名和描述



19）设置【IF condition 】





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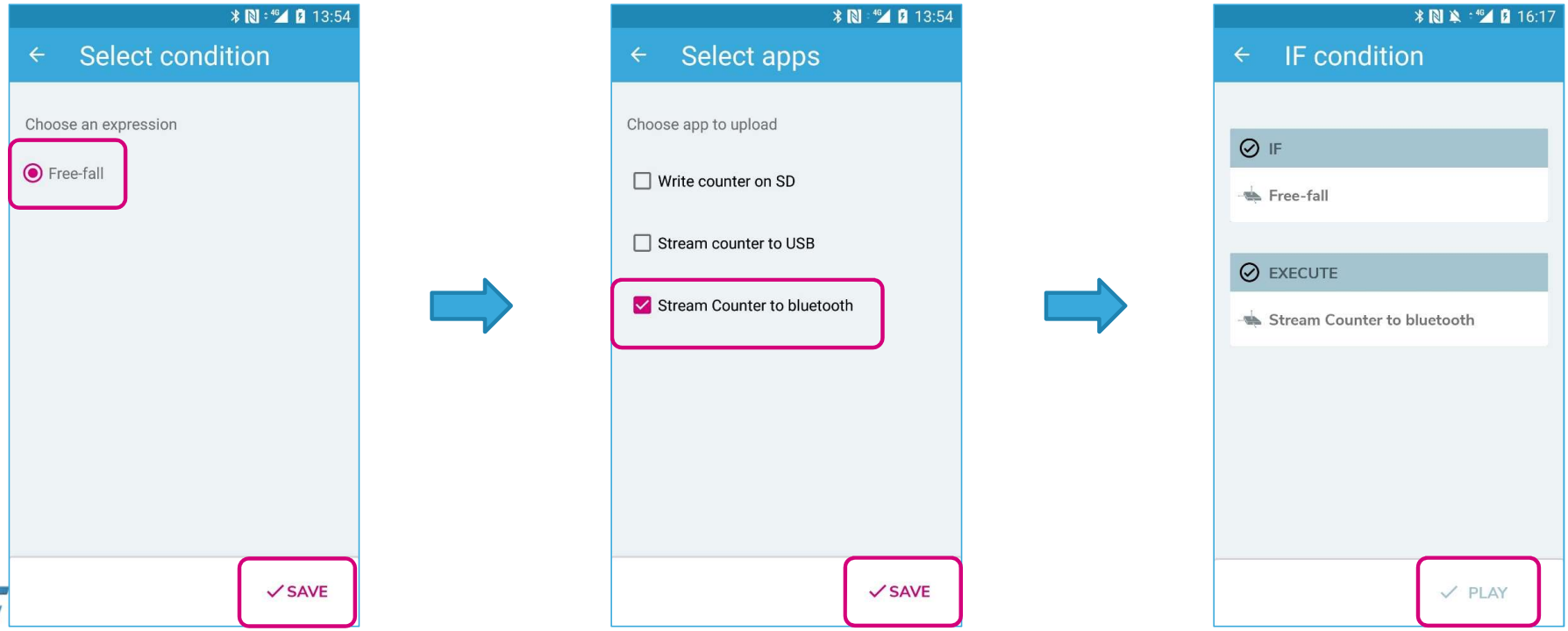
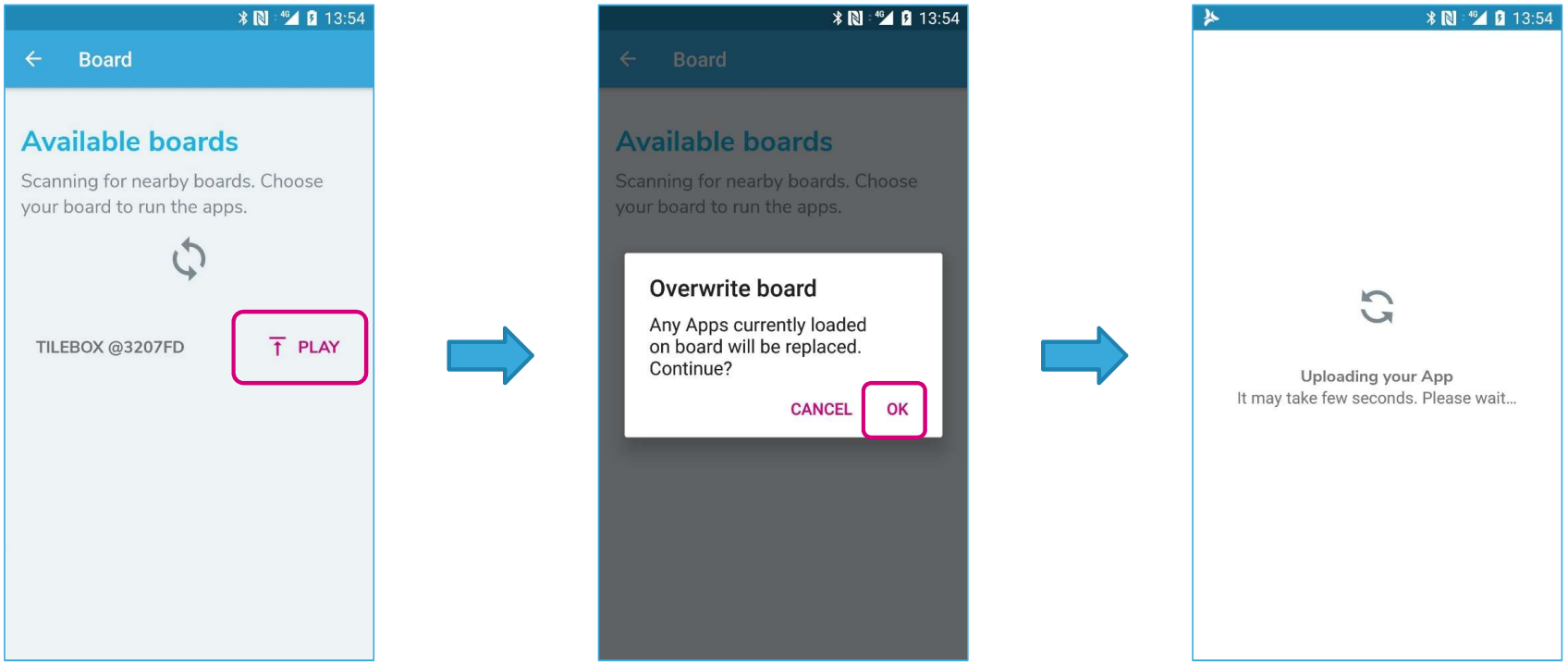
设置输出

20）为App选择蓝牙输出



加载新的App到SensorTile.box

21）点击【PLAY】，等待加载App到SensorTile.box



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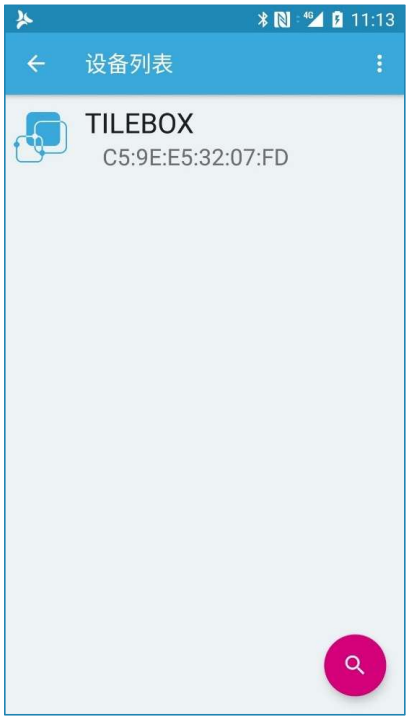
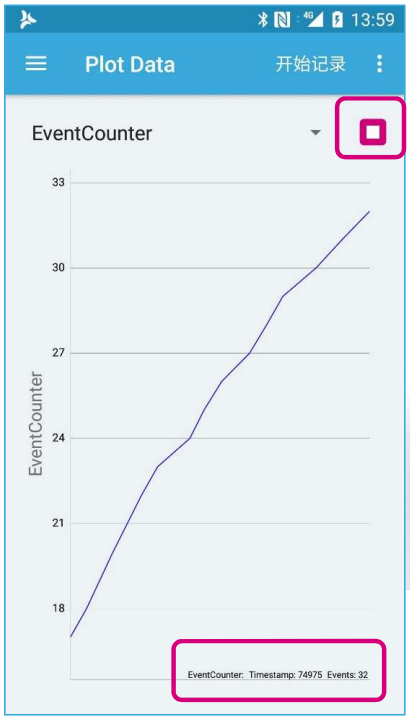
自由落体检测

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



当检测到自由落体运动
绿色LED灯亮

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编程模式

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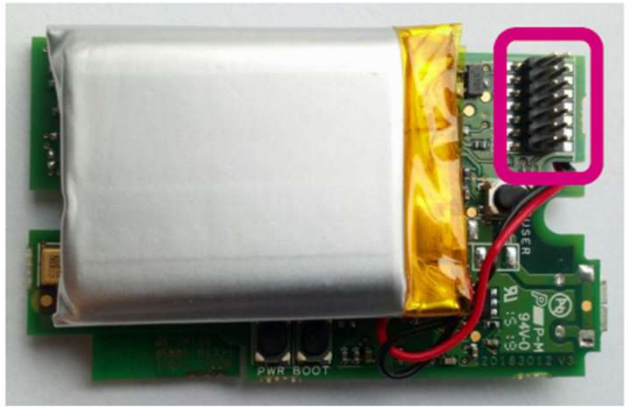
编程/调试

- 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



2

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ST-LINK连接

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

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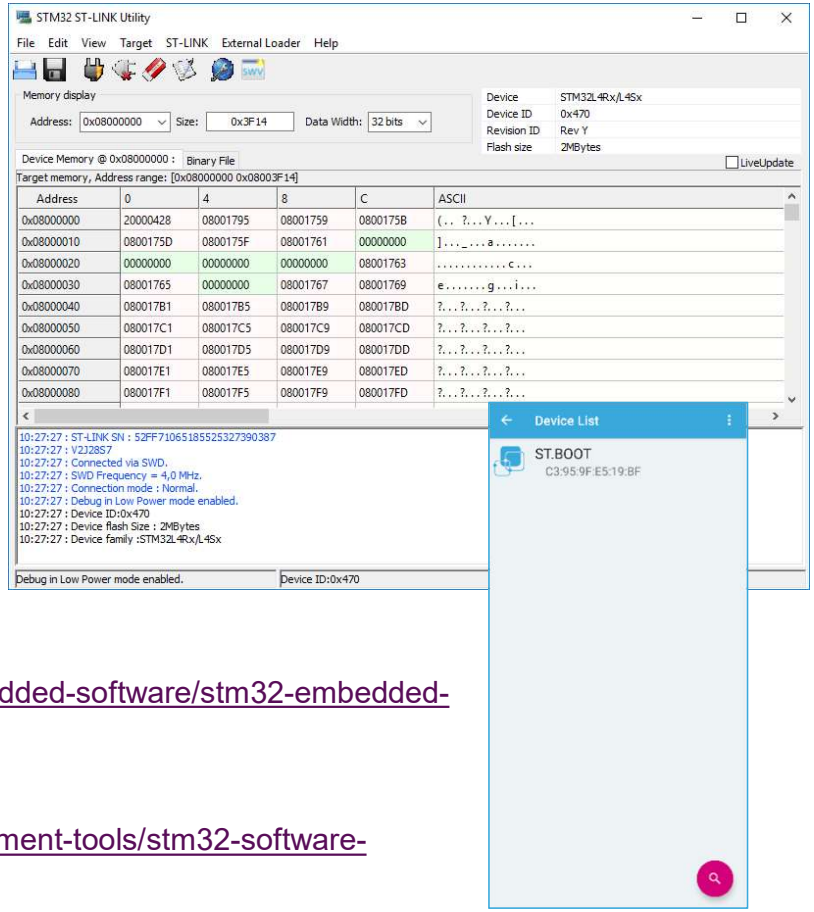
通过ST-LINK用ST-LINK Utility更新固件

- 用STM32 ST-LINK Utility更新固件
  1. 选择【Connect to the target】连接目标板，读取MCU内当前的二进制文件
  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-embedded-software/stm32-embedded-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-development-tools/stm32-software-development-tools/stm32-programmers/stsw-link004.html

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其他工具的使用

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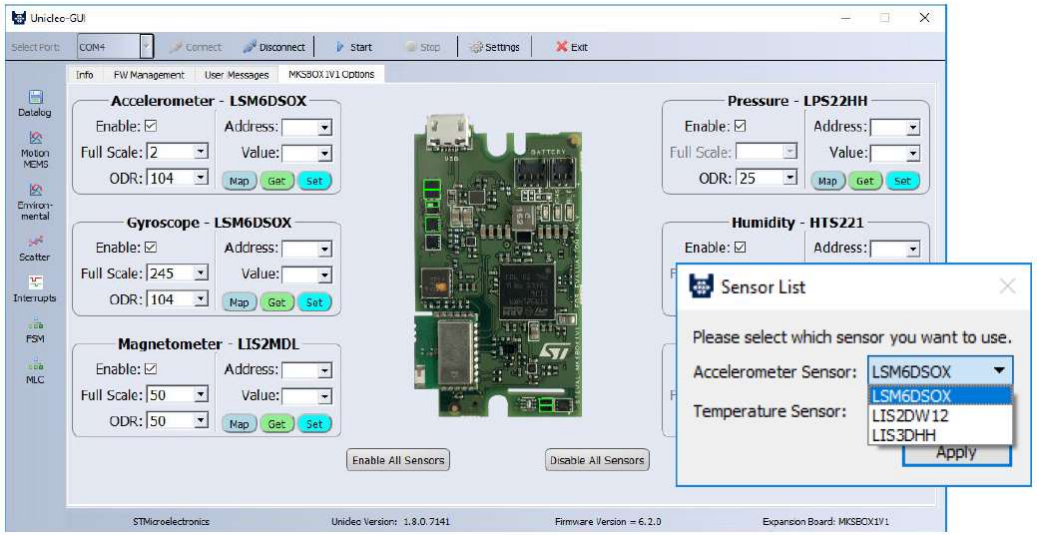
Unicleo GUI

- 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

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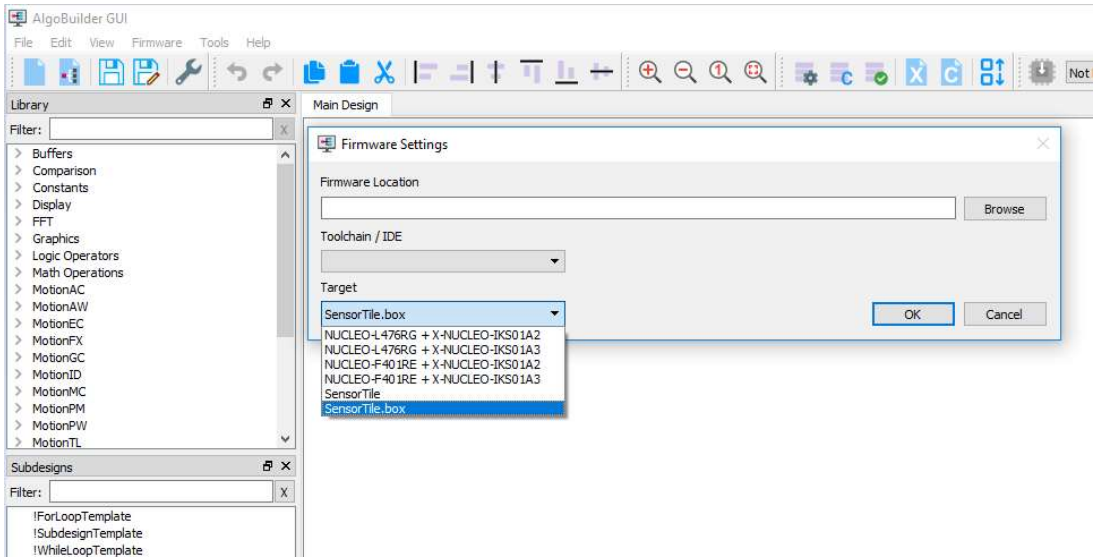
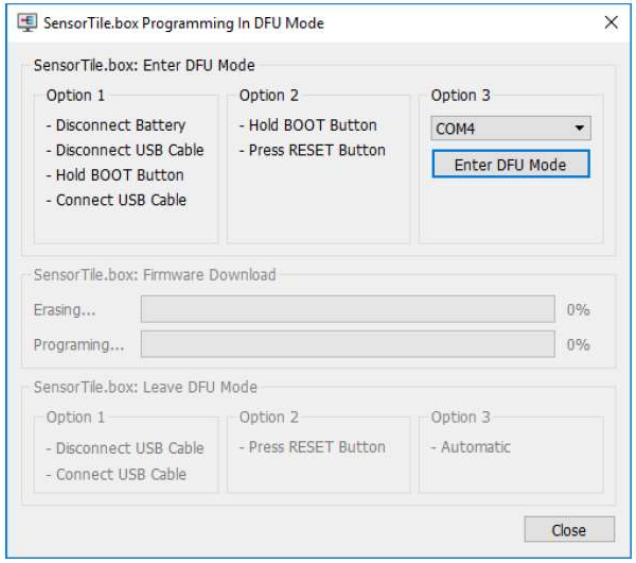
AlgoBuilder

- 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安装包：

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

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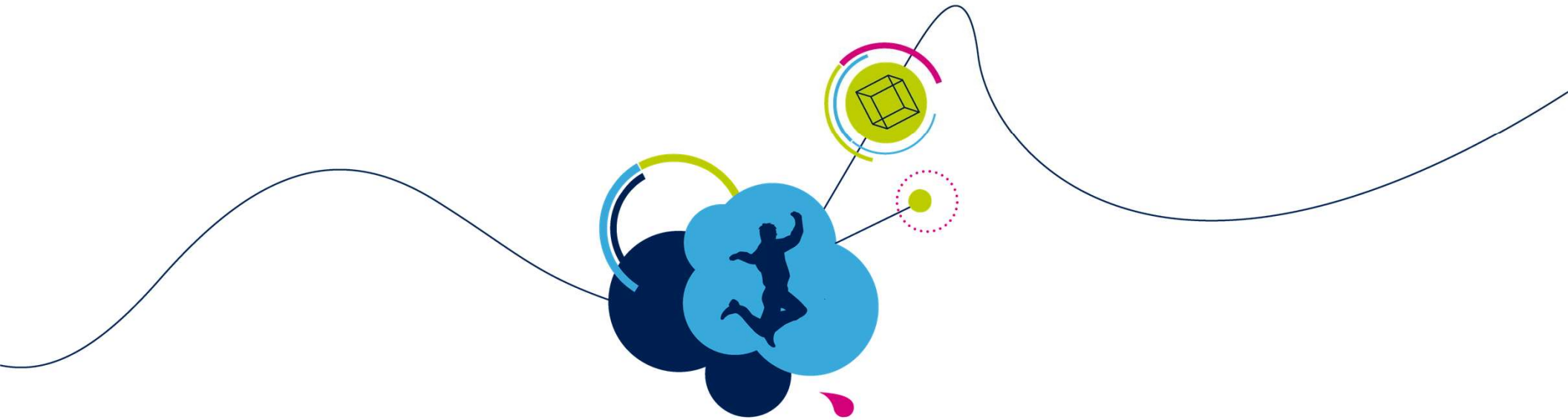

谢谢!

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